Yakin

JAWAPAN DAN ULASAN

KERTAS SOALAN PEPERIKSAAN SEBENAR SPM 2021-2025

FIZIK

Dwibahasa

SIJIL PELAJARAN MALAYSIA 2021

Kertas 1 / *Paper* 1

1 **C** Kuantiti asas: Panjang, jisim, masa, suhu termodinamik, arus elektrik, keamatan berluminositi dan jumlah bahan.
Base quantity: *length*, *mass*, *time*, *thermodynamic temperature*, *electric current*, *luminous intensity and amount of substance.*

2 **B** Disebabkan inersia, pemandu dan penumpang akan terus bergerak ke hadapan dengan halaju tetap dan menghentam stering dan cermin hadapan apabila kereta berhenti secara tiba-tiba.
Due to inertia, the driver and passengers will continue moving forward with constant velocity and hit the steering or windscreen when the car stops in a sudden.

3 **A** Daripada persamaan $s = ut + \frac{1}{2}gt^2$, apabila s tetap dan u sifar, g berkadar songsang dengan t. Kekuatan medan graviti, g Bulan adalah lebih rendah berbanding Bumi, maka masa yang diambil untuk kotak sampai ke permukaan, t adalah lebih panjang.
From the equation $s = ut + \frac{1}{2}gt^2$, *when* s *constant and* u *zero*, g *is inversely proportional to* t. *Gravitational field strength*, g *on the Moon is less than that on Earth*, *hence the time taken by the box to reach the surface*, t *are longer.*

4 **B** Kecerunan graf sesaran-masa menunjukkan halaju objek.
0 – P: Halaju malar, 1 m s^{-1}
PQ: Halaju sifar, 0 m s^{-1}
QRS : Halaju malar (pada arah bertentangan), –1 m s^{-1}
Gradient of a displacement-time graph shows velocity of object.
0 – P : *Constant velocity*, 1 m s^{-1}
PQ : *Zero velocity*, 0 m s^{-1}
QRS : *Constant velocity* (*opposite direction*), –1 m s^{-1}

5 **A** $v^2 = u^2 + 2gs$
$= 0 + 2(9.81)(5)$
$v = 9.9045$ m s^{-1}

6 C Daripada persamaan $v = \sqrt{\frac{2GM}{r}}$, halaju lepas dipengaruhi oleh jisim Bumi, M dan jarak objek dari pusat Bumi, r.

From the equation $v = \sqrt{\frac{2GM}{r}}$, *escape velocity is influenced by the mass of the Earth*, M *and the distance of the object from the centre of Earth*, r.

7 B Apabila $r < R$, nilai g berkadar terus dengan jarak dari pusat Bumi. Apabila $r \geqslant R$, nilai g berkadar songsang dengan jarak dari pusat Bumi.

When $r < R$, *the value of* g *is directly proportional to the distance from the centre of the Earth. When* $r \geqslant R$, *the value of* g *is inversely proportional to the distance from the centre of the Earth.*

8 B Ciri-ciri satelit bukan geopegun: Arah putarannya tidak semestinya sama dengan arah putaran Bumi, tempoh orbitnya melebihi atau kurang daripada 24 jam, kedudukannya berada di atas kedudukan geografi yang berubah-ubah di permukaan Bumi serta digunakan untuk pengimejan Bumi, GPS dan ramalan cuaca.

Characteristics of non-geostationary satellite: *Direction of rotation need not be the same as the direction of the Earth rotation*, *orbit period can be more or less than* 24 *hours*, *the position of satellite is above the changing locations on the surface of the Earth and use for earth imaging*, GPS *and weather forecast*.

9 C Daya graviti/ *Gravitational force*:

$$F = \frac{GMm}{r^2}$$

$$= \frac{(6.67 \times 10^{-11})(5.97 \times 10^{24})(54)}{(6.37 \times 10^{6})^2}$$

$$= 529.93 \text{ N} = 5.30 \times 10^{2} \text{ N}$$

10 C Daripada $FD = mv^2$, $v^2 = \frac{1}{m} FD$, di mana FD ialah kecerunan (malar)

From $FD = mv^2$, $v^2 = \frac{1}{m} FD$, *where* FD *is the gradient* (*constant*)

11 A Hukum Charles: Apabila suhu gas berkurang, tenaga kinetik purata molekul berkurang dan kadar perlanggaran antara molekul udara dengan dinding botol berkurang, halaju berkurang. Untuk mengekalkan tekanan, isi padu gas berkurang (jarak antara molekul udara berkurang), maka kadar perlanggaran molekul dan dinding botol tidak berubah.

Charles' law: *When the temperature of gas decreased*, *the average kinetic energy of molecules decreases and the rate of collision between air molecules and the inner wall of the bottle decreases*, *velocity decreases*. *To maintain the pressure*, *the volume of the gas decreases*, *so that the rate of collision between the gas and the inner wall of the bottle does not change*.

12 A Haba pendam pelakuran suatu bahan ialah kuantiti haba yang diserap semasa peleburan atau dibebaskan semasa pembekuan bahan tanpa perubahan suhu.

Latent heat of fusion of a substance is the quantity of heat absorbed during melting or released during solidification of the substance without a change in temperature.

13 B Panjang K sama dengan panjang X, maka frekuensi aslinya sama dengan frekuensi X.

Length of K *is equal to length of* X, *therefore the natural frequency is equal to frequency* X.

14 C Fenomena pembiasan. Panjang gelombang berkurang apabila kedalaman berkurang.

Phenomenon of refraction. *Wavelength decreases when depth decreases*.

15 A Frekuensi gelombang ultrasonik melebihi 20 kHz yang digunakan dalam telekomunikasi jarak dekat.

Frequency of ultrasonic wave exceeds 20 kHz *used in short range telecommunications*.

16 A $u = 2f$

Ciri-ciri imej: Nyata, songsang dan sama saiz.

Characteristics of image: *Real*, *inverted and same size*.

17 D Daripada rajah dan $m = \frac{v}{u} = \frac{h_i}{h_o}$, jarak objek, u berkadar songsang dengan ketinggian imej, h_i.

From diagram and $m = \frac{v}{u} = \frac{h_i}{h_o}$, *object distance*, u *is inversely proportional to the height of image*, h_i.

18 D Imej dari kanta kamera: Jarak objek yang dekat menghasilkan imej yang besar, jarak objek yang jauh menghasilkan imej yang kecil.
Image from camera lens: *Shorter distance of object produced bigger image*, *longer distance of object produced smaller image*.

19 B Daripada gabungan/ *From combination of* $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ dan/ *and* $m = \frac{v}{u}$ $\left(u = \frac{v}{m}\right)$:

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

$$\frac{1}{f} = \frac{1}{\frac{v}{m}} + \frac{1}{v}$$

$$\frac{1}{f} = \frac{m}{v} + \frac{1}{v}$$

$$\frac{1}{f} = \frac{m+1}{v}$$

$v = fm + f$, f ialah pintasan-y, X
f *is* y-*intercept*, X

20 B $F_x = 500 \text{ kos/ cos } 60^\circ$
$= 250 \text{ N}$

21 D Daripada F = ma, pecutan, a berkadar songsang dengan jisim, m.
From F = ma, *acceleration*, a *is inversely proportional to the mass*, m.

22 A $F_{net} = 850 - (150 + W \sin \theta)$
$= 850 - (150 + 1\,000 \sin 30^\circ)$
$= 850 - (150 + 500)$
$= 200 \text{ N}$

23 C Ketinggian turus merkuri menunjukkan tekanan atmosfera.
The height of mercury column shows atmospheric pressure.

24 D Faktor yang mempengaruhi tekanan air ialah kedalaman.
Factor that affects water pressure is the depth.

25 D $P = \frac{F}{A}$

$150 = \frac{F}{200}$

$F = 30\,000 \text{ N}$

26 A $F = ma$

$W - F_B = ma$

$2\,500 - 2400 = 250a$

$a = 0.4 \text{ m s}^{-2}$

27 D Apabila beza keupayaan antara plat logam bertambah, kekuatan medan elektrik bertambah.
When potential difference between metal plates increases, *electric field strength increases*.

28 B Apabila rintangan dawai berkurangan (dawai lebih tebal), arus yang mengalir melalui mentol bertambah.
When resistance decreases (*thicker wire*), *the current flows through bulb increases*.

29 C $P = \frac{V^2}{R}$

$= \frac{240^2}{25} = 2\ 304$ W

30 B Nilai r = kecerunan graf/ *Value of* r = *gradient of the graph*:

$r = \frac{0.5 - 3.0}{3.0 - 0}$

$-r = 0.833\ \Omega$

31 C Penjana elektrik arus ulang-alik menggunakan dua gelang gelincir. Dalam keadaan mendatar, gegelung memotong fluks magnet menghasilkan arus aruhan yang maksimum.
Alternating current generator uses two split rings. In horizontal position, *the coil cut the magnetic field and produced maximum alternating current*.

32 B Daya lastik bertambah apabila kekuatan medan magnet bertambah dengan menggunakan magnet melengkung.
Catapult force increases when the strength of magnetic field increases by using a curve magnet.

33 C Kecekapan transformer (voltan output tinggi) boleh ditingkatkan dengan mengurangkan kehilangan tenaga dengan menggunakan gegelung dawai kuprum yang tebal, teras besi berlamina, teras besi lembut dan gegelung sekunder melilit gegelung primer.
Efficiency of transformer (*higher output voltage*) *can be increased by reducing energy loss by using thicker copper wire coil, laminated iron core*, *soft iron core and winding the secondary coil on the primary coil*.

34 C Diod hanya membenarkan arus mengalir melalui satu arah sahaja (pincang hadapan).
Diode allows current to flow in one direction only (*in forward biased*).

35 C Rektifikasi gelombang penuh. Dalam kitar separuh positif, arus melalui M-N-T-S.
Full wave rectification. *During positive half cycle*, *current flows through* M-N-T-S.

36 B Katod disambungkan ke terminal negatif manakala anod disambungkan ke terminal positif bekalan kuasa. Elektron dibebaskan apabila filamen pada katod dipanaskan. Elektron memecut dengan halaju tinggi menuju ke anod.
Cathode connected to the negative terminal, *while anode connected to the positive terminal of the power supply. Electrons released when the filament in cathode was heated*. *Electrons accelerate at high velocity towards anode*.

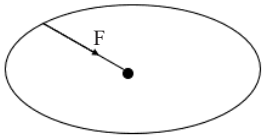
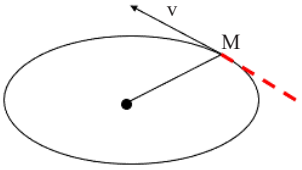
37 A Mengendalikan bahan radioaktif menggunakan lengan robotik mengurangkan risiko terdedah kepada bahan radioaktif.
Handling radioactive materials using robotic arms reduce the risks of being exposed to the radioactive materials.

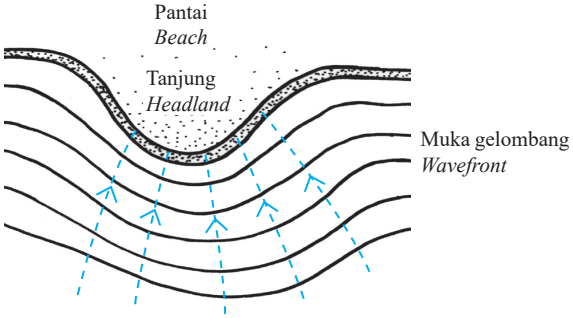
38 D Fungsi rod kawalan boron: Menyerap neutron berlebihan.
Fungsi moderator grafit: Memperlahankan kelajuan neutron.
Function of the boron control rod: *Absorb the excessive neutron*.
Function of the graphite moderator: *Slows down the speed of neutron*.

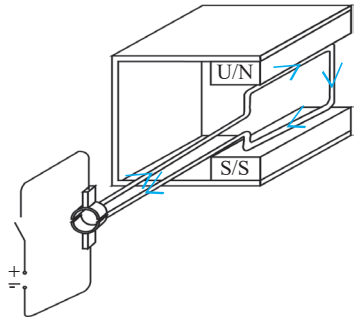
39 C Tenaga nuklear merupakan sumber tenaga bersih yang tidak memberi kesan kepada ekosistem dan jejak karbon.
Nuclear energy is clean and no effect to the ecosystem and carbon footprint.

40 C Nukleus yang lebih ringan (hidrogen) bergabung membentuk satu nukleus yang lebih berat dan membebaskan tenaga yang tinggi.
Lighter nuclei (*hydrogen*) *fuse together to form a single heavier nucleus and releasing enormous energy*.

Bahagian A / ***Section A***

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
1	(*a*)	(i)	✓ Haba pendam/ *Latent heat*	1	4
		(ii)	Cecair dan pepejal/ *Liquid and solid*	1	
		(iii)	Tenaga kinetik tidak berkurang/sama/malar/tetap/tidak berubah. *Kinetic energy not decreased/same/constant/remain/not changed.*	1	
	(*b*)		Tenaga haba dibebaskan/hilang/keluar/dilesapkan. *Heat energy released/lost/out/dissipated.*	1	
2	(*a*)		Frekuensi minimum untuk menghasilkan kesan fotoelektrik *Minimum frequency to produce photoelectric effect*	1	5
	(*b*)		$(6.6 \times 10^{-34})(9 \times 10^{14})$ [Gantian yang betul/ *Correct substitution*] 5.94×10^{-19} J [Jawapan dan unit yang betul] [*Correct answer with unit*]	2	
	(*c*)		Keamatan cahaya bertambah, bilangan elektron bertambah. *Intensity of light increases, number of electrons increases.*	2	
3	(*a*)	(i)	Daya memusat/ *Centripetal force*	1	6
		(ii)		1	
		(iii)	 [Arah v tangen pada bulatan] [*Direction of* v *tangent to the circle*]	1	
	(*b*)		$F = \frac{mv^2}{r}$ $= \frac{(0.2)(10)^2}{1.5}$ = 13.33 N [Minimum 2 t.p./ *Minimum 2 d.p.*]	2	
	(*c*)		Bertambah/ *Increases*	1	
4	(*a*)	(i)	Suis automatik/ *Automatic switch*	1	
		(ii)	$V_1 = \frac{R_1}{R_1 + R_2} \times V$ $1.2 = \frac{R_1}{R_1 + 10\,000} \times 6$ $R_1 = 2.5\ k\Omega$ [Jawapan dan unit yang betul] [*Correct answer with unit*]	3	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
		(iii)	$\frac{5 \times 10^{-3}}{50 \times 10^{-6}} = 100$ [Gantian yang betul/ *Correct substitution*] [Jawapan yang betul/ *Correct answer*]	2	
	(*b*)		– Rintangan PPC bertambah *Resistance of LDR increased* – Voltan tapak bertambah *Base voltage increased* – Arus tapak, I_b mengalir *Base current, I_b flow* – Transistor diaktifkan *Transistor activated* – Arus pengumpul mengalir *Collector current flow* [Mana-mana **tiga** jawapan diterima] [*Any* **three** *answers accepted*]	3	**9**
5	(*a*)		✓ gelombang melintang/ *transverse waves*	1	
	(*b*)	(i)	Kedalaman air di kawasan Y > kawasan X/Sebaliknya *The depth of water in region* Y > *region* X/*Vice versa*	1	
		(ii)	Panjang gelombang di kawasan Y > kawasan X/Sebaliknya *The wavelength in region* Y > *region* X/*Vice versa*	1	
		(iii)	Frekuensi gelombang air di kawasan X dan kawasan Y tidak berubah. *The frequency of water wave in region* X *dan region* Y *are not change.*	1	
	(*c*)		Semakin bertambah kedalaman air, semakin bertambah panjang gelombang/Sebaliknya *The depth of water increases, the wavelength increase/Vice versa*	1	
	(*d*)		Pembiasan/ *Refraction*	1	
	(*e*)	(i)	 [Mana-mana **dua** garis melengkung yang menumpu ke arah tanjung dalam julat garis putus-putus] [*Any* **two** *curved lines converged to the cape in the range of the dashed lines*]	1	
		(ii)	$\frac{v_1}{\lambda_1} = \frac{v_2}{\lambda_2}$ $v_2 = \frac{(20)(2.5)}{8}$ $= 6.25 \text{ m s}^{-1}$	2	**9**
6	(*a*)		Peraturan Tangan Kiri Fleming *Fleming's Left Hand Rule*	1	
	(*b*)	(i)	Ketebalan dawai kuprum 6.1(b) > 6.1(a)/Sebaliknya *The thickness of the copper wire* 6.1(b) > 6.1(a)/*Vice versa*	1	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
		(ii)	Saiz sudut ayunan dawai kuprum 6.1(b) > 6.1(a)/Sebaliknya *The size of swing angle of the copper wire* 6.1(b) > 6.1(a)/*Vice versa*	1	
		(iii)	Daya yang bertindak ke atas dawai kuprum 6.1(b) > 6.1 (a)/Sebaliknya *The force that acted on the copper wire* 6.1(b) > 6.1(a)/*Vice versa*	1	
	(*c*)	(i)	Semakin bertambah ketebalan dawai kuprum, semakin bertambah daya yang bertindak ke atas dawai kuprum/Sebaliknya *The thickness of the copper wire increases, the force acted on the copper wire increases/Vice versa*	1	
		(ii)	Semakin bertambah saiz sudut ayunan dawai kuprum, semakin bertambah daya yang bertindak ke atas dawai kuprum/sebaliknya *The size of swing angle of copper wire increases, the force acted on the copper wire increases/Vice versa*	1	
	(*d*)		Arah bertentangan/berlawanan/songsang atau ke kiri atau ke dalam *Opposite direction/inverse to the left or inwards*	1	
	(*e*)	(i)	 [Arah arus yang betul pada mana-mana bahagian pada gegelung] [*Correct direction of current at any parts on the coil*]	1	
		(ii)	Lawan arah jam/ *Anti-clockwise direction*	1	**9**
7	(*a*)		Nukleus berat pecah kepada dua nukleus yang lebih ringan yang sama jisim atau berjisim kecil. *Heavy nucleus split into two nucleus of equal mass or lighter mass.*	1	
	(*b*)	(i)	$0.198264 \times (1.66 \times 10^{-27})$ $= 3.291 \times 10^{-28}$ kg	1	
		(ii)	$E = mc^2$ $= (3.291 \times 10^{-28})(3 \times 10^{8})^2$ $= 2.961 \times 10^{-11}$ J [Gantian yang betul/ *Correct substitution*] [Jawapan dan unit yang betul/ *Correct answer with unit*]	2	
	(*c*)	(i)	Boron/ *Boron*: • Kawal kadar tindak balas/Kawal kadar pembelahan nukleus/Serap neutron berlebihan *Control rate of reaction/Control rate of nucleus fission/Absorb excessive neutrons*	2	
		(ii)	Grafit/ *Graphite*: • Perlahankan neutron/Kawal halaju neutron/Kawal tenaga kinetik neutron *Slow down neutron/Control velocity of neutron/Control kinetic energy of neutron*	2	
	(*d*)		K	1	**9**

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
8	(*a*)		Pantulan dalam penuh/ *Total internal reflection*	1	
	(*b*)		$n = \frac{1}{\sin c}$ $1.5 = \frac{1}{\sin c}$ $c = 41.81^{o}$ [Minimum dua t.p./ *Minimum two d.p.*]	2	
	(*c*)	(i)	Kecil/Rendah. Lebih banyak pantulan dalam penuh berlaku. *Small/Low. More total internal reflection occurs.*	2	
		(ii)	Tinggi/Tumpat. Indeks biasan tinggi/Sudut genting kecil/Lebih banyak pantulan dalam penuh berlaku. *High/Denser. High refractive index/Small critical angle/More total internal reflection occurs.*	2	
		(iii)	Rata/Licin. Lebih banyak pantulan dalam penuh berlaku. *Even/Smooth. More total internal reflection occurs.*	2	**9**

Bahagian B / *Section* B

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
9	(*a*)		Daya graviti *Gravitational force*	1	
	(*b*)		$\frac{\sin 60^{o}}{15} = \frac{\sin 60^{o}}{T}$ $T = 15$ N **atau/ *or*** $W^2 = T^2 + T^2 - 2(T \times T \text{ kos/ cos } 60^{o})$ $W^2 = 2T^2 - 2T^2 \text{ kos/ cos } 60^{o}$ $15^2 = 2T^2 - T^2$ $T^2 = 15^2$ $T = 15$ N	4	
	(*c*)	(i)	$s = ut + \frac{1}{2}gt^2$ $4 = 0 + \frac{1}{2}(9.81)t^2$ $t = 0.903$ s [Gantian yang betul/ *Correct substitution*] [Jawapan dan unit betul, minimum dua t.p.] [*Correct answer with unit, minimum two d.p.*]	2	
		(ii)	$v = u + gt$ $= 0 + (9.81)(0.903)$ $= 8.86 \text{ m s}^{-1}$ **atau/ *or*** $v^2 = u^2 + 2gh$ $= 0 + 2(9.81)(4)$ $v = 8.86 \text{ m s}^{-1}$ **atau/ *or***		

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
			$s = \frac{1}{2}(u + v)t$ $4 = \frac{1}{2}(0 + v)(0.903)$ $v = 8.86 \text{ m s}^{-1}$ **atau/** ***or*** $mgh = \frac{1}{2}mv^2$ $v = \sqrt{2gh}$ $= \sqrt{2 \times 9.81 \times 4}$ $= 8.86 \text{ m s}^{-1}$		
		(iii)	Daya impuls besar/Kadar perubahan momentum tinggi/Masa hentaman pendek *Greater impulsive force/High rate of change of momentum/Shorter time of impact*	1	
	(*d*)		**Ciri-ciri** ***Characteristics*** / **Sebab** ***Reason*** Sudut kecil, θ / *Small angle, θ* — Daya tinggi / *High force* Kabel tidak kenyal / *Inelastic cable* — Daya seragam/Panjang kabel tetap/Kabel tidak menegang / *Uniform force/Length of cable remain/Cable not stretched* Tegangan maksimum tinggi / *High maximum tension* — Menampung daya tinggi/Tidak putus/Tahan lasak/Kuat / *Support high force/Not snap/Durable/Strong* Papan kayu / *Wooden plank* — Kurang tekanan/Tambah luas permukaan atau sentuhan / *Less pressure/Increase surface* or *contact area* Pilih S kerana sudut, θ kecil, kabel tidak kenyal, tegangan maksimum tinggi dan papan kayu. *Choose* S *because small angle*, θ *inelastic cable*, *high maximum tension and wooden plank.*	10	**20**
10	(*a*)		Kadar pengaliran cas *Rate of flow of charge*	1	
	(*b*)	(i)	$P = \frac{V^2}{R}$ $1\,000 = \frac{240^2}{R}$ $R = 57.6 \text{ ohm}/\Omega$	3	
		(ii)	$P = I^2R$ $= 4.2^2 \times 57.6$ $= 1\,016.064$ W [Minimum dua t.p./ *Minimum two d.p.*]	2	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
	(*c*)		– Tenaga elektrik ditukarkan kepada tenaga haba. *Electrical energy converted into heat energy.* – Elemen pemanas berbentuk gegelung. *Coiled shaped heating element.* – Panjang elemen pemanas bertambah, rintangan bertambah. *Length of heating element increases, resistance increases.* – Rintangan menghasilkan haba. *Resistance produced heat.* – Haba yang tinggi dihasilkan. *A lot of heat produced.* – Haba dipindahkan ke periuk/Periuk serap haba dari elemen pemanas. *Heat is transferred to the pot/Pot absorbed heat from the heating element.* [Mana-mana **empat** jawapan diterima] [*Any* **four** *answers accepted*]	4	
	(*d*)		**Cadangan** ***Suggestions*** / **Sebab** ***Reason*** Bentuk dawai perintang: Bergelung / *Shape of resistance wire*: *Coiled* — Rintangan tinggi/Panjang/Banyak haba / *Higher resistance/Long/More heat* Kerintangan dawai perintang: Tinggi / *Resistivity of resistance wire*: *High* — Lebih haba/Rintangan tinggi / *More heat/High resistance* Bahan dawai perintang: Nikrom / *Material of resistance wire*: *Nichrome* — Takat lebur tinggi/Rintangan tinggi/Banyak haba / *High melting point/High resistance/More heat* Bahan salutan luar: Keluli / *Casing material*: *Steel* — Tidak teroksida/Tahan suhu tinggi/Konduktor haba yang baik / *Not oxidise/Withstand high temperature/Good heat conductor* Pilih model L kerana dawai perintang bergelung, kerintangan dawai perintang tinggi, bahan dawai perintang ialah nikrom dan bahan salutan luar ialah keluli. *Choose model* L *because coiled resistance wire, high resistivity of resistance wire, material of resistance wire is nichrome and casing material is steel.*	10	**20**

Bahagian C / *Section* C

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
11	(*a*)		Kelajuam bendalir yang mengalir bertambah, tekanan berkurang. *Speed on a moving fluid increases, pressure decreases*	1	
	(*b*)		– Laju air di atas bertambah. *Speed of water above increases.* – Tekanan di bawah bertambah/Sebaliknya *The pressure of water below increases/Vice versa* – Perbezaan tekanan *Pressure difference* – Daya angkat terhasil *Lift force produced* – Daya angkat > berat atau daya paduan ke atas *Lift force > weight or resultant force upwards*	4	
	(*c*)		– Ketinggian papan luncur dari permukaan air pada Rajah 11.3 lebih tinggi/Sebaliknya *High of the surfboard from the water supply in Diagram* 11.3 *is higher/Vice versa* – Daya geseran air yang bertindak ke atas papan luncur pada Rajah 11.3 lebih rendah/Sebaliknya *Water friction acted on the surfboard in Diagram* 11.3 *is lower/Vice versa* – Laju papan luncur pada Rajah 11.3 lebih tinggi/sebaliknya *Speed of surfboard in Diagram* 11.3 *is higher/Vice versa* – Ketinggian bertambah, daya geseran berkurang/Sebaliknya *Height of surface increases, frictional force decreases/Vice versa* – Daya geseran berkurang, laju papan luncur bertambah. *Water friction decreases, speed of the surface increases.*	5	

Soalan *Questions*	Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
(*d*)		10	20

Cadangan *Suggestions*	Sebab *Reason*
Ciri-ciri bot ***Characteristic of boat*** – Ketumpatan bot rendah *Low density of boat*	Ringan/Jisim rendah *Light/Low mass*
– Bot kuat/Kukuh/Aluminium/keluli *Strong boat/Aluminium boat/Steel boat*	Tidak pecah/Tidak bocor/Kuat/Kukuh/Tahan lasak *Not break/Not leak/Strong/Durable*
– Jisim bot kecil/Bot ringan *Mass of boat small/Boat lighter*	Bot pecut *Boat accelerates*
– Bot aerodinamik *Aerodynamic boat*	Kurang geseran/rintangan/seretan *Less friction/resistance/drag*
Saiz bot ***Size of boat*** – Besar/Panjang/Luas/Lebar *Big/Long/Wide*	Terapung/Daya apungan besar/Banyak air tersesar *Float/Greater buoyant force/Displaced more water*
Ciri-ciri hidrofoil ***Characteristic of hydrofoil*** – Ketumpatan hidrofoil rendah *Low density of hydrofoil*	Jisim rendah/Pecut *Low mass/Accelerates*
– Jisim hidrofoil kecil/Hidrofoil ringan *Mass of hydrofoil small/Hydrofoil light*	Pecut *Accelerates*
– Kukuh/Aluminium/Keluli/Plastik fiber *Strong/Aluminium/Steel/Fibre plastic*	Tidak pecah/Kuat/Kukuh/Tahan atau tidak karat *Not break/Strong/Durable/Not rust*
Bilangan hidrofoil ***Number of hydrofoil*** – Hidrofoil banyak/lebih daripada dua *Many hydrofoil/more than two*	Daya lebih/Kuasa lebih/Tenaga lebih/Momentum lebih/Daya apungan besar *More force/More power/More energy/More momentum/Great buoyant force*
Kuasa enjin yang digunakan ***Power of the engine used*** – Besar/Berkuasa tinggi *Large/High power*	Daya besar atau tinggi/Lebih daya/Momentum atau tenaga tinggi/Daya apungan besar *Big or high force/More force/High momentum or energy/Great buoyant force*

[Maksimum 10 markah daripada mana-mana bahagian]
[*Maximum* 10 *marks from any parts*]

Kertas 1 / *Paper* 1

1 **C** Kuantiti asas pada label ialah jisim (55.2 g), suhu (80 ºC) dan masa (3 minit)
Base quantities stated in the label are mass (55.2 g), *temperature* (80 º C) *and time* (3 *minutes*)

2 **C** Graf garis lengkung dengan kecerunan negatif dan tidak menyentuh kedua-dua paksi menunjukkan P berkadar songsang dengan V.
Curve line graph with negative gradient and not touching both axes show P *is inversely proportional to* V.

3 **C** $v = \frac{s}{t}$

$v = \frac{10\ 000\ m}{3\ 600\ s}$

$v = 2.78\ m\ s^{-1}$

4 **C** Kecerunan graf = Halaju. Kecerunan OP seragam maka halaju OP seragam, manakala kecerunan PQ sifar maka halaju PQ sifar.
Gradient of graph = Velocity. Gradient of OP *is uniform thus velocity* OP *uniform*, *while gradient of* PQ *is zero thus velocity* PQ *zero*.

5 **A** Spring X berdiameter besar mempunyai pemalar spring yang kecil (spring lembut), manakala spring Y berdiameter kecil mempunyai pemalar spring yang lebih besar (spring keras). Maka pemanjangan spring X lebih besar berbanding spring Y.
Spring X *with a larger diameter has a smaller spring constant* (*soft spring*), *while spring* Y *with a smaller diameter has a larger spring constant*. *Thus*, *the extension of spring* X *is bigger compared to spring* Y.

* Tidak boleh menganggap spring X dan spring Y mempunyai pemalar spring yang sama walaupun kedua-duanya spring keluli kerana soalan tidak menyatakan spring adalah serupa.
* *Cannot assume spring* X *and spring* Y *has a same spring constant even though both are steel spring as the question does not state that they are identical spring*.

6 **A** Pengurangan jisim bahan api mengurangkan jisim keseluruhan roket, maka pecutan roket bertambah. (Menurut F = ma, jisim berkadar songsang dengan pecutan)
Reduction in fuel mass causes reduction in total masses of the rocket, *thus acceleration of rocket increases*. (*According to* F = ma, *mass is inversely proportional to acceleration*)

7 **D** $J = mv - mu$
$= (0.02)(5) - (0.02)(-10)$
$= 0.1 + 0.2$
$= 0.3\ kg\ m\ s^{-1}$

8 **B** $v^2 = u^2 + 2as$
$100^2 = 0 + 2(4)(s)$
$s = 1250\ m$

9 **C** Daripada persamaan $\frac{mv^2}{r} = \frac{GMm}{r^2}$, daya memusat, $F = \frac{mv^2}{r}$ adalah sama dengan daya graviti antara Bumi dan satelit, $F = \frac{GMm}{r^2}$.

From the equation $\frac{mv^2}{r} = \frac{GMm}{r^2}$, *centripetal force*, $F = \frac{mv^2}{r}$ *is equal to the gravitational force between the Earth and the satellite*, $F = \frac{GMm}{r^2}$.

10 D Ciri-ciri satelit Geopegun: Arah gerakan sama dengan arah putaran Bumi, tempoh orbit sama dengan tempoh putaran Bumi iaitu, 24 jam, berada di atas kedudukan geografi atau lokasi yang sama pada permukaan Bumi.
Characteristics of Geostationary satellite: *Direction of motion same as the direction of rotation of Earth*, *orbital period equal to period of rotation of Earth which is,* 24 *hours*, *above the same geographical position or location on the surface of the Earth*.

11 B Termometer mengaplikasikan prinsip keseimbangan terma. Apabila keseimbangan terma dicapai, pemindahan haba bersih antara pesakit dan termometer adalah sifar dan suhu badan pesakit adalah sama dengan bacaan suhu termometer.
Thermometer applied the principle of thermal equilibrium. *When thermal equilibrium is achieved the net heat transfer between the patient and the thermometer is zero and the temperature of the patient is equal to the temperature reading of the thermometer*.

12 B Air yang mendidih menyerap haba pendam pengewapan dan bertukar menjadi stim. Apabila stim terkondensasi pada permukaan pakaian, haba pendam tentu yang tinggi dibebaskan ke pakaian dan membantu menghilangkan kedutan pada pakaian dengan lebih cepat dan efisien.
Boiling water absorbs latent heat of vaporisation and changes to steam. *When the steam condenses on clothes*, *large amount of latent heat is released onto the clothes to help removing wrinkles faster and more efficient*.

13 A Hukum Charles menyatakan bahawa isi padu adalah berkadar terus dengan suhu mutlak bagi suatu gas berjisim tetap pada tekanan malar. Air panas mempunyai suhu yang tinggi, maka isi padu bola ping pong bertambah.
Charles' law states that volume is directly proportional to absolute temperature for a fixed mass gas at constant temperature. *Hot water has a high temperature, thus the volume of the ping pong ball increases*.

14 B Pelembapan berlaku di mana amplitud ayunan kerusi goyang berkurang dengan masa kerana kehilangan tenaga secara beransur-ansur sehingga ayunan berhenti.
Damping occurs where amplitude of oscillation of the rocking chair decreases with time due to gradual loss of energy until the oscillation stops.

15 B Inersia bertambah apabila jisim bertambah. Gelas yang berjisim besar mempunyai inersia yang lebih besar untuk mengekalkan keadaan asalnya iaitu pegun. Maka, gelas tidak bergerak apabila alas meja disentap.
Inertia increases as mass increases. *Glass with greater mass has a greater inertia to remain its original state at rest*. *Thus*, *the glass does not move when table cloth is pulled in a sudden*.

16 A Rumah yang tinggi membolehkan udara panas berada di atas, maka haba tidak terperangkap dalam rumah dan udara dalam rumah menjadi lebih sejuk.
A high house let the hot air to rise above, *so no heat trap inside the house and the air in the house become cooler*.

17 A Busur 'bulbous' menghasilkan gelombang air berinterferens memusnah dengan gelombang air yang dihasilkan oleh busur kapal. Maka air di sekitar kapal menjadi lebih tenang dan mengurangkan geseran air yang menentang pergerakan kapal.
Bulbous bow produces water waves that destructive interference with the water waves produced by the bow of the ship. *Thus, the water around the ship calmer to reduce the water drag that oppose the motion of the ship*.

18 D Ciri-ciri gelombang terbias: Arah berubah, laju berubah, panjang gelombang berubah dan frekuensi tetap.
Characteristics of refracted wave: *Direction changes*, *speed changes*, *wavelength changes and frequency remain*.

19 B

$$n = \frac{\sin i}{\sin r}$$

$$n = \frac{\sin 60^\circ}{\sin 35.2^\circ}$$

$$n = 1.50238871$$

$$n = \frac{1}{\sin c}$$

$$1.50238871 = \frac{1}{\sin c}$$

$$\sin c = 0.6656$$

$$c = 41.73^\circ$$

20 A Imej yang dihasilkan oleh kanta cembung bergantung kepada panjang fokus dan jarak objek dari kanta. Panjang fokus yang lebih panjang, jarak objek dari kanta yang lebih pendek menghasilkan imej yang lebih besar.
The image produced by a convex lens depends upon the focal length of the lens and the distance of the object from the lens. Longer focal length, shorter object distance produced bigger image.

21 D Kapal terbang mengalami pecutan sifar apabila kesemua daya yang bertindak ke atas kapal terbang berada dalam keseimbangan.
Aeroplane experiences zero acceleration when all forces acting on the aeroplane are in equilibrium.

22 C Apabila jisim bertambah, berat beban bertambah. Maka, daya komponen beban yang ditunjukkan oleh neraca spring bertambah.
When mass increases, the weight of load increases. Thus, the component forces of the load show by the spring balance increases.

23 A Hukum Hooke diaplikasikan pada spring.
Hooke's Law applied in a spring.

24 B Udara yang nipis di altitud tinggi menyebabkan tekanan atmosfera menjadi rendah.
Thin air at high altitudes causes the atmospheric pressure to be lower.

25 100 N

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

$$\frac{F_1}{200 \times 10^{-2}} = \frac{100}{2}$$

$$F_1 = 100 \text{ N}$$

[Tiada pilihan jawapan di kertas peperiksaan 2022
No answer choice in examination paper 2022]

26 C Bagi jasad terapung, daya apungan sama dengan berat air disesarkan. Apabila berat kapal bertambah, daya apungan bertambah, maka berat air disesarkan bertambah.
For floating body, the buoyant force is equal to the weight of water displaced. When weight of ship increases, buoyant force increases, thus weight of water displaced increases.

27 A Prinsip Bernoulli menyatakan bahawa apabila halaju bendalir bertambah, tekanan bendalir berkurang. Halaju angin di hadapan garisan kuning adalah tinggi, menghasilkan kawasan bertekanan rendah. Angin di belakang garisan kuning lebih tenang (halaju rendah), menghasilkan kawasan bertekanan tinggi. Perbezaan tekanan menghasilkan daya yang bertindak dari kawasan bertekanan tinggi ke kawasan bertekanan rendah.
Bernoulli's principle states that when the velocity of fluid increases, the pressure in the fluid decreases. The velocity of wind in front of the yellow line is high, causes a low-pressure region. The wind behind the yellow line is calmer (low velocity), causes a high-pressure region. Difference in pressure produced force acting from a high-pressure region to low pressure region.

28 A Daripada graf V-I, rintangan ditentukan melalui kecerunan graf, di mana $R = \frac{V}{I}$.
From V-I *graph, resistance is determined from the gradient, where* $R = \frac{V}{I}$.

29 A Haba terhasil daripada elemen pemanas yang mempunyai rintangan yang tinggi. Rintangan elemen pemanas ditingkatkan dengan menggunakan dawai nikrom (rintangan tinggi), luas keratan rentas dawai kecil (dawai halus) dan dawai yang panjang.
Heat produced from high resistance heating element. Resistance in the heating element can be increased by using nichrome wire (high resistance), small cross-sectional area wire (finer wire) and longer wire.

30 D Nilai rintangan dalam bagi sel kering yang disusun secara selari akan berkurang, $\frac{1}{r} = \frac{1}{r_1} + \frac{1}{r_2}$.

Mengikut persamaan ε = IR + Ir, d.g.e. sel kering, ε yang disusun secara selari juga berkurang.

Value of internal resistance for dry cells arranged in parallel will be decreases, $\frac{1}{r} = \frac{1}{r_1} + \frac{1}{r_2}$.

According to equation ε = IR + Ir, e.m.f. *dry cells*, ε *arranged in parallel also decreases.*

31 D Spesifikasi "240 V, 1500 W" bermaksud seterika stim menggunakan atau melesapkan 1500 J tenaga elektrik dalam satu saat apabila disambungkan dengan bekalan kuasa atau beroperasi pada 240 V.
Specification "240 V, 1500 W" *means the iron steam use or dissipated* 1500 J *electrical energy in one second when connected to or operated at* 240 V *of power supply*.

32 D Medan lastik ialah medan magnet paduan yang dihasilkan oleh interaksi antara medan magnet daripada konduktor pembawa arus dengan medan magnet daripada magnet kekal. Medan lastik mengenakan satu daya paduan ke atas konduktor itu.
A catapult field is a resultant magnetic field produced by the interaction between the magnetic field from a current-carrying conductor and the magnetic field from a permanent magnet. The catapult field exerts a resultant force on the conductor.

33 A Hukum Faraday menyatakan bahawa magnitud d.g.e. aruhan adalah berkadar terus dengan kadar pemotongan fluks magnet. Bagi gerakan relatif antara solenoid dengan magnet, d.g.e. aruhan bertambah apabila laju gerakan relatif bertambah (jarak antara magnet bar dan gegelung bertambah), bilangan lilitan solenoid bertambah, kekuatan medan magnet bertambah.
Faraday's law states that the magnitude of induced e.m.f. *is directly proportional to the rate of cutting of magnetic flux. For the relative motion of a solenoid and magnet, the induced* e.m.f. *increases when the speed of relative motion increases* (*distance between the bar magnet and the coil increases*), *the number of turns of the solenoid increases and the strength of the magnetic field increases*.

34 D Kaedah yang betul untuk mengurangkan kehilangan tenaga dalam sebuah transfomer:
Method to reduce energy loss in a transformer:

1. Menggunakan dawai kuprum tebal (mengurangkan rintangan gegelung)
   Using thick copper wire (*reduce resistance of coil*)

2. Menggunakan teras besi berlamina (elak arus pusar)
   Using a laminated iron core (*prevent eddy current*)

3. Menggunakan teras besi lembut (elak histerisis)
   Using a soft iron core (*prevent hysterisis*)

4. Lilitkan gegelung sekunder di atas gegelung primer (elak kebocoran fluks magnet).
   Wind the secondary coil on top of primary coil (*prevent leakage of magnetic flux*).

35 A Rektifikasi gelombang separuh dengan voltan output diratakan oleh kapasitor.
Half-wave rectification with smoothen output voltage by a capacitor.

36 B Apabila suis S dihidupkan, mentol P menyala dengan malap kerana perintang berintangan tinggi* dan arus tapak, I_B adalah sangat kecil. Mentol Q menyala dengan terang kerana arus pengumpul, I_C adalah besar berbanding dengan arus tapak, I_B.
When switch S *is turned on, bulb* P *is dim because resistor has a high resistance* and the base current,* I_B *is very small. Bulb* Q *lights up very brightly because the collector current,* I_c *is large compared with the base current,* I_B.

* Rintangan tinggi pada litar tapak untuk mengehadkan arus tapak supaya transistor tidak menjadi panas dan terbakar.
* *The resistance at the base circuitis large to limit the base current,* I_B *so that the transistor will not become too hot and burn.*

37 A Perubahan nombor proton/ *Change in proton number* = 92 – 92 = 0
Perubahan nombor nukleon/ *Change in nucleon number* = 238 – 234 = 4
Sinaran radioaktif yang dibebaskan/ *Radioactive rays released*: 1 alfa/*alpha*, 2 beta

$$^{238}_{92}U \rightarrow {}^{234}_{92}U + {}^{4}_{2}He + 2\,{}^{0}_{-1}\beta$$

38 B Pembelahan nukleus ialah tindak balas nuklear apabila satu nukleus yang berat membelah menjadi dua atau lebih nukleus yang lebih ringan dengan membebaskan tenaga yang banyak.
Nuclear fission is a nuclear reaction when a heavy nucleus splits into two or more lighter nuclei while releasing a large amount of energy.

39 D Apabila suatu permukaan logam disinari oleh alur cahaya yang mempunyai frekuensi tertentu, elektron daripada logam itu dapat dipancar keluar. Fenomena ini dikenali sebagai kesan fotoelektrik.
When a metal surface is illuminated by a beam of light at a certain frequency, electrons can be emitted from the metal. This phenomenon is known as photoelectric effect.

40 C Daripada persamaan Teori Fotoelektrik Einstein:
From equation of Einstein's Photoelectric Theory:

$$hf = W + \frac{1}{2}mv^2_{maks}$$

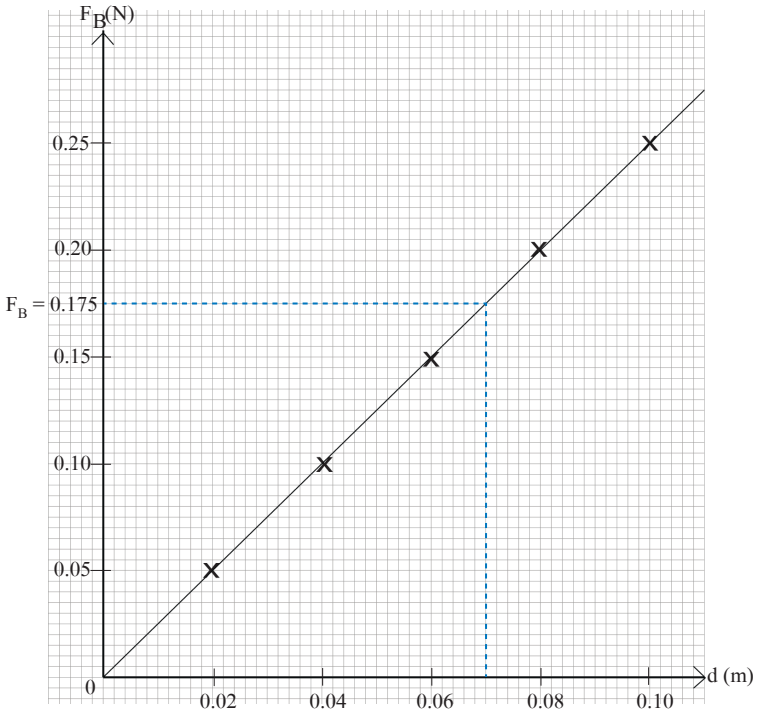
hf = tenaga foton
photon energy

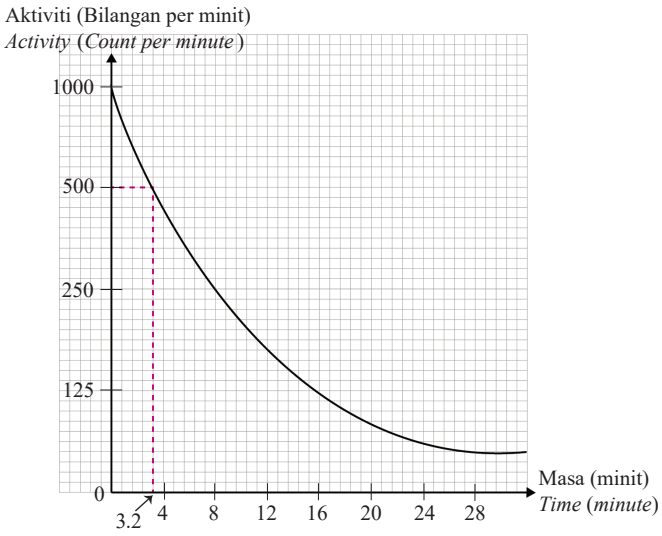
f = frekuensi minimum foton cahaya yang menghasilkan kesan fotoelektrik
minimum frequency of a light photon which produce photoelectric effect

W = tenaga minimum yang diperlukan untuk membebaskan fotoelektron
minimum energy required to release a photoelectron

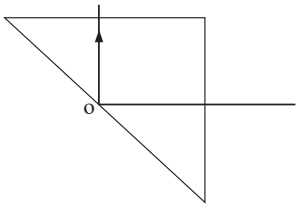
$\frac{1}{2}mv^2_{maks}$ = tenaga kinetik maksimum fotoelektron
maximum kinetic energy of a photoelectron

Bahagian A / *Section* A

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
1	(*a*)		Kuantiti terbitan/Kuantiti vektor *Derived quantity/Vector quantity*	1	4
	(*b*)	(i)	✓ kedalaman rod tenggelam di dalam air, d *depth of rod immerse in water*, d	1	
		(ii)	 – Melukis garisan tegak dari 0.07 m hingga ke graf *Draw vertical line from* 0.07 m *towards the graph* – Menyatakan nilai F_B dengan betul iaitu, 0.175 *State the value of* F_B *correctly which is,* 0.175	2	
2	(*a*)		Kesan fotoelektrik *Photoelectric effect*	1	
	(*b*)		– Elektron ditarik ke anod. *Electrons are attracted to anode.* – Pergerakan elektron dari katod ke anod menghasilkan arus. *Movement of electrons from cathode to anode produce current.* – Kadar pengaliran cas ditunjukkan oleh pesongan penunjuk miliammeter. *Rate of charge flow show by deflection of miliammeter pointer.* [Mana-mana **dua** jawapan diterima] [*Any* **two** *answers accepted*]	2	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
	(*c*)		Penggantian/ *Substitution*: $W = (6.63 \times 10^{-34})(5.2 \times 10^{14})$ Jawapan dengan unit yang betul/ *Answer with correct unit*: 3.4476×10^{-19} J // 3.4476×10^{-19} N m // 3.4476×10^{-19} Js Hz	2	**5**
3	(*a*)	(i)	Masa untuk jisim/aktiviti/bilangan nukleus/keaktifan menjadi separuh./ Masa untuk separuh jisim/bilangan nukleus mereput. *Time for mass/activity/number of nucleus/nuclei to become half./Time for half of mass/number of nucleus/nuclei to decay.*	1	
	(*b*)		 – Melukis garis mengufuk dari 500 ke graf. *Draw a horizontal line from* 500 *to the graph.* – Menulis jawapan 3.2 minit. *Write the answer* 3.2 *minutes.*	2	
	(*c*)		$N = \left(\frac{1}{2}\right)^{n} N_0$ $= \left(\frac{1}{2}\right)^{4} 1000$ = 62.5 bilangan per minit/ *count per minute* **atau/** ***or*** 1000 → 500 → 250 → 125 → 62.5	2	
	(*d*)		Untuk menjadi lebih stabil/Nukleus tidak stabil *To become more stable/Unstable nuclei*	1	**6**
4	(*a*)		Kedudukan geografi berubah/Orbit rendah atau tinggi daripada orbit Bumi geopegun/Tempoh pendek/panjang daripada 24 jam/Tempoh orbit berbeza dengan tempoh putaran Bumi/Arah gerakan tidak perlu sama dengan arah putaran Bumi. *Changing geographical position/High or low orbit than geostationary Earth orbit/Period short/long than* 24 *hours/Orbital period different with period of rotation of Earth/Direction of motion need not be the same with the direction of Earth rotation.* [Mana-mana **satu** jawapan diterima] [*Any* **one** *answer accepted*]	1	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
	(*b*)	(i)	$v = \sqrt{\frac{GM}{R}}$ $= \sqrt{\frac{(6.67 \times 10^{-11})(5.97 \times 10^{24})}{(850 \times 10^3 + 6.37 \times 10^6)}}$ $= 7426.4538 \text{ m s}^{-1}$ // $7.426 \times 10^3 \text{ m s}^{-1}$ [Minimum tiga t.p./ *Minimum three* d.p.]	3	
		(ii)	$T = \sqrt{\frac{4\pi^2 r^3}{GM}}$ $= \sqrt{\frac{4\pi^2(850 \times 10^3 + 6.37 \times 10^6)^3}{(6.67 \times 10^{-11})(5.97 \times 10^{24})}}$ $= 6108.5141 \text{ s}$	2	
	(*c*)		– Jatuh atau turun ke orbit yang lebih rendah/Jejari orbit berkurang *Fall or lower orbit/Orbital radius decreases* – Jatuh dengan halaju tinggi/Jatuh dengan pecutan *Fall with high velocity/Fall with acceleration* – Kekuatan medan graviti bertambah *Gravitational field strength increases* – Rintangan, geseran atau seretan udara bertambah/Suhu bertambah *Air resistance, friction or drag increases/Temperature increases* – Meletup/Terbakar/Menjana haba/Melanggar Bumi *Explode/Burnt/Generate heat/Hit the Earth* [Mana-mana **tiga** jawapan diterima] [*Any* **three** *answers accepted*]	3	**9**
5	(*a*)		Frekuensi sama dan sefasa/Frekuensi sama dan beza fasa yang teta. *Same frequency and in phase/Same frequency and constant phase different*	1	
	(*b*)	(i)	Rajah 5.1 < Rajah 5.2/Sebaliknya *Diagram* 5.1 < *Diagram* 5.2/*Vice versa*	1	
		(ii)	Rajah 5.1 > Rajah 5.2/Sebaliknya *Diagram* 5.1 > *Diagram* 5.2/*Vice versa*	1	
		(iii)	Sama/Rajah 5.1 = Rajah 5.2 *Same/Diagram* 5.1 = *Diagram* 5.2	1	
	(*c*)	(i)	a bertambah, X berkurang/Berkadar songsang a *increases*, X *decreases/Inversely proportional*	1	
		(ii)	Interferens *Interference*	1	
	(*d*)	(i)	[Gantian yang betul/ *Correct substitution*] $1.8 = \frac{(3)(X)}{10}$ [Jawapan dengan unit yang betul/ *Answer with correct unit*] X = 6 cm	2	
		(ii)	Berkurang *Decreases*	1	**9**

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
6	(*a*)		Daya graviti yang bertindak ke atas jasad. *Gravitational force acting on a body.*	1	
	(*b*)	(i)	Daya apungan sama dengan jumlah berat kayak dan atlet. *The buoyant force is equal to the total weight of the kayak and the athlete.*	1	
		(ii)	[Gantian yang betul/ *Correct substitution*] $F_B = \rho Vg$ $1100 = (1000)(V)(9.81)$ [Jawapan dengan betul/ *Correct answer*] V = 0.1121 [Minimun tiga t.p./ *Minimum three d.p.*]	2	
	(*c*)	(i)	Kayak P/Kayak atlet X *Kayak* P/*Athlete* X*'s kayak*	1	
		(ii)	Kayak P/Kayak atlet X *Kayak* P/*Athlete* X*'s kayak*	1	
		(iii)	Kayak P/Kayak atlet X *Kayak* P/*Athlete* X*'s kayak*	1	
	(*d*)	(i)	Berat beban bertambah, isi padu air yang tersesar bertambah/Berkadar terus *The weight of the load increases, the volume of water displaced increases/ Directly proportional*	1	
		(ii)	Berat beban bertambah, daya apungan bertambah/Berkadar terus *The weight of the load increases, the buoyant force increases/Directly proportional*	1	**9**
7	(*a*)		Nisbah laju cahaya dalam vakum kepada laju cahaya dalam medium/ Nisbah sin sudut tuju kepada sin sudut biasan *Ratio of speed of light in vacuum to the speed of light in medium/Ratio of sin of incident angle to the sin of refractive angle*	1	
	(*b*)	(i)	[Gantian yang betul/ *Correct substitution*] $n = \frac{1}{\sin c}$ $1.49 = \frac{1}{\sin c}$ [Jawapan dengan unit yang betul/ *Answer with correct unit*] $c = 42.155°$	2	
		(ii)		1	
	(*c*)	(i)	– Panjang fokus lebih panjang *Focal length longer* – Imej tajam/Imej jelas *Sharp image/Clear image*	2	
		(ii)	– Diameter kanta lebih panjang *Diameter of lense more longer* – Imej tajam/Imej jelas *Sharp image/Clear image*	2	
	(*d*)		Kanta P *Lens* P	1	**9**

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
8	(*a*)		Rektifikasi gelombang separuh *Half-wave rectification*	1	
	(*b*)		– Beza keupayaan meningkat, kapasitor dicas atau tenaga disimpan dalam kapasitor. *Potential difference increase, capacitor charged or energy stored in capacitor.* – Beza keupayaan menyusut, kapasitor dinyahcas atau tenaga dikembalikan ke dalam litar. *Potential difference decrease, capacitor discharged or released energy in circuit.* – Voltan output dirata/Arus rata *Smooth output voltage/Smooth current* [Mana-mana **dua** jawapan diterima] [*Any* **two** *answers accepted*]	2	
	(*c*)	(i)	– 4 – Rektifikasi gelombang penuh/ *Full-wave rectification*	2	
		(ii)	– Tinggi/ *High* – Arus rata atau licin/Voltan output rata/Simpan banyak cas atau tenaga *Smooth current/Smooth output voltage/Store more charge or energy*	2	
	(*d*)		[Gantian yang betul/ *Correct substitution*] $\frac{N_s}{N_p} = \frac{V_s}{V_p}$ $\frac{N_s}{N_p} = \frac{12}{240}$ $\frac{N_s}{N_p} = \frac{1}{20}$ [Jawapan yang betul/ *Correct answer*] $N_p:N_s = 20:1$	2	**9**

Bahagian B / *Section* B

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
9	(*a*)		Penghasilan d.g.e. aruhan daripada gerakan relatif antara konduktor dengan medan magnet atau apabila konduktor itu berada di dalam medan magnet yang berubah *Production of an induced* e.m.f. *from relative motion between the conductor and a magnetic field or when the conductor is in a changing magnetic field*	1	
	(*b*)	(i)	X – Utara/ *North* (U/N) Y – Selatan/ *South* (S)	2	
		(ii)	Menyatakan arah aliran arus dengan betul: *State direction of flow of current correctly*: Arus dari A ke B/Arus ke kanan *Current from* A *to* B/*Current to the right* Menentukan arah pesongan penunjuk galvanometer yang betul: *Determine the deflection of galvanometer pointer correctly*: Pesong ke kiri atau A/ *Deflects to the left or* A	2	

<table>
<tr><th colspan="3">Soalan
Questions</th><th>Jawapan
Answers</th><th>Sub markah
Subs marks</th><th>Jumlah markah
Total marks</th></tr>
<tr><td></td><td></td><td>(iii)</td><td>– Menentang utara atau N/Hukum Lenz/ Oppose North or N/Lenz law
– Ada d.g.e./Ada arus/Pemotongan atau perubahan fluks (medan magnet)
Has e.m.f./Has current/Cutting or change of flux (magnetic field)
[Mana-mana satu jawapan diterima]
[Any one answer accepted]</td><td>1</td><td rowspan="3">20</td></tr>
<tr><td></td><td>(c)</td><td></td><td>– Gerakan relatif antara konduktor/gegelung/solenoid dan medan magnet
Relative motion between conductor/coil/solenoid and magnetic field
– Medan magnet terpotong/Perubahan fluks atau medan magnet
Cutting of magnetic field/Changing magnetic flux or field
– D.g.e. teraruh atau terhasil.
E.m.f. induced or produced.
– Mematuhi Hukum Lenz
Obey Lenz's Law
– Arah arus aruhan sentiasa menentang perubahan fluks yang menghasilkannya.
Induced current always oppose change of flux which producing it.
[Mana-mana empat jawapan diterima]
[Any four answers accepted]</td><td>4</td></tr>
<tr><td></td><td>(d)</td><td></td><td>
<table>
<tr><th>Ciri-ciri
Characteristics</th><th>Sebab
Reason</th></tr>
<tr><td>Jenis bekalan kuasa: Arus ulang alik
Type of power supply: Alternating current</td><td>Perubahan atau pemotongan fluks atau medan magnet
Changing or cutting of magnetic flux or field</td></tr>
<tr><td>Bahan permukaan dapur: Seramik
Material for surface of cooker: Ceramic</td><td>Muatan haba tentu tinggi/Tidak panas/ Kenaikan suhu rendah/Penebat
High specific heat capacity/Not hot/Low rise in temperature/Insulator</td></tr>
<tr><td>Bahan dasar periuk: Besi
Material for base of pot: Iron</td><td>Ada arus pusar/Wujud aruhan elektromagnet/Hasil d.g.e.
Form eddy current/Form induced current/ Produce e.m.f.</td></tr>
<tr><td>Jenis gegelung elektromagnet: Kuprum
Type of electromagnetic coil: Copper</td><td>Rintangan rendah/Kerintangan rendah/Hasil banyak arus/Medan magnet kuat
Low resistance/Low resistivity/Produce more current/Stronger magnetic field</td></tr>
<tr><td>Dapur aruhan L dipilih.
Induction cooker L is chosen.</td><td>Menggunakan arus ulang alik, bahan permukaan dapur seramik, bahan dasar periuk besi, jenis gegelung elektromagnet kuprum
Use alternating current, material for surface cooker metallic, material for base of pot iron and type of electromagnetic coil copper</td></tr>
</table>
</td><td>10</td></tr>
</table>

<table>
<tr><th colspan="3">Soalan
Questions</th><th>Jawapan
Answers</th><th>Sub markah
Subs marks</th><th>Jumlah markah
Total marks</th></tr>
<tr><td>10</td><td>(a)</td><td>(i)</td><td>Mengukur beza keupayaan/voltan/d.g.e.
Measure potential difference/voltage/e.m.f.</td><td>1</td><td rowspan="4"></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>– Ammeter tunjuk atau ada bacaan/Bacaan ammeter bertambah/Jarum atau penunjuk ammeter terpesong
Ammeter shows or has reading/Ammeter reading increases/Needle or pointer of ammeter deflects
– Bacaan voltmeter berkurang.
Voltmeter reading decreases.</td><td>2</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>– Arus, cas atau elektron mengalir/Beza keupayaan atau voltan merentasi mentol.
Current, charge or electron flow/Potential difference or voltage across bulb.
– Mengatasi rintangan dalam sel/Voltan susut apabila litar lengkap.
Overcome internal resistance of cell/Voltage drop when circuit complete.</td><td>2</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>
<table>
<tr><th>Ciri-ciri
Characteristics</th><th>Sebab
Reason</th></tr>
<tr><td>Jenis sumber cahaya: Diod pemancar cahaya/Mentol LED/LED
Source of light: Light emitting diode/LED bulb/LED</td><td>Kehilangan tenaga atau kuasa rendah/Kurang haba/Kecekapan tinggi/Keamatan tinggi.
Low energy or power loss/Less heat/High efficiency/High intensity.</td></tr>
<tr><td>Sambungan sumber cahaya: Selari (terima lukisan)
Connection of light source: Parallel (accept drawing)</td><td>Rintangan berkesan keci/Arus besar/Satu mentol rosak yang lain masih berfungsi.
Small effective resistance/More current/One bulb blow others still function.</td></tr>
<tr><td>Ciri wayar penyambung: Dawai kerintangan rendah
Characteristic of connecting wire: Low resistivity wire</td><td>Rintangan rendah/Kecekapan tinggi/Banyak arus/Kehilangan kuasa/tenaga rendah/Kehilangan haba rendah.
Low resistance/High efficiency/More current/Less power/energy loss/Less heat loss.</td></tr>
<tr><td>Sambungan sel kering
Connection of dry cells:
Alt.1–Sel kering sesiri/Jenis I/Sambungan I
Alt.1– Dry cells in series/Type I/Connection I

Alt.2– Sel kering selari/Jenis II/Sambungan II/Sel kering gabungan/Sel kering selari dan sesiri
Alt.2– Dry cells in parallel/Type I/Connection II/Dry cells combination/Dry cells parallel and series</td><td>Alt.1–Voltan tinggi/d.g.e. tinggi/Keamatan tinggi/Kuasa tinggi/Tenaga tinggi.
Alt.1–High voltage/High e.m.f./High intensity/High power/High energy.

Alt.2–Jumlah rintangan dalam berkurang/Arus tinggi/Keamatan tinggi/Kuasa tinggi/Tenaga tinggi.
Alt.2– Total internal resistance small/High current/High intensity/High power/High energy.</td></tr>
</table>
</td><td>8</td></tr>
</table>

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
		(ii)	Litar R dipilih. *Circuit* R *is chosen*. Jenis sumber cahaya LED, sambungan sumber cahaya selari, wayar penyambung kerintangan rendah, sel kering (Alt.1/Alt.2) *Source of light* LED, *connection of light source parallel*, *low resistivity connecting wire, dry cells* (Alt.1/Alt.2)	2	
	(*d*)	(i)	[Gantian yang betul/ *Correct substitution*] $\frac{1}{r} = \frac{1}{r_1} + \frac{1}{r_2}$ $\frac{1}{r} = \frac{1}{0.5} + \frac{1}{0.5}$ [Jawapan yang betul/ *Correct answer*] r = 0.25 Ω		
		(ii)	[Rintangan berkesan yang betul/ *Correct effective resistance*] R = 60 + 0.25 = 60.25 Ω [Gantian yang betul/ *Correct substitution*] ε = I (R + r) 9 = I (60.25) [Jawapan dengan unit yang betul/ *Answer with correct unit*] I = 0.149 A [Minimum tiga t.p./ *Minimum three d.p.*)	5	**20**

Bahagian C / *Section* C

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
11	(*a*)		Darjah kepanasan *Degree of hotness*	1	
	(*b*)	(i)	– Suhu awal 11.1(*a*) = 11.1(*b*)/Suhu awal sama *Initial temperature* 11.1(*a*) = 11.1(*b*)/*Initial temperature same or equal* – Jisim 11.1(*a*) > 11.1(*b*)/Sebaliknya *Mass* 11.1(*a*) > 11.1(*b*)/*Vice versa*	5	
		(ii)	– Kenaikan suhu 11.2(*b*) > 11.2(*a*)/Sebaliknya *Rise in temperature* 11.2(*b*) > 11.2(*a*)/*Vice versa*		
		(iii)	– Jisim bertambah, kenaikan suhu berkurang/Jisim berkadar songsang dengan kenaikan suhu. *Mass increases*, *rise in temperature decreases*/*Mass is inversely proportional to rise in temperature*. – Muatan haba tentu malar/Haba malar/Masa dan kuasa malar *Specific heat capacity constant*/*Heat constant*/*Time and power constant*		

Soalan *Questions*	Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
(*c*)	– Muatan haba tentu pasir rendah/Muatan haba tentu air laut tinggi *Specific heat capacity of sand lower/Specific heat capacity of sea water large or high* – Tenaga sama/Haba sama *Energy same/Heat same* – $Q = mc\theta$ – Muatan haba tentu berkadar songsang dengan kenaikan suhu. *Specific heat capacity is inversely proportional to rise in temperature.* – Kenaikan suhu pasir tinggi/Kenaikan suhu air laut rendah. *Rise in temperature of sand high/Rise in temperature of sea water low.* [Mana-mana **empat** jawapan diterima] [*Any* **four** *answers accepted*]	4	
(*d*)	**Cadangan** ***Suggestions*** / **Sebab** ***Reason***		
	Muatan haba tentu dinding: Tinggi *Specific heat capacity of wall: High*	Kenaikan suhu rendah/Penebat *Low rise in temperature/Insulator*	
	Muatan haba tentu bumbung: Tinggi *Specific heat capacity of roof: High*	Kenaikan suhu rendah/Penebat *Low rise in temperature/Insulator*	
	Bahan dinding: Konkrit atau simen/Batu-bata/Kayu/Tanah liat/Berpenebat *Material of wall: Concrete/Cement/Brick/Wood/Clay/Insulated*	Pengaliran haba rendah/Kurang kekonduksian haba/Kurang serap haba/Muatan haba tentu tinggi *Low heat flow/Low heat conduction/Less heat absorb/High specific heat capacity*	
	Bahan bumbung: Seramik/Styrofoam/Asbestos/Batu-bata/Rumbia/Konkrit/Polimer/Berlapis/Berpenebat *Material of roof: Ceramic/Styrofoam/Asbestos/Brick/Concrete/Polymer/Layered/Insulated*	Pengaliran haba rendah/Kurang kekonduksian haba/Kurang serap haba/Muatan haba tentu tinggi *Low heat flow/Low heat conduction/Less heat absorb/High specific heat capacity*	
	Banyak tingkap *Many windows*	Haba tidak terperangkap/Banyak udara masuk atau keluar/Meningkatkan perolakan/Haba dibebaskan/Peredaran udara lebih baik *Heat not trapped/More air in or out/Increase convection/Hot air released/Better air flow*	
	Tingkap besar *Large window*	Haba tidak terperangkap/Banyak udara masuk atau keluar/Meningkatkan perolakan/Haba dibebaskan/Peredaran udara lebih baik *Heat not trapped/More air in or out/Increase convection/Hot air released/Better air flow*	

Soalan *Questions*	Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*

Cadangan *Suggestions*	Sebab *Reason*
Lubang udara *Air hole*	Haba tidak terperangkap/ Banyak udara masuk atau keluar/ Meningkatkan perolakan/Haba dibebaskan/Peredaran udara lebih baik *Heat not trapped/More air in or out/ Increase convection/Hot air released/ Better air flow*
Bumbung tinggi/Siling tinggi *High roof/High ceiling*	Haba tidak terperangkap/Udara dalam rumah sejuk/Udara panas di atas/Haba dibebaskan *Heat not trapped/Cool air in house/ Hot air above/Heat released*
Tingkap berlapis/Tingkap kalis panas *Layered window/Hot proof window*	Kurang haba masuk/Kurang konduksi haba/Tidak serap haba *Less heat in/Less heat conduction/ Not absorb heat*

10

20

Kertas 1 / *Paper 1*

1 **D** Laju 600 km j^{-1} → Kuantiti terbitan; 600 km j^{-1} ke arah barat → Kuantiti vektor
Speed 600 km h^{-1} → *Derived quantity*; 600 km h^{-1} *to the west* → *Vector quantity*

2 **B** Separuh bulatan/ *Half of circular path* = 2r
= 2 × 63.6 m
= 127.2 m

3 **B** Masa hentaman bertambah, maka mengurangkan risiko kecederaan.
Lengthen the impact time, thus reduces the risk of injuries.

4 **C** Momentum pemain X berbeza dengan pemain Y kerana jisim dan laju berbeza. Mengikut prinsip keabadian momentum, jumlah momentum sebelum perlanggaran adalah sama dengan jumlah momentum selepas perlanggaran. Selepas berlanggar, kedua-dua pemain jatuh bersama-sama dengan halaju yang sama adalah perlanggaran tak kenyal, $m_X u_X + m_Y m_Y = (m_X + m_Y)v$
Momentum player X *different with player* Y *due to different mass and speed. According to principle of conservation of momentum, the total momentum before collision is equal to the total momentum after collision. After collision, both players fall together with common final velocity is an inelastic collision,* $m_X u_X + m_Y m_Y = (m_X + m_Y)v$

5 **B** Hukum gerakan Newton kedua menyatakan bahawa apabila daya bersih bertindak ke atas jasad, pecutan jasad berkadar terus dengan magnitud daya dan berkadar songsang dengan jisim jasad.
Newton's second law of motion states that when a net force is acting on a body, the acceleration of the body is directly proportional to the magnitude of the force and is inversely proportional to its mass.

6 **D** Pemindahan haba di antara dua jasad bersentuhan secara terma berlaku dalam kedua-dua arah. Kadar aliran haba daripada jasad bersuhu tinggi adalah lebih tinggi berbanding kadar aliran haba daripada jasad bersuhu rendah. Kadar aliran haba bersih menjadi sifar apabila keseimbangan terma telah dicapai di mana suhu akhir kedua-dua jasad adalah sama.
Transfer of heat between two bodies in thermal contact occurs in both directions. Rate of flow of heat from high temperature body is higher compared to rate of flow of heat from low temperature body. The net rate of flow of heat becomes zero when thermal equilibrium is reached, where the final temperature of both bodies is equal.

7 **A** Keju mempunyai muatan haba tentu yang lebih tinggi berbanding roti. Maka, suhu keju turun dengan lebih perlahan berbanding roti kerana haba dibebaskan pada kadar yang rendah.
Cheese has higher specific heat capacity compared to bread. Hence, temperature of cheese decreases slowly compared to bread as heat is released at a low rate.

8 **A** Daya graviti yang bertindak di antara dua jasad di alam semesta adalah sama mengikut rumus

$$F = \frac{GMm}{r^2}$$

Gravitational force acting between two bodies in the universe is equal according to formula

$$F = \frac{GMm}{r^2}$$

9 **A** Halaju lepas ialah halaju minimum yang diperlukan oleh suatu jasad di permukaan Bumi untuk mengatasi daya graviti Bumi dan terlepas ke angkasa.
Escape velocity is the minimum velocity needed by a body on Earth's surface to overcome the gravitational force and escape to the outer space.

10 B Dua kuantiti fizik daripada graf sesaran-masa bagi gelombang ialah amplitud (sesaran maksimum dari titik kedudukan keseimbangan) dan tempoh (masa diperlukan untuk menghasilkan satu gelombang penuh).
Two physical quantities determine from displacement-time graph is amplitude (*maximum displacement from equilibrium position*) *and period* (*time needed to produce one complete wave*).

11 A Menambahkan panjang tali akan menambahkan tempoh ayunan. Tempoh ayunan berkadar songsang dengan frekuensi ayunan.
Increasing the length of thread will increase the period of oscillation. Period of oscillation is inversely proportional to frequency of oscillation.

12 B Eksperimen dwicelah Young menunjukkan interferens gelombang. Daripada rumus $x=\frac{\lambda D}{a}$, jarak antara pinggir-pinggir, x berkadar terus dengan panjang gelombang, λ dan jarak antara dwicelah dengan skrin, D, dan berkadar songsang dengan jarak antara dwicelah, a. Cahaya biru mempunyai panjang gelombang yang lebih pendek berbanding cahaya kuning, maka jarak antara pinggir-pinggir bagi cahaya biru adalah lebih pendek berbanding cahaya kuning.
Young's double slit experiment shows interference of waves. From the formula $x = \frac{\lambda D}{a}$, *distance between fringes,* x *is directly proportional to wavelength,* λ *and distance between the double slits and the screen,* D *and inversely proportional to the distance between the double slits,* a. *Blue light has a shorter wavelength compared to yellow light, hence the distance between fringes for blue light is shorter than the yellow light.*

13 D Gelombang bermula dari titik antinod (lembangan) **P** dan berakhir di titik kedudukan keseimbangan **Q**.
Waves started from the antinode point (*trough*) **P** *and ended at the equilibrium position point* **Q**.

14 A Merujuk kepada spektrum gelombang elektromagnet mengikut peningkatan frekuensi; Gelombang radio, gelombang mikro, inframerah, cahaya nampak, ultra ungu, sinar-X dan sinar gama. Maka, **Q** ialah gelombang mikro dan **R** ialah ultra ungu.
According to electromagnetic waves spectrum with increasing frequency; *Radio wave, microwave, infrared, visible light, ultraviolet,* X-*ray and gamma ray. Hence,* **Q** *is microwave and* **R** *is ultraviolet.*

15 A Jarak objek, u bagi kanta pembesar ialah kurang daripada panjang fokus kanta, f (u < f). Ciri imej bagi kanta pembesar ialah maya, tegak dan dibesarkan.
Object distance, u *for magnifying lens is less than the focal length,* f (u < f). *Characteristic of image for magnifying lens is virtual, upright and magnified.*

16 C Sudut tuju, i lebih besar daripada sudut genting, c (i > c), maka pantulan dalam penuh berlaku.
The angle of incidence, i *is greater than the critical angle,* c (i > c). *Hence, total internal reflection occurs.*

17 D $\frac{v}{u} = \frac{h_i}{h_0}$

$\frac{15}{7.5} = \frac{20}{h_0}$

$h_0 = 10$ cm

18 C Ciri-ciri imej pada cermin cekung bagi objek yang berada kurang daripada panjang fokus cermin, (u < f) ialah maya, tegak dan dibesarkan.
Characteristics of image on concave mirror for object placed less than the focal length of the mirror, (u < f) *is virtual, upright and magnified.*

19 A Kapal terbang pada halaju malar berada dalam keseimbangan daya, di mana daya tujah ke hadapan = daya seretan.
An aeroplane at constant velocity is in equilibrium of force, where the forward thrust = frictional force.

20 A $F_{net} = 10\text{ N} + (-15\text{ N}) = -5\text{ N}$ (ke kiri, ke arah Aina/ *to the left, towards Aina*)

21 B Troli bermula dari keadaan pegun. Apabila dilepaskan, troli mengalami pecutan malar. Sebaik menaiki landasan, halaju troli berkurang sehingga berhenti di hujung landasan.
The trolley started from rest. When released, it experienced uniform acceleration. As it climbs the incline track, its velocity decreases until it stops at the end of the track.

22 B Paras merkuri di lengan kiri manometer lebih rendah berbanding paras merkuri di lengan kanan manometer. Hal ini menunjukkan tekanan gas dalam belon lebih tinggi berbanding tekanan atmosfera.
Mercury level in the left arm is lower compared to that at the right arm. This shows that the gas pressure in balloon is greater than the atmospheric pressure.

23 C $P = h\rho g$
$= (50)(1\ 000)(9.81)$
$= 490\ 500\ \text{Pa} \approx 4.9 \times 10^5\ \text{Pa}$

24 B Hukum Boyle/ *Boyle's law*:
$P_1V_1 = P_2V_2$
$(4\ 000)\ (2.0) = P_2\ (2.5)$
$P_2 = 3\ 200\ \text{Pa}$

25 C Elektrik dari stesen penjana kuasa dihantar kepada pengguna melalui wayar yang mempunyai rintangan rendah pada voltan yang tinggi dan arus yang rendah untuk meminimumkan kehilangan tenaga atau kuasa. Halk ini ditunjukkan melalui rumus kehilangan kuasa, $P = I^2R$.
Electricity from the power generating station is transmitted to the consumer along a low resistance cable at high voltage and low current to minimize the energy or power loss. This shows from the formula of power loss, $P = I^2R$.

26 C Laju ayunan bola ping pong dapat ditingkatkan dengan menambahkan beza keupayaan voltan lampau tinggi (VLT) dan mengurangkan jarak antara dua plat logam.
The speed of oscillation of the ping pong ball can be increases by increasing the potential difference of extra high tension (EHT) *and decreasing the distance between the two metal plates.*

27 D $R_T = \left[\frac{1}{2} + \frac{1}{2}\right]^{-1} + 1$
$= 2\ \Omega$
$V = IR$
$3 = I(2)$
$I = 1.5\ \text{A}$

28 D $\mathcal{E} = IR + Ir$
$= (1.2)(4.5) + (1.2)(0.5)$
$= 6.0\ \text{V}$

29 B Peraturan Tangan Kiri Fleming:
Fleming's Left-Hand Rule:
Ibu jari → Arah daya (gerakan konduktor)
Thumb → Direction of force (*motion of conductor*)
Jari telunjuk → Arah Selatan medan magnet
Index finger → Direction of south of the magnetic field
Jari tengah → Arah aliran arus
Middle finger → Direction of flow of current

30 A Gerakan magnet keluar dan masuk dalam solenoid menyebabkan perubahan arah aruhan yang terhasil, maka jarum galvanometer terpesong ke kiri dan kanan bertentangan dengan arah gerakan magnet (Hukum Lenz).
The movement of the magnet in and out to the solenoid causes the change in the direction of the induced current, hence the galvanometer needle deflected to the left and right alternately opposite to the direction of motion of the magnet (*Lenz's law*).

31 A Pasangan daya magnet yang bertentangan arah menghasilkan kesan putaran pada gegelung kuprum berarus (Hukum Tangan Kiri Fleming).
A pair of magnetic forces in opposite direction produced a turning effect on the current-carrying copper coil (*Fleming's Left Hand Rule*).

32 A Komponen elektronik yang digunakan sebagai penguat arus ialah transistor yang terdiri daripada tiga terminal iaitu, tapak (B), pengeluar (E) dan pengumpul (C).
Electronic component used as a current amplifier is transistor which consists of three terminals namely base (B)*, emitter* (E) *and collector* (C).

33 B Transistor NPN terdiri daripada gabungan semikonduktor jenis p pada tapak (Y), dan semikonduktor jenis n pada pengeluar (Z) dan pengumpul (X).
NPN *transistor made of combinations of* p-*type semiconductor at the base* (Y)*, and* n-*type semiconductor at the emitter* (Z) *and collector* (C).

34 A Pada waktu malam, rintangan PPC bertambah, maka voltan tapak bertambah. Arus tapak, I_B mengalir dan mengaktifkan transistor. Arus pengumpul, I_C yang lebih besar mengalir dan menyalakan mentol M.
At night, resistance of LDR *increases, hence base voltage increases. Base current,* I_B *flows and activated the transistor. A greater collector current,* I_C *flows and light up bulb* M.

35 B Teras grafit digunakan dalam reaktor nuklear untuk memperlahankan gerakan neutron.
Graphite cores in nuclear reactors is used to slow down the motion of neutrons.

36 B Kebocoran paip di bawah tanah dikesan menggunakan radioisotop yang mengeluarkan zarah beta dengan separuh hayat 12 jam agar tiub pengesan Geiger-Muller mempunyai tempoh yang cukup untuk mengesan lokasi kebocoran. Sumber radioisotop tidak berada lama dalam air agar tidak membahayakan pengguna.
The leakage of underground pipe is detected by using a radioisotope which emits beta particles with 12 *hours half-life, so that the Geiger-Muller detector tube has enough time to locate the leakage. The radioisotope sources do not remain longer in the water, so it won't harm the consumers.*

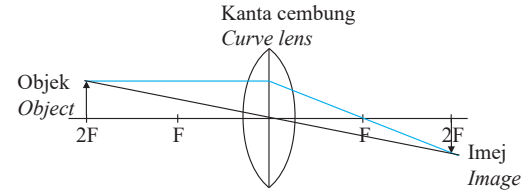
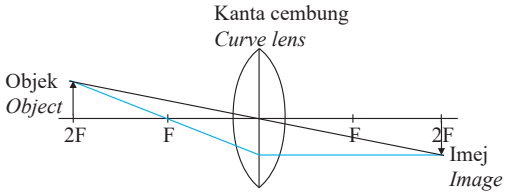
37 B Perubahan nombor proton/ *Change in proton number* = 39 – 38 = 1
Perubahan nombor nukleon/ *Change in nucleon number* = 90 – 90 = 0
Sinaran radioaktif yang dibebaskan/ *Radioactive radiation released*: Zarah beta/ *Beta particle*, β
$^{90}_{38}\text{Sr} \rightarrow {}^{90}_{39}\text{Sr} + {}^{0}_{-1}\beta$ + tenaga/*energy*

38 D Unit bagi jisim atom dan zarah subatom ialah unit jisim atom (u.j.a.).
The unit of mass of atoms and subatomic particles is atomic mass unit (a.m.u.).

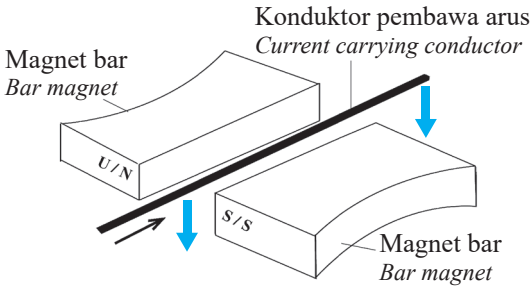
39 D Apabila suatu permukaan logam disinari oleh alur cahaya yang mempunyai frekuensi yang lebih tinggi daripada frekuensi ambang logam, elektron daripada logam itu dapat dipancar keluar. Fenomena ini dikenali sebagai kesan fotoelektrik.
When a metal surface is illuminated by a beam of light at a frequency higher than the threshold frequency of the metal, electrons can be emitted from the metal. This phenomenon is known as photoelectric effect.

40 D Teori kuantum Max Plank dan Albert Einstein menyatakan bahawa foton ialah cahaya tenaga yang wujud dalam bentuk diskrit (paket tenaga).
The Quantum Theory of Max Plank and Albert Einstein stated that a photon is a light energy exists in the discrete form (*energy packet*).

Bahagian A / *Section* A

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
1	(*a*)		Kuantiti haba diperlukan untuk menaikkan suhu 1 kg bahan sebanyak 1°C. *Amount of heat required to raise the temperature of* 1 kg *substance by* 1°C.	1	
	(*b*)	(i)	✓ Pada waktu siang, daratan lebih cepat panas. *During day time, the land heats up.*	1	
		(ii)	Muatan haba tentu daratan atau pasir lebih kecil daripada air laut/ Sebaliknya *Specific heat capacity of the land or sand is smaller than sea/Vice versa*	1	
	(*c*)		Bayu laut *Sea breeze*	1	4
2	(*a*)		Hukum Hooke *Hooke's law*	1	
	(*b*)		$\frac{20}{8} / \frac{20}{0.08}$ $= 2.5 \text{ N cm}^{-1} / 250 \text{ N m}^{-1}$	2	
	(*c*)	(i)	Berkurang/Kecil *Decreases/Small*	1	
		(ii)	Spring kuprum mempunyai pemalar spring yang lebih rendah/Spring kuprum kurang kenyal/Spring kuprum lebih lembut *Copper spring has a lower spring constant/Copper spring is less elastic/Copper spring is soft*	1	5
3	(*a*)		Kanta penumpu *Converging lens*	1	
	(*b*)		 **atau/ *or*** 	1	
	(*c*)	(i)	Berkurang *Decreases*	1	
		(ii)	Dikecilkan *Diminished*	1	
	(*d*)		$m = \frac{v}{u}$ $m = \frac{9}{12} / \frac{0.09}{0.12}$ $= 0.75$	2	6

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
4	(*a*)		NPN/Npn/npn	1	
	(*b*)		– Rintangan PPC/tapak bertambah *Resistance* LDR/*base increases* – Voltan tapak bertambah *Base voltage increases* – Arus tapak mengalir *Base current flow* – Transistor diaktifkan atau dihidupkan *Transistor activated or on* – Arus pengumpul tinggi mengalir *High collector current flow* [Mana-mana **tiga** jawapan diterima] [*Any* **three** *answers accepted*]	3	
	(*c*)	(i)	$V_{PPC/LDR} = \frac{R_{PPC/LDR}}{R_{PPC/LDR} + R_2} \times V$ $= \frac{50 \times 10^3}{(50 \times 10^3 + 10 \times 10^3)} \times 18$ $= 15\ V$	3	
		(ii)	$V = IR$ $15 = I\,(50 \times 10^3)$ $I = 0.0003\ A = 3 \times 10^{-4}\ A$	2	**9**
5	(*a*)		Pembelauan *Diffraction*	1	
	(*b*)	(i)	Rajah 5.1 > Rajah 5.2/Sebaliknya *Diagram* 5.1 > *Diagram* 5.2/*Vice versa*	1	
		(ii)	Rajah 5.1 > Rajah 5.2/Sebaliknya *Diagram* 5.1 > *Diagram* 5.2/*Vice versa*	1	
		(iii)	Rajah 5.1 < Rajah 5.2/Sebaliknya Rajah 5.1 tidak ketara/ Rajah 5.2 ketara *Diagram* 5.1 < *Diagram* 5.2/*Vice versa* *Diagram* 5.1 *not significant*/*Diagram* 5.2 *significant*	1	
	(*c*)	(i)	Saiz celah berkurang, penyebaran gelombang bertambah atau ketara/ Sebaliknya *The size of the slit decreases, the spreading of waves increases or significant/ Vice versa*	1	
		(ii)	Amplitud gelombang berkurang, penyebaran gelombang bertambah/ ketara/Sebaliknya *The amplitude of waves decreases, the spreading of waves increases or significant/Vice versa*	1	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
	(*d*)		Tenaga berkurang *Energy decreases*	1	
	(*e*)		– Frekuensi dikurangkan *Decreasing the frequency* – Panjang gelombang bertambah/Gelombang bunyi dibelau atau disebar lebih *Wavelength increases/Sound waves diffract or spread more*	2	9
6	(*a*)	(i)		1	
		(ii)	Medan magnet paduan/Medan magnet yang dihasilkan oleh interaksi antara medan magnet konduktor pembawa arus dan magnet kekal. *Resultant magnetic field/Magnetic field produced by interaction between the magnetic field from a current carrying conductor and permanent magnet.*	1	
	(*b*)	(i)	Rajah 6.2(a) = Rajah 6.2(b) *Diagram* 6.2(a) = *Diagram* 6.2(b)	1	
		(ii)	Rajah 6.2(a) < Rajah 6.2(b) *Diagram* 6.2(a) < *Diagram* 6.2(b)	1	
		(iii)	Rajah 6.2(a) < Rajah 6.2(b) *Diagram* 6.2(a) < *Diagram* 6.2(b)	1	
	(*c*)	(i)	Beza keupayaan bertambah, kelajuan putaran gegelung bertambah/Sebaliknya *The potential difference increases, the speed of rotation of coil increases/Vice versa*	1	
		(ii)	Beza keupayaan bertambah, daya bertambah/Sebaliknya *The potential difference increases, the force increases/Vice versa*	1	
	(*d*)		– Bergetar/Tidak berputar/Pegun/Tidak bergerak *Vibrates/Does not rotate/Stationary/Does not move* – Daya songsang berkala/Arah daya berubah-ubah *Force reversed periodically/Direction of force changes alternately*	2	9
7	(*a*)		Daya memusat/Daya graviti *Centripetal force/Gravitational force*	1	
	(*b*)	(i)	$r = R + h$ $= 6\,370 + 30\,500$ $= 36\,870$	1	
		(ii)	$T = \sqrt{\frac{GM}{r}}$ $T = \sqrt{\frac{(6.67 \times 10^{-11})(5.97 \times 10^{24})}{36\,870 \times 10^{3}}}$ $= 3286.3477 \text{ m s}^{-1}$	2	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
	(*c*)	(i)	– Geopegun *Geostationary* – Kedudukan geografi yang sama/Mengorbit Bumi dengan arah yang sama dengan putaran Bumi/Tempoh orbit 24 jam/Tempoh orbit sama dengan tempoh putaran Bumi *Same geographical location/Orbiting the Earth in the same direction as the Earth's rotation/Orbital period* 24 *hours/Orbital period equal to Earth's rotation period*	2	
		(ii)	– 24 jam 24 *hours* – Sama tempoh putaran Bumi/Kedudukan geografi sama *Same with Earth's rotation period/Same geographical location*	2	
	(*d*)		Satelit P *Satellite* P	1	**9**
8	(*a*)		Tenaga (Kerja dilakukan) oleh sumber elektrik untuk menggerakkan 1 Coulomb cas dalam litar lengkap atau tertutup/Beza keupayaan merentasi sel apabila tiada arus atau litar terbuka *Energy* (*Work done*) *by electrical source to move* 1 *Coulomb charge in a complete or closed circuit/Potential difference across cell when no current or open circuit*	1	
	(*b*)		$\varepsilon = I (R + r)$ $6 = I (2^* + 2)$ I = 1.5 A (Jawapan bergantung kepada nilai R digunakan) (*Answer depend on value* R *used*) * Terima sebarang nilai untuk R termasuk sifar * *Accept any value for* R *including zero*	2	
	(*c*)	(i)	– Banyak *More* – Daya gerak elektrik bertambah (d.g.e. bertambah)/Voltan tinggi/Arus bertambah *Electromotive force increases* (e.m.f *increases*)/*High voltage Current increases*	2	
		(ii)	– Bersiri *Series* – Daya gerak elektrik bertamba (d.g.e. bertambah) Voltan tinggi/Arus bertambah *Electromotive force increases* (e.m.f *increases*) *High voltage/Current increases*	2	
		(iii)	– LED/Jimat tenaga LED/*Energy saving* – Jimat tenaga/Kecekapan tinggi/Kurang hilang kuasa atau tenaga/Kurang haba *Save energy/High efficiency/Reduce power or energy loss/Less heat*	2	**9**

Bahagian B / *Section* B

<table>
<tr><th colspan="3">Soalan
Questions</th><th>Jawapan
Answers</th><th>Sub markah
Subs marks</th><th>Jumlah markah
Total marks</th></tr>
<tr><td>9</td><td>(a)</td><td></td><td>Daya impuls/Daya graviti
Impulsive force/Gravitational force</td><td>1</td><td rowspan="3"></td></tr>
<tr><td></td><td>(b)</td><td></td><td>– Lapisan dalam topi daripada bahan lembut/getah/kain/span/busa/polisterin/kusyen
Inner lining soft/rubber/cloth/sponge/foam/cushion
– Masa impak atau hentaman panjang/Kurang daya impuls
Longer impact time/Reduce impulsive force
– Bahan luar topi kuat/gentian karbon
Outside material strong/carbon fibre
– Topi tidak pecah/kuat/tahan daya tinggi
Helmet does not break/strong/withstand high force</td><td>4</td></tr>
<tr><td></td><td>(c)</td><td></td><td>
<table>
<tr><th>Ciri-ciri
Characteristics</th><th>Sebab
Reason</th></tr>
<tr><td>Ketinggian penghentak cerucuk: Tinggi
Height of the pile driver: High</td><td>Momentum, daya atau tenaga tinggi/Cerucuk lebih dalam
High momentum, force or energy/Driver penetrate deeper</td></tr>
<tr><td>Jisim penghentak cerucuk: Besar
Mass of the pile driver: Large/Big</td><td>Momentum, daya atau tenaga tinggi/Inersia tinggi/Cerucuk lebih dalam
High momentum, force or energy/High inertia/The pile is deeper</td></tr>
<tr><td>Bahan cerucuk: Konkrit/Besi
Material of pile: Concrete/Iron</td><td>Kuat/Tidak pecah/Tahan daya tinggi
Strong/Do not break/Withstand high force</td></tr>
<tr><td>Bentuk hujung cerucuk: Tajam/Tirus
Shape of tip of the pile: Sharp/Point edge</td><td>Tekanan tinggi/Luas permukaan kecil/Cerucuk lebih dalam atau mudah masuk
High pressure/Small surface area/Pile penetrate deeper or easy to penetrate</td></tr>
<tr><td>R (jika bahan cerucuk konkrit)
R (if material of pile is concrete)
Q (jika bahan cerucuk besi)
Q (if material of pile is iron)</td><td>Ketinggian penghentak cerucuk tinggi, jisim penghentak cerucuk besar, bahan cerucuk konkrit atau besi, bentuk hujung cerucuk tajam
Height of the pile driver high, mass of the pile driver large, material of the pile driver concrete or iron, shape of tip of the pile sharp</td></tr>
</table>
</td><td>10</td></tr>
</table>

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
	(*d*)	(i)	Halaju penghentak cerucuk sejurus sebelum hentaman *Velocity of pile driver just before impact* $v = u + at$ $= 0 + (9.81)(2)$ $= 19.62 \text{ m s}^{-1}$ **atau/ *or*** $F = \frac{mv-mu}{t}$ $(450)(9.81) = \frac{450\,(v-0)}{2}$ $v = 19.62 \text{ m s}^{-1}$	3	
		(ii)	Perubahan momentum *Change of momentum* $= mv - mu$ $= (450)(19.62) - (450)(0)$ $= 8\,829 \text{ kg m s}^{-1}$	2	**20**
10	(*a*)		Tekanan disebabkan oleh berat lapisan udara yang bertindak ke atas permukaan Bumi *Pressure caused by weight of air layer acting on Earth's surface*	1	
	(*b*)	(i)	– Ketumpatan tinggi *High density* ● Ketinggian barometer rendah *Height of barometer is short* – Daya tarikan antara molekul tinggi/Daya lekitan tinggi *High cohesive force* ● Tidak melekat pada dinding kaca *Does not stick to the glass wall* – Legap *Opaque* ● Cahaya tidak menembusi *Light cannot penetrate* – Meniskus merkuri mudah dibaca atau dilihat *Meniscus easy to read or see* – Kekal sebagai cecair pada ketinggian berbeza *Remain as liquid at different height* – Tidak mudah meruap *Not easily vaporize* [Mana-mana **tiga** jawapan diterima] [*Any* **three** *answers accepted*]	3	
		(ii)	Bacaan merkuri jitu atau tepat *Mercury reading is accurate*	1	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
	(*c*)		<table><tr><th>Ciri-ciri *Characteristics*</th><th>Sebab *Reason*</th></tr><tr><td>Bahan beg: Kulit *Bag material*: *Leather*</td><td>Kuat/fleksibel/tidak koyak *Strong/flexible/do not tear*</td></tr><tr><td>Bahan tiub pelindung: Loyang *Protector tube material*: *Brass*</td><td>Melindungi tiub kaca/kuat/tidak pecah *Protect glass tube/strong/do not break*</td></tr><tr><td>Bahan penunjuk: Gading *Pointer material*: *Ivory*</td><td>Tidak bertindak balas dengan merkuri /tidak karat/tidak aktif secara kimia/ lengai *Do not react with mercury/do not rust/ chemically not active/inert*</td></tr><tr><td>Instrumen tambahan: Termometer *Additional instrument*: *Thermometer*</td><td>Mengukur suhu/menentukan tekanan pada suhu berbeza/menghubungkait tekanan dengan suhu *Measure temperature/determine pressure at different temperature/relates pressure with temperature*</td></tr><tr><td>Barometer Q *Barometer* Q</td><td>Bahan beg kulit, bahan tiub pelindung loyang, bahan penunjuk gading dan instrumen tambahan termometer *Bag material is leather, protector tube is brass, pointer material is ivory and additional instrument is thermometer*</td></tr></table>	10	
	(*d*)	(i)	Tekanan atmosfera di permukaan laut *Atmospheric pressure at sea level* $P = h\rho g$ $= (0.76)(1.36 \times 10^4)(9.81)$ $= 101\ 396.16$ Pa // 1.014×10^5 Pa Tukar ke unit mbar *Convert to* mbar $P = \frac{101\ 396.16 \text{ // } 1.014 \times 10^5}{100}$ $= 1\ 013.9616$ mbar // 1.014×10^3 mbar	3	
		(ii)	$P_{puncak/top} = (0.3)(13\ 600)(9.81)$ $= 40\ 024.8$ Pa $P_{permukaan\ laut/sea\ level} = 101\ 396.16$ Pa Ketinggian gunung *Height of mountain* $P = h\rho g$ $101\ 396.16 - 40\ 024.8 = h\ (1.3)(9.81)$ $h = 4\ 812.308$ m	2	**20**

Bahagian C / *Section* C

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
11	(*a*)		Masa yang diambil oleh bilangan nukleus/jisim nukleus/aktiviti bahan radioaktif untuk mereput/menjadi separuh daripada nilai asalnya. *Time taken for a number of nucleus/mass of nucleus/radioactive material to decay/become half from its initial value.*	1	
	(*b*)		– Bilangan nuklues asal Radiosotop Y = Radioisotop X/Bilangan nukleus asal sama. *The number of original nuclei of Radioisotope* Y = *Radioisotope* X/*The number of original nuclei is same or equal.* – Separuh hayat Radioisotop Y > Radioisotop X/Sebaliknya [ikut label murid] *Half-life of Radioisotope* Y > *Radioisotope* X/*Vice versa* [*depends on student's label*] – Kadar reputan Radioisotop Y < Radioisotop X/Sebaliknya *Decay rate of Radioisotope* Y < *Radioisotope* X/*Vice versa* – Bilangan nukleus asal tidak dipengaruhi oleh separuh hayat. *The number of original nuclei does not affected by half-life.* – Semakin bertambah separuh hayat, semakin berkurang kadar reputan. *Half life increases, decay rate decreases.*	5	
	(*c*)		– Jumlah jisim sebelum reputan lebih besar daripada jumlah jisim selepas reputan. *Total mass before decay is greater than total mass after decay.* – Berlaku pengurangan jisim/Kehilangan jisim *Mass reduce/Mass loss* – Cacat jisim *Mass defect* – Cacat jisim = Jumlah jisim sebelum reputan – Jumlah jisim selepas reputan *Mass defect = Total mass before decay – Total mass after decay* – $E = mc^2$ – Cacat jisim berubah menjadi tenaga nuklear yang tinggi *Mass defect change or convert to large nuclear energy* [Mana-mana **empat** jawapan diterima] [*Any* **four** *answers accepted*]	4	
	(*d*)		**Cadangan** ***Suggestion*** / **Sebab** ***Reason*** Dinding tebal / *Thicker wall* — Elak Sinaran radioaktif terbebas ke persekitaran/Elak kebocoran radiasi / *Avoid radiation released to the environment/ Avoid leakage of radiation* Separuh hayat panjang / *Long half-life* — Tidak ganti kerap/Guna lama/Tahan lama / *Do not replaced frequently/Long lasting* Radioisotop pepejal / *Solid radioisotope* — Mudah dikendalikan/diurus/dibawa/ dialihkan/Tidak tumpah / *Easy to handle/manage/carry/Do not spill*		

Soalan *Questions*	Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*

Cadangan *Suggestion*	Sebab *Reason*
Radioisotop Uranium/ Plutonium *Uranium/Plutonium radioisotope*	Separuh hayat panjang/Pembelahan nuklear berlaku/Tindak balas berantai berlaku *Long half-life/Nuclear fission occur/Chain reaction occur*
Rod pengawal boron/ kadmium *Boron/Cadmium control rod*	Serap neutron berlebihan atau serap neutron sekunder/Kawal tindak balas berantai atau kawal kadar tindak balas *Absorbs excess neutron or absorbs secondary neutron/Control chain reaction or control rate of reaction*
Moderator grafit *Graphite moderator*	Perlahankan laju neutron *Slow down/The speed of neutron*
Air sebagai ejen penyejuk *Water as cooling agent*	Serap haba daripada tindak balas nuklear/Muatan haba tentu tinggi *Absorbs heat from nuclear reaction/High specific heat capacity*
Turbin berjisim kecil/ Ketumpatan turbin rendah *Small mass turbine/Low density turbine*	Inersia kecil/Jisim kecil atau ringan *Small inertia/Low mass or light*
Diameter dawai besar/ dawai tebal/luas keratan rentas dawai besar *Large diameter wire/thick wire/large cross section of wire*	Rintangan rendah *Low resistance*
Dawai kuprum *Copper wire*	Rintangan rendah/Kerintangan rendah *Low resistance/Low resistivity*
Turbin besar *Large turbine*	Potong banyak fluks atau medan magnet/Arus tinggi/D.g.e. tinggi/Voltan tinggi *Cut more magnetic flux or field/High current/High* e.m.f./*High voltage*
Bilangan lilitan gegelung banyak *More number of turns of coil*	Potong banyak fluks atau medan magnet/Arus tinggi/Voltan tinggi *Cut more magnetic flux or field/High current/High voltage*

[Mana-mana **lima** cadangan dan sebab diterima]
[*Any* **five** *suggestions and reasons accepted*]

10

20

Kertas 1 / *Paper 1*

1 C Terdapat 7 kuantiti asas: Panjang, jisim, masa, suhu termodinamik, arus elektrik, keamatan berluminositi dan kuantiti bahan.
There are 7 base quantities: Length, mass, time, thermodynamic temperature, luminous intensity and amount of substance.

2 B Daya impuls merupakan kadar perubahan momentum dalam perlanggaran atau hentaman dalam masa yang singkat.
Impulsive force is the rate of change of momentum in a collision or impact in a short period of time.

3 C Dalam persamaan $T^2 = \frac{4\pi^2 L}{g}$
T^2 = paksi-*y*/ *y-axis*
L = paksi-*x*/ *x-axis*
$\frac{4\pi^2}{g}$ = kecerunan/ *gradient*
T^2 berkadar terus dengan L.
T^2 *is directly proportional to* L.

4 D Halaju akhir, $v = \frac{3.0 \text{ cm}}{0.02 \text{ s}}$
Final velocity, v
$= 150 \text{ cm s}^{-1}$
Tips: Halaju akhir merujuk kepada hujung pita pada bahagian ekor anak panah arah gerakan
Final velocity refers to the end of tape at the tail of the arrow of the direction of motion

5 D Perlanggaran kenyal berlaku. Prinsip Keabadian Momentum menyatakan bahawa jumlah momentum sebelum perlanggaran adalah sama dengan jumlah momentum selepas perlanggaran jika tiada sebarang daya luar bertindak.
An elastic collision occurs. The Principle of Conservation of Momentum states that the total momentum before collision is equal to the total momentum after collision if no external force is acting on it.

6 C Daya graviti ialah berat barbel yang bertindak ke arah pusat Bumi.
Gravitational force is the weight of the barbell acting towards the centre of Earth.

7 C Suatu objek dikatakan mengalami gerakan jatuh bebas jika pergerakan objek itu dipengaruhi oleh daya graviti sahaja. Hal ini bermakna objek yang jatuh bebas tidak mengalami tindakan daya yang lain seperti rintangan udara atau geseran. Pecutan objek yang jatuh bebas disebabkan oleh daya tarikan graviti dinamakan pecutan graviti, g. Nilai purata bagi pecutan graviti Bumi ialah 9.81 m s^{-2}.
An object experiences free fall if the motion of the object is affected only by gravitational force. This implies a free-falling object does not experience the action of other forces such as air resistance or friction. The acceleration of a free-falling object caused by gravitational force is known as gravitational acceleration, g. *The average value of Earth's gravitational acceleration is* 9.81 m s^{-2}.

8 A $F = \frac{Gm_1 m_2}{r^2}$
Hukum Kegravitian Semesta Newton menyatakan bahawa daya graviti antara dua jasad adalah berkadar terus dengan hasil darab jisim kedua-dua jasad dan berkadar songsang dengan kuasa dua jarak di antara pusat dua jasad berkenaan.
Newton's Universal Law of Gravitation states that the gravitational force between two bodies is directly proportional to the product of the masses of both bodies and inversely proportional to the square of the distance between the centres of the two bodies.

9 B Jika laju linear satelit menjadi kurang daripada laju linear yang sepatutnya, satelit itu akan jatuh ke orbit yang lebih rendah dan terus memusar mendekati Bumi sehingga memasuki atmosfera.
If the linear speed of the satellite becomes less than the required linear speed, the satellite will fall to a lower orbit and continue to revolve towards the Earth until it enters the atmosphere.

10 C Apabila dua objek bersentuhan secara terma, suhu objek yang panas akan menurun, manakala suhu objek yang sejuk akan meningkat sehingga suhu kedua-dua objek tersebut menjadi sama. Pemindahan haba bersih antara dua objek itu adalah sifar. Kedua-dua objek itu dikatakan berada dalam keadaan keseimbangan terma.
When two objects are in thermal contact, the temperature of the hot object will drop, while the temperature of the cold object will rise until the temperature of both objects become the same. Net heat transfer between the two objects becomes zero. Both objects are said to be in thermal equilibrium.

11 C Elemen pemanas lazimnya diperbuat daripada nikrom atau tungsten kerana mempunyai muatan haba tentu yang rendah (cepat menjadi panas), rintangan elektrik yang tinggi, kebolehan menahan suhu tinggi dan kadar pengoksidaan yang rendah berbanding besi dan kuprum.
Heating elements are commonly made of nichrome or tungsten, as they have a low specific heat capacity (*get hot quickly*)*, high electrical resistance, ability to withstand high temperatures and low rate of oxidation compared to ferum or iron and copper.*

12 C $Pt = m\ell$
$290 \times 3 \times 60 = 200 \times \ell$
$\ell = 261 \text{ J g}^{-1}$

13 A Hukum Charles menyatakan bahawa isi padu adalah berkadar terus dengan suhu mutlak bagi suatu gas berjisim tetap pada tekanan malar. Apabila suhu gas meningkat, tenaga kinetik purata molekul bertambah, iaitu molekul bergerak dengan halaju yang lebih tinggi. Untuk mengekalkan tekanan gas yang malar, isi padu gas akan bertambah supaya kadar perlanggaran molekul gas dengan dinding bekas tidak berubah.
Charles' Law states that volume is directly proportional to absolute temperature for a fixed mass of gas at constant pressure. When the temperature of the gas increases, the average kinetic energy of its molecules increases, which is the molecules move with higher velocity. To keep a constant gas pressure, the volume of gas increases so that the rate of collision of gas molecules with the walls of the container is unchanged.

14 B Resonans berlaku apabila suatu sistem ayunan dikenakan daya luar yang mempunyai frekuensi yang sama dengan frekuensi asli sistem ayunan tersebut. Semasa resonans, sistem berayun dengan frekuensi aslinya menyebabkan sistem berayun dengan amplitud maksimum.
When a periodic force is applied to an oscillating system at its natural frequency, the oscillating system is said to be at resonance. During resonance, system oscillates with its natural frequency which caused the system oscillates with maximum amplitude.

15 A Pembelauan gelombang ialah penyebaran gelombang apabila gelombang itu merambat melalui suatu celah atau tepi suatu penghalang. Semakin berkurang saiz celah, penyebaran gelombang lebih ketara (sebar lebih) menyebabkan amplitud gelombang berkurang. Semakin berkurang amplitud, semakin berkurang tenaga yang dibawa oleh gelombang tersebut.
Diffraction of waves is the spreading of waves when the waves propagate through a slit or side of a barrier. The smaller the size of the slit, spreading of waves is more significant (*spread more*) *causes the amplitude decreases. As the amplitude decreases,the energy carried by the wave decreases.*

16 A
$$\lambda = \frac{ax}{D}$$
Daripada persamaan interferens gelombang di atas, *a* (jarak pemisahan antara dua sumber koheren) berkadar songsang dengan *x* (jarak pemisahan antara dua garis antinod atau garis nod yang bersebelahan). Maka apabila *a* bertambah, *x* berkurang.
From the equation of wave interference above, a (*distance of separation between two coherent sources*) *is inversely proportional to x* (*distance of separation between two adjacent antinodal lines or nodal lines*)*. Hence, when a increases, x decreases.*

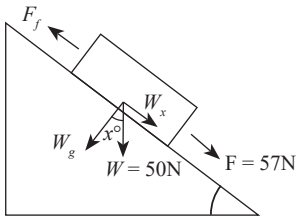
17 B Aplikasi sinaran inframerah: Untuk memasak (ketuhar, pemanggang dan pembakar), untuk melihat dalam gelap (kamera inframerah dan teropong inframerah), mengeringkan cat pada kereta, rawatan sakit otot, alat kawalan jauh untuk televisyen dan pemain DVD.
Applications of infrared ray: *For cooking* (*oven, grill and toaster*), *for night vision* (*infrared camera and infrared binoculars*), *drying paint on car, treatment of muscle pain, remote control device for television and* DVD *player.*

18 B Berlakunya pembiasan cahaya. Cahaya merambat dari air (ketumpatan optik tinggi) ke udara (ketumpatan optik rendah). Laju cahaya berkurang (dari air ke udara) dan cahaya dibiaskan menjauhi normal.
Refraction of light occurred. Light propagates from water (*high optical density*) *to air* (*low optical density). Speed of light decreases* (*from water to air*) *and light refracted away from normal.*

19 D Apabila cahaya merambat dari medium berketumpatan optik tinggi ke medium berketumpatan optik rendah (air ke udara) di mana $i > c$, maka pantulan dalam penuh berlaku.
When light propagates from medium of high optical density to a medium of low optical density (*water to air*), *where* $i > c$, *then total internal reflection occurs.*

20 D
$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$
$$\frac{1}{12} = \frac{1}{16} + \frac{1}{v}$$
$$\frac{1}{v} = \frac{1}{12} - \frac{1}{16}$$
$$\frac{1}{v} = \frac{4}{192} = \frac{1}{48}$$
$v = 48$ cm

21 B



Berat beg pakaian/ *Weigh of luggage*, $W = 50$ N
Sudut/ *Angle*, $\theta = 30°$
Beg pakaian pegun = semua daya seimbang
Luggage is stationary = all forces are balanced
$W_x = W \sin \theta$
$= 50 \sin 30°$
$= 25$ N
$F_f = W_x = 25$ N

22 B Aplikasi Hukum Hooke ditunjukkan oleh objek yang mempunyai kekenyalan iaitu, busur dan panah.
Application of Hooke's Law show by an object with elasticity, which is bow and arrow.

23 C Semasa perlanggaran hadapan, pemandu akan terhumban ke hadapan disebabkan inersia. Papan pemuka yang keras boleh mendatangkan kecederaan kepada pemandu akibat hentaman dalam tempoh yang singkat yang menghasilkan daya impuls yang tinggi.
During head on collision, the driver will be thrown forwards due to inertia. A hard dashboard may cause injuries due to short time impact which produced high impulsive force.

24 A Bentuk aerofoil pada sayap kapal terbang menyebabkan udara mengalir pada kelajuan yang berbeza melalui bahagian atas dan bahagian bawahnya. Menurut prinsip Bernoulli, halaju udara yang tinggi di bahagian atas mewujudkan suatu kawasan bertekanan rendah, manakala halaju udara yang rendah di bahagian bawah menghasilkan kawasan bertekanan tinggi.
The aerofoil shape of the wing of an aeroplane causes air to flow at different speeds past the top section and the bottom section. According to Bernoulli's principle, the higher air velocity at the top section produces a region of low pressure, while the lower air velocity at the bottom section produces a region of high pressure.

25 C Daya angkat terhasil daripada perbezaan tekanan yang disebabkan oleh pengaliran udara dengan halaju yang berbeza. Udara yang mengalir dengan halaju yang tinggi pada bahagian atas bola pingpong menghasilkan satu kawasan bertekanan udara yang rendah. Perbezaan antara tekanan tinggi di bahagian bawah dengan tekanan rendah di bahagian atas bola ping pong menghasilkan satu daya paduan ke atas. Daya paduan ini ialah daya angkat yang mengangkat bola ping pong itu.
Lift force is produced from the difference in pressure caused by the flow of air at different velocities. Air flowing at a high velocity above the ping pong ball produces a region of low pressure. The difference between the high pressure below the ball and the low pressure above the ping pong ball produces a resultant force upwards. This resultant force is the lift force that lifts the ping pong ball.

26 B Ion positif mempunyai jisim dan saiz yang lebih besar berbanding dengan ion negatif. Oleh itu, sebaran yang tertarik ke plat logam bercas negatif adalah lebih besar berbanding dengan sebaran yang tertarik ke plat logam bercas positif.
Positive ions have larger mass and size compared to negative ions. Therefore, the spread of flames towards the negatively charged metal plate is greater than towards the positively charged metal plate.

27 C Sambungan sel kering secara selari dapat mengurangkan rintangan dalam berkesan.
The arrangement of dry cells in parallel reduces the effective internal resistance.

28 C $E = IR + Ir$
$4.5 = 0.5(8) + 0.5(r)$
$4.5 = 4 + 0.5r$
$r = 1\ \Omega$

29 D Dalam sistem elektrik, kuasa elektrik diberikan oleh rumus:
In an electrical system, electrical power is given by the formula:
$P = VI$
di mana/ *where*:

P = kuasa elektrik/ *electrical power*
V = voltan/ *voltage*
I = arus/*current*

Dengan menaikkan voltan, kuasa elektrik boleh ditingkatkan tanpa perlu menaikkan arus secara berlebihan. Hal ini sangat penting kerana arus yang tinggi boleh menyebabkan pemanasan dan kehilangan tenaga melalui rintangan kabel (disebabkan oleh $P = I^2R$).
Oleh itu, penggunaan voltan tinggi membolehkan lebih banyak kuasa dihantar secara efisien, yang sesuai untuk pergerakan kenderaan elektrik.
By increasing the voltage, electric power can be increased without the need to excessively increase the current. This is important because high current can cause heating and energy loss through the resistance of the cables (*as given by* $P = I^2R$).
Therefore, the use of high voltage allows more power to be transmitted efficiently, making it suitable for powering electric vehicles.

30 C Kelajuan putaran motor elektrik bertambah apabila arus dalam gegelung bertambah (rintangan gegelung berkurang), kekuatan medan magnet bertambah dan gegelung dengan lebih banyak lilitan digunakan.
The speed of rotation of an electric motor increase when current in the coil increases (*resistance of coil decreases*), *strength of magnetic field increases and coil with more turns is used.*

31 D $V = IR$
$12 = I \times 6$
$I = 2.0$ A
Arus akan melalui suis yang tiada rintangan tanpa melalui perintang 2 Ω dan perintang 4 Ω.
Current will flow through the switch which has no resistance without passing through the 2 Ω *resistor and the* 4 Ω *resistor.*

32 C Penjana arus terus dan penjana arus ulang-alik mengaplikasikan aruhan elektromagnet untuk menghasilkan d.g.e. aruhan.
The direct current generator and alternating current generator apply electromagnetic induction to produce induced e.m.f.

33 A Petua tangan kiri Fleming digunakan untuk menentukan arah pesongan sinar katod oleh medan magnet dalam tiub palang Maltese.
Fleming's left-hand rule is used to determine the direction of deflection of cathode rays caused by the magnetic field in the Maltese cross tube.

34 D Gambar rajah 21 menunjukkan perataan output rektifikasi gelombang penuh. Kapasitor, C disambungkan selari dengan beban, *R*. Apabila bekalan kuasa dihidupkan, arus output boleh diratakan.
Diagram 21 *shows a smoothing of full-wave rectification output. Capacitor,* C *is connected in parallel to the load, R. When the power supply is turned on, the output current becomes smooth.*

35 A Arus tapak yang kecil menghasilkan suatu voltan, V_{BE}. Apabila V_{BE} mencapai satu nilai minimum, litar pengumpul akan dihidupkan.
A small base current produces a voltage, V_{BE}. *When* V_{BE} *achieves a minimim value, the collector circuit will switch on.*

36 D Separuh hayat sampel radioaktif ialah 8 hari.
The half life of the radioactive sample is 8 *days.*

$$N = \left(\frac{1}{2}\right)^n N_0$$

$$N = \left(\frac{1}{2}\right)^1 2\,000$$

$$N = 1\,000$$

37 D Di dalam reaktor nuklear, tindak balas pembelahan nukleus uranium-235 menghasilkan dua nukleus anak, tiga neutron yang bergerak pantas dan membebaskan tenaga yang besar. Neutron-neutron tersebut akan membedil nukleus uranium-235 yang lain dan membebaskan neutron yang lebih banyak melalui pembelahan nukleus yang berterusan. Tindak balas berterusan ini dikenali sebagai tindak balas berantai.
*In a nuclear reactor, the fission of uranium-*235 *nucleus produces two daughter nuclei, three fast moving neutrons and releases a large amount of energy. These neutrons will bombard other uranium-*235 *nuclei and release more neutrons through continuous nuclear fission. These continuous reactions is known as a chain reaction.*

38 B Moderator grafit memperlahankan neutron yang bergerak pantas yang terhasil supaya pembelahan nukleus boleh berlaku.
Graphite moderator slows down the fast-moving neutrons released so that nuclear fission can occur.

39 C Tenaga foton berkadar terus dengan frekuensi cahaya. Cahaya biru mempunyai frekuensi paling tinggi, diikuti oleh hijau dan merah.
Photon energy is directly proportional to the light frequency. Blue light has the highest frequency, followed by green light and red light.

40 B Tenaga foton adalah berkadar terus dengan frekuensi gelombang cahaya.
The photon energy is directly proportional to the frequency of the light waves.

Penjelasan/ *Explanation*:
Ini berdasarkan persamaan Planck dalam teori kuantum:
This is based on Planck equation in quantum theory:
$E = hf$
di mana/ *where*:
- E = tenaga foton/ *photon energy*
- h = pemalar Planck/ *Planck constant*
- f = frekuensi gelombang/ *wave frequency*

Bahagian A / *Section* A

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
1	(*a*)	(i)	Berkadar songsang *Inversely proportional*	1	4
		(ii)	Bertambah secara linear *Linearly increases*	1	
	(*b*)		Kuantiti skalar: Jarak/Masa *Scalar quantity*: *Distance*/*Time* Kuantiti vektor: Halaju purata *Vector quantity*: *Average velocity*	2	
2	(*a*)		Daya geseran/Rintangan udara/Seretan *Frictional force*/*Air resistance*/*Drag*	1	5
	(*b*)		$\sin 30 = \frac{W_x}{300}$ $W_x = 300 \sin 30°$ $= 150$ N	2	
	(*c*)	(i)	$F = W_x / W_x - F = 0 / F - W_x = 0$	1	
		(ii)	Keseimbangan daya/Daya seimbang/Daya paduan sifar *Forces in equilibrium*/*Balanced force*/*Zero resultant force*	1	
3	(*a*)	(i)	^4_2He / α	1	6
		(ii)	Nukleus tidak stabil/Nukleus jisim besar *Unstable nucleus*/*Big mass nucleus*	1	
	(*b*)	(i)	$0.513 \times 1.66 \times 10^{-27} = 8.5158 \times 10^{-28}$ kg [Jawapan dan unit yang betul] [*Correct answer and unit*]	1	
		(ii)	$8.5158 \times 10^{-28} \times (3 \times 10^8)^2$ $= 7.6642 \times 10^{-11}$ J [Jawapan dan unit yang betul] [*Correct answer and unit*]	2	
	(*c*)		Keabadian tenaga/Jisim dan tenaga diabadikan/Jisim dan tenaga saling bertukar. *Conservation of energy*/*Mass and energy conserved*/*Mass and energy interchanged.*	1	
4	(*a*)		Ukur ketumpatan/Ambil bacaan ketumpatan/Tentukan bacaan ketumpatan *Measure density*/*Take reading of density*/*Determine reading of density*	1	
	(*b*)	(i)	$W = mg$ $= 0.028$ kg $\times 9.81$ ms^{-2} $= 0.2747$ kg ms^{-2} (N) [Jawapan dan unit yang betul] [*Correct answer and unit*]	2	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
		(ii)	Daya apungan = Berat hidrometer *Buoyant force = Weight of hydrometer*	1	
		(iii)	$V = \frac{m}{p} = \frac{0.2747 \text{ kg ms}^{-2}}{1020 \text{ kg m}^{-3} \times 9.81 \text{ ms}^{-2}}$ $= 2.745 \times 10^{-5} \text{ m}^3$ [Jawapan dan unit yang betul] [*Correct answer and unit*]	2	
	(*c*)	(i)	Berkurang *Decreases*	1	
		(ii)	– Daya apungan tidak berubah/sama/malar *Buoyant force unchanged/same/constant* – Isi padu tersesar berkurang *Volume displaced decreases* – Ketumpatan bertambah/Gliserin lebih tumpat daripada larutan garam *Density increases/Glycerine is denser than salt water*	2	**9**
5	(*a*)		Aruhan elektromagnet/Pemotongan fluks *Electromagnetic induction/Cutting of flux*	1	
	(*b*)	(i)	Rajah 4.2 > Rajah 4.1/Sebaliknya *Diagram* 4.2 > *Diagram* 4.1/*Vice versa*	1	
		(ii)	Rajah 4.2 > Rajah 4.1/Sebaliknya *Diagram* 4.2 > *Diagram* 4.1/*Vice versa*	1	
		(iii)	Rajah 4.2 > Rajah 4.1/Sebaliknya *Diagram* 4.2 > *Diagram* 4.1/*Vice versa*	1	
	(*c*)	(i)	Ketinggian magnet bar dilepaskan bertambah, laju magnet bar bertambah/Sebaliknya *The height of the bar magnet is released increases, the speed of the bar magnet increases/Vice versa*	1	
		(ii)	Laju magnet bar bertambah, arus aruhan bertambah/Sebaliknya *The speed of the bar magnet increases, the induced current increases /Vice versa*	1	
	(*d*)		Arus aruhan/D.g.e aruhan/Arus pusar/Kutub yang sama pada solenoid *Induced current/Induced* e.m.f./*Eddy current/Same pole of solenoid*	1	
	(*e*)		$T - F_p = ma$ $0.3 - F_p = 0.04 \times 0.05$ $F_p = 0.298 \text{ N}$ [Jawapan dan unit yang betul] [*Correct answer and unit*]	2	**9**
6	(*a*)		Suhu/Tekanan/Haba/Daya *Suhu/Tekanan/Haba/Daya*	1	
	(*b*)		Tenaga kinetik molekul/gas bertambah/Halaju molekul atau gas bertambah/Kadar perlanggaran antara molekul/gas dengan dinding bertambah/Perubahan momentum bertambah *Kinetic energy of molecules gas increases/Velocity of molecules or gas increases/ Rate of collision between molecules or gas and inner wall increases/Change of momentum increases*	1	
	(*c*)	(i)	Rajah 5.1 < Rajah 5.2 *Diagram* 5.1 < *Diagram* 5.2	1	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
		(ii)	Rajah 5.1 < Rajah 5.2 *Diagram* 5.1 < *Diagram* 5.2	1	
		(iii)	Tekanan udara dalam bola ping pong/Jisim *Pressure inside the ping pong ball/Mass*	1	
	(*d*)	(i)	Suhu bertambah, isi padu bertambah/Sebaliknya *Temperature increases, the volume increases/Vice versa*	1	
		(ii)	Hukum Charles *Charles' law*	1	
	(*e*)		$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\frac{V_1}{301} = \frac{33.5}{363}$ $V_1 = 27.78\ cm^3$ // $2.778 \times 10^{-5}\ m^3$ [Jawapan dan unit yang betul] [*Correct answer and unit*]	2	**9**
7	(*a*)		Rintangan suatu bahan bagi seunit panjang/Suatu ukuran bagi keupayaan konduktor untuk menentang pengaliran arus elektrik *Resistance of a material per unit length/A measure of a conductor's ability to resist the flow of electric current*	1	
	(*b*)		$1.25 \times 10^{-5} \times 10^{-4}\ m^2$ // $1.25 \times 10^{-9}\ m^2$ $R = \frac{pl}{A}$ $= \frac{5.6 \times 10^{-8}\ \Omega\ m \times 0.54\ m}{1.25 \times 10^{-9}\ m^2}$ $= 24.192\ \Omega$ [Jawapan dan unit yang betul] [*Correct answer and unit*]	3	
	(*c*)	(i)	Kuasa mentol: Tinggi/Besar *The power of the bulb*: *High/Large* Sebab: Tenaga tinggi/banyak *Reason*: *High/More energy*	2	
		(ii)	Kerintangan dawai filamen: Tinggi *Resistivity of the filament wire*: *High* Sebab: Rintangan tinggi/Haba tinggi *Reason*: *High resistance/High heat*	2	
	(*d*)		Mentol K *Bulb* K	1	**9**
8	(*a*)		Bukan geopegun *Non geostationary*	1	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
	(*b*)		$v = \sqrt{\frac{GM}{r}}$ $= \sqrt{\frac{(6.67 \times 10^{-11})(5.97 \times 10^{24})}{4.237 \times 10^{7}}}$ $= 3065.6379 \text{ m s}^{-1}$ [Jawapan dan unit yang betul] [*Correct answer and unit*]	2	
	(*c*)	(i)	Saiz antena: Besar/Lebar *The size of the antenna*: *Big*/*Wide* Sebab: Terima/kumpul banyak isyarat *Reason*: *Receive*/*collect more signals*	2	
		(ii)	Sumber tenaga satelit: Solar/Nuklear/Suria/Matahari/Bahan radioaktif (Uranium-235) *The energy source of the satellite*: *Solar*/*Nuclear*/*Sun*/*Radioactive substance* (*Uranium*-235) Sebab: Boleh diperbaharui/Tahan lama/Tenaga dibekalkan berterusan/Elak kehabisan tenaga. *Reason*: *Renewable*/*Long lasting*/*Energy supply continuously*/*Prevent running out of power*	2	
		(iii)	Jisim satelit Kecil/Ringan *The mass of the satellite*: *Small*/*Light* Sebab: Kurang tenaga diperlukan semasa pelancaran/Daya paduan tinggi /Pecutan tinggi *Reason*: *Less energy required during launched*/*Higher resultant force*/*High acceleration*	2	**9**

Bahagian B / *Section* B

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
9	(*a*)		Gelombang air/Cahaya/Gelombang elektromagnet (semua gelombang dalam spektrum elektromagnet) *Water wave*/*Light*/*Electromagnetic wave* (*all waves in* EM *spectrum*)	1	
	(*b*)		– Bot P berada di garis antinod/Bot P berada di kawasan interferens membina *Boat* P *is on the antinode line*/*Boat* P *is in the region of constructive interference* – Amplitud maksimum atau paling besar/Sesaran paduan paling tinggi *Maximum or largest amplitude*/*Combine displacement is highest* – Bot Q berada di garis nod/Bot Q berada di kawasan interferens memusnah *Boat* Q *is on the node line*/*Boat* Q *is in the region of destructive interference* – Amplitud sifar/Tiada amplitud *Zero amplitude*/*No amplitude*	4	

<table>
<tr><th colspan="3">Soalan
Questions</th><th>Jawapan
Answers</th><th>Sub markah
Subs marks</th><th>Jumlah markah
Total marks</th></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>$x = \frac{\lambda D}{\alpha}$
$x = \frac{34 \times 50}{60}$
$x = \frac{28.33}{2}$
$x = 14.17$ m

[Jawapan dan unit yang betul]
[Correct answer and unit]</td><td>3</td><td rowspan="3">20</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>$f = \frac{v}{\lambda}$
$f = \frac{20}{34}$
= 0.5882 Hz (Minimum dua t.p/ Minimum two d.p)

([Jawapan dan unit yang betul]
[Correct answer and unit]</td><td>2</td></tr>
<tr><td></td><td>(d)</td><td></td><td>
<table>
<tr><th>Ciri-ciri
Characteristics</th><th>Sebab
Reason</th></tr>
<tr><td>Ketinggian tambak: Tinggi
The height of the embankment: High</td><td>Elak ombak masuk/Tahan ombak tinggi/Elak daya tinggi
Avoid waves enter/Withstand high wave/ Avoid high force</td></tr>
<tr><td>Bukaan tambak: Sempit
The opening of the embankment: Narrow</td><td>Gelombang lebih tersebar/Amplitud kecil/Tenaga kecil atau kurang/ Pembelauan ketara/Belau lebih
Waves spread more/Small amplitude/ Energy decreases or less/Diffraction significant/Diffracts more</td></tr>
<tr><td>Bentuk tambak: Bercerun
The shape of the embankment: Sloped</td><td>Halaju berkurang/Kedalaman berkurang/Panjang gelombang berkurang
Velocity decreases/Depth decreases/ Wavelength decreases</td></tr>
<tr><td>Permukaan tambak: Kasar
The surface of the embankment: Rough</td><td>Pantul pelbagai arah/Tenaga kurang/ Daya kurang
Reflects in varies direction/Energy decreases/Force decreases</td></tr>
<tr><td>M</td><td>Ketinggian tambak tinggi, bukaan tambak sempit, bentuk tambak bercerun dan permukaan tambak kasar
Height of the embankment high, the opening of the embankment narrow, the shape of the embankment sloped and the surface of the embankment rough</td></tr>
</table>
</td><td>10</td></tr>
</table>

<table>
<tr><th colspan="3">Soalan
Questions</th><th>Jawapan
Answers</th><th>Sub markah
Subs marks</th><th>Jumlah markah
Total marks</th></tr>
<tr><td>10</td><td>(a)</td><td></td><td>Ukur arus/Ukur kadar pengaliran cas
Measure current/Measure rate of flow of charge</td><td>1</td><td rowspan="6">20</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>$K = eV$
$= 1.6 \times 10^{-19} \times 6\,000$
$= 9.6 \times 10^{-16}$ J</td><td>3</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>$eV = \frac{1}{2}mv^2$
$v = \sqrt{\frac{2eV}{m}}$
$= \sqrt{\frac{2(9.6 \times 10^{-16})}{9.11 \times 10^{-31}}}$
$= 4.591 \times 10^{7}$ m s^{-1}

[Jawapan dan unit yang betul]
[Correct answer and unit]</td><td>2</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>– Katod dipanaskan
Cathode heated
– Tenaga kinetik elektron tinggi
Electron has high kinetic energy</td><td>2</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>– Interaksi medan magnet dengan gerakan elektron hasilkan daya
Interaction between magnetic field and motion of electron produce force
– Petua Tangan Kiri Fleming
Fleming's Left-hand Rule
– Sinar katod/Elektron terpesong
Cathode ray/Electron deflected</td><td>2</td></tr>
<tr><td></td><td>(d)</td><td></td><td>
<table>
<tr><th>Ciri-ciri/ Characteristics</th><th>Sebab/ Reason</th></tr>
<tr><td>Bekalan kuasa X: Tinggi/Besar
Power supply X: High/Large</td><td>Bebas banyak elektron/Banyak haba/ Kadar pancaran termion tinggi
Release more electrons/More heat/Rate of thermionic emission high</td></tr>
<tr><td>Bekalan kuasa Y: Tinggi/Besar
Power supply Y: High/Large</td><td>Halaju tinggi/Pecutan tinggi/Tenaga tinggi/Medan elektrik kuat
High velocity/High acceleration/High energy/Strong electric field</td></tr>
<tr><td>Ada plat pemesongan
Has deflection plate</td><td>Pesongkan elektron/Pesongkan sinar katod
Deflects electrons/Deflects cathode ray</td></tr>
<tr><td>Vakum
Vacuum</td><td>Tiada halangan/Tiada kehilangan tenaga/Halaju maksimum/Elektron tidak langar udara.
No obstacle/No energy loss/Maximum velocity/Electron does not collide with air</td></tr>
<tr><td>Q</td><td>Bekalan kuasa X tinggi, bekalan kuasa Y tinggi, ada plat pemesongan dan vakum
Power supply X high, power supply Y high, has deflection plate and vacuum</td></tr>
</table>
</td><td>10</td></tr>
</table>

Bahagian C / *Section* C

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
11	(*a*)		Pembiasan *Refraction*	1	
	(*b*)	(i)	Sudut biasan Rajah 10.1 > Rajah 10.2 *Angle of refraction in Diagram* 10.1 > *Diagram* 10.2	3	
		(ii)	Ketumpatan optik Rajah 10.1 < Rajah 10.2 *Optical density in Diagram* 10.1 < *Diagram* 10.2		
		(iii)	Halaju cahaya yang melalui blok Rajah 10.1 > Rajah 10.2 *The velocity of light passing through the block in Diagram* 10.1 > *Diagram* 10.2		
	(*c*)	(i)	Indeks biasan bertambah, ketumpatan optik bertambah *Refractive index increases, optical density increases*	2	
		(ii)	Indeks biasan bertambah, halaju cahaya yang melalui medium berkurang *Refractive index increases, velocity of light passing through the medium decreases*		
	(*d*)		– Cahaya merambat dari air ke udara/Cahaya dari medium lebih tumpat ke medium kurang tumpat *Light propagates from water to air/Lights from denser to less dense medium* – Ketumpatan air lebih tinggi/Ketumpatan udara lebih rendah *Density of water higher/Density of air lower* – Cahaya dibiaskan *Light refracted* – Menjauhi normal *Away from normal* – Halaju cahaya dalam udara tinggi *Velocity of light in air is high* – Indeks biasan air tinggi/Indeks biasan udara rendah *Refractive index of water is high/Refractive index of air is low* – Dalam ketara *Apparent depth* [Mana-mana **empat** jawapan diterima] [*Any* **four** *answers accepted*]	4	

Soalan *Questions*	Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*

(*e*)

Ciri-ciri/ *Characteristics*	Sebab/ *Reason*
Kelenturan tinggi *High flexibility*	Mudah bengkok *Bent easily*
Indeks biasan teras dalam tinggi *High refractive index of inner core*	Pantulan dalam penuh/Sudut genting rendah *Total internal reflection/Small critical angle*
Ketulenan tinggi *High purity*	Cahaya tidak terhalang atau diserap/ Tiada kehilangan tenaga atau data/Cahaya dipantul sepenuhnya/Pantulan dalam penuh *Light does not blocked or absorbed/No energy or data signal loss/Light fully reflected/Total internal reflection*
Kaca / Gentian kaca Kasar *Glass / Fibre glass rough*	Indeks biasan tinggi/Pantulan dalam penuh/Sudut genting rendah *High refractive index/Total internal reflection/ Low critical angle*
Himpunan *Bundle*	Banyak cahaya atau data/Lebih terang *More light or data signal/Brighter*
Indeks biasan penyalut luar rendah *Refractive index cladding low*	Pantulan dalam penuh di teras dalam *Total internal reflection at inner core*
Ketumpatan optik tinggi *High optical density*	Indeks biasan tinggi/Pantulan dalam penuh/ Sudut genting rendah *High refractive index/Total internal reflection/ Small critical angle*

[Mana-mana **lima** ciri dan sebab diterima]
[*Any* **five** *characteristics and reasons accepted*]

10

20

Kertas 1 / *Paper* 1

1 D Tujuh kuantiti asas: Panjang, jisim, masa, suhu termodinamik, arus elektrik, keamatan berluminositi dan kuantiti bahan.
Seven base quantities: *Length, mass, time, thermodynamic temperature, electric current, luminous intensity and amount of substance.*

2 A Air pada bulu anjing dalam keadaan bergerak apabila anjing menggoyangkan badannya. Apabila anjing berhenti bergoyang, inersia air akan menyebabkan air terus bergerak dan meninggalkan permukaan bulu anjing. Situasi ini melibatkan kesan inersia yang dijelaskan dalam Hukum Gerakan Newton Pertama.
Water on dog's fur are in motion as the dog shaking its body. When the dog stops shaking, the inertia of the water causes the water to continue in motion and leave the surface of the dog's fur. This situation involves the effects of inertia which explained in Newton's First Law of Motion.

3 A Gelas yang terlepas daripada tangan akan jatuh mengikut pecutan graviti Bumi iaitu, 9.81 m s^{-2}.
A glass slipping from hand will fall due to Earth's gravitational acceleration of 9.81 m s^{-2}.

4 D
$$M_1V_1 = -M_2V_2$$
$$(0.0036)(90) = -(2.24)(V_2)$$
$$V_2 = -0.1446 \text{ m s}^{-1}$$

5 B Bahan yang mempunyai muatan haba tentu yang tinggi dapat menyerap sejumlah besar haba tanpa mengalami peningkatan suhu yang besar. Oleh itu, haba di dalam rumah dapat dikurangkan dan rumah menjadi kurang panas pada waktu siang.
Materials with high specific heat capacity can absorb a large amount of heat without a large increase in temperature. Therefore, the house becomes less hot during the daytime.

6 A Dalam sistem hidraulik, tekanan dipindahkan sama rata mengikut Prinsip Pascal:
$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$
Apabila luas permukaan omboh besar, A_2 ditambah, daya output, F_2 juga menjadi lebih besar. Maka, jek hidraulik boleh mengangkat kereta yang lebih berat.
In a hydraulic system, pressure is transmitted equally according to Pascal's Principle:
$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$
When the surface area of the large piston, A_2, *is increased, the output force,* F_2, *also increases. Therefore, the hydraulic jack can lift a heavier car.*

7 B Bagi suatu jasad yang melakukan gerakan membulat, daya memusat bertindak ke atasnya dengan arah yang sentiasa menuju ke pusat bulatan itu.
For a body in circular motion, a centripetal force acts on the body in a direction towards the centre of the circle.

8 C Hukum Kepler Kedua menyatakan bahawa garis yang menyambungkan planet dengan Matahari akan mencakupi luas yang sama dalam selang masa yang sama apabila planet bergerak di dalam orbitnya.
Kepler's Second Law states that a line that connects a planet to the Sun sweeps out equal areas in equal times when moving in the orbit (*Law of Areas*).

9 D Objek yang mempunyai muatan haba tentu tinggi mengambil masa yang lebih panjang untuk menyerap haba (meningkatkan suhu dan menjadi panas) dan membebaskan haba (menurunkan suhu dan menjadi sejuk).
Object with high specific heat capacity took longer time to absorb heat (*increase in temperature and become hot*) *and release heat* (*decrease in temperature and become cold*).

10 B

$Q = mc\theta$

$42\,000 = (0.5)(300)(300 - T_i)$

$T_i = 20°C$

11 A Hukum Boyle menyatakan bahawa tekanan berkadar songsang dengan isi padu bagi suatu gas berjisim tetap pada suhu malar. Isi padu gas berkurang omboh picagari ditolak dengan satu daya, maka tekanan di dalam picagari bertambah.

Boyle's Law states that pressure is inversely proportional to volume for a fixed mass of gas at constant temperature. The volume of gas decreases as the piston of a syringe is pushed by a force, hence the pressure inside the syringe increases.

12 D Haba pendam tentu pengewapan diperlukan dalam perubahan keadaan jirim daripada cecair kepada gas. Haba ini diserap daripada persekitaran. Apabila sesuatu cecair menyejat, molekul-molekul cecair menyerap haba ini untuk memutuskan ikatan antara molekul. Persekitaran kehilangan haba. Oleh itu, penyejatan menyebabkan kesan penyejukan kepada persekitaran.

Specific latent heat of vaporisation is required in the change of phase from liquid to gas. This heat is absorbed from the surrounding. When a liquid evaporates, the liquid molecules absorb this heat to break the bond between molecules. The surrounding loses heat. Therefore, evaporation causes cooling to the surrounding.

13 A Spektrum elektromagnet terdiri daripada tujuh jenis gelombang elektromagnet yang disusun mengikut pertambahan panjang gelombang dan pengurangan frekuensi dalam urutan berikut: Sinar gama, sinar-X, sinar ultraungu, cahaya nampak, sinar inframerah, gelombang mikro dan gelombang radio.

Electromagnetic spectrum is made up of seven types of electromagnetic waves arranged in increasing wavelength and decreasing frequency in this sequence: Gamma ray, x-ray, ultraviolet ray, visible light, infrared ray, microwave and radio wave.

14 B Ayunan yang amplitudnya semakin berkurang dengan masa menunjukkan bahawa sistem mengalami kehilangan tenaga secara beransur-ansur. Akhirnya, ayunan itu akan berhenti. Fenomena ini dikenali sebagai pelembapan.

An oscillation with its amplitude decreasing with time shows that the system experiences a gradual loss of energy. Finally, the oscillation stops. This phenomenon is known as damping.

15 C

$P_{gas} = P_{atm} + h$

$= 75 \text{ cm Hg} + 20 \text{ cm Hg}$

$= 95 \text{ cm Hg}$

16 D Pembelauan gelombang ialah penyebaran gelombang apabila gelombang merambat melalui satu celah atau sisi suatu penghalang. Amplitud gelombang berkurang apabila tenaga gelombang mencapah dan tersebar ke kawasan yang lebih luas.

Diffraction of waves is the spreading of waves when the waves propagate through a slit or side of a barrier. Amplitude of wave decreased as wave energy diverges and spread out to a wider region.

17 A

$\lambda = ax/D$

$= \dfrac{(1.50)(0.02)}{3.0}$

$= 0.01 \text{ m}$

18 C

$n = \dfrac{\sin i}{\sin r}$

$= \dfrac{\sin 49^o}{\sin 30^o}$

$= 1.51$

19 D Fenomena pantulan dalam penuh berlaku apabila cahaya bergerak dari medium berketumpatan optik tinggi ke medium berketumpatan optik rendah, dengan sudut tuju lebih besar daripada sudut genting. Sudut genting, c ialah sudut tuju dalam medium berketumpatan optik tinggi apabila sudut biasan dalam medium berketumpatan optik rendah adalah bersamaan dengan 90°.

The phenomenon of total internal reflection happens when light travels from a medium of high optical density to a medium of low optical density, with the angle of incidence larger than the critical angle. Critical angle, c *is the angle of incidence in the medium of high optical density when the angle of refraction in the medium of lower optical density is equal to* 90°.

20 A Ciri-ciri imej bagi kanta pembesar di mana jarak objek, u kurang daripada panjang fokus kanta, f ialah maya, tegak dan dibesarkan.

Characteristics of image for magnifying glass where object distance, u *less than focal length,* f *is virtual, upright and magnified.*

21 D Jarak antara kanta objek dengan kanta mata > $f_o + f_e$. Jarak objek berada di antara f_o dan $2f_o$. Kanta mata membentuk imej akhir yang maya, diperbesarkan dan songsang berbanding objek. Ketebalan kanta objek (L_1) adalah lebih besar daripada kanta mata (L_2).

Distance between objective lens and eyepiece lens > $f_o + f_e$. *Object distance is between* f_o *and* $2f_o$. *Eyepiece lens forms the final image, which is virtual, magnified and inverted compared to object. Thickness of objective lens* (L_1) *is greater than the eyepiece* (L_2).

22 A Belon yang lebih besar mempunyai isi padu udara tersesar yang lebih besar. Mengikut Prinsip Archimedes, semakin banyak udara disesarkan, semakin besar daya apungan yang bertindak pada belon.
Oleh sebab kedua-dua belon pegun di udara, ini bermaksud:

Daya apungan, FB = Berat belon, W

Jadi apabila daya apungan bertambah, berat belon juga mesti bertambah supaya kekal seimbang.

A larger balloon displaces a greater volume of air. According to Archimedes' Principle, the greater the volume of air displaced, the greater the buoyant force acting on the balloon.
Since both balloons are stationary in the air, this means:

Buoyant force, FB = *Weight of balloon,* W

Therefore, when the buoyant force increases, the weight of the balloon must also increase to remain in equilibrium.

23 B Sesuatu objek dikatakan berada dalam keseimbangan daya apabila daya-daya yang bertindak ke atasnya menghasilkan daya paduan sifar.

An object is said to be in equilibrium of forces when the forces acting on it produce a zero resultant force.

24 C Fasa QR dalam Rajah 18(*a*): Haba pendam dibebaskan dan ikatan antara molekul terbentuk. Molekul bergerak di seluruh cecair. Tenaga kinetik molekul tidak berkurang. Suhu adalah malar.
Fasa QR dalam Rajah 18(*b*): Haba pendam diserap untuk melemahkan ikatan antara molekul. Molekul dibebaskan daripada kedudukan tetapnya dan bergerak di seluruh cecair. Tenaga kinetik molekul tidak bertambah. Suhu adalah malar.

Phase of QR *in Diagram* 18(*a*): *Latent heat is released and molecular bond is formed. Molecules move throughout the liquid. Kinetic energy of molecules does not decrease. Temperature is constant.*
Phase of QR *in Diagram* 18(*b*): *Latent heat is absorbed to weaken the bond between molecules. Molecules are released from their fixed position and move throughout the liquid. Kinetic energy of molecules does not increase. Temperature is constant.*

25 B Dalam sifon, air mengalir dari kawasan bertekanan tinggi ke kawasan bertekanan rendah. Tekanan air di titik X lebih tinggi kerana titik X berada pada kedalaman yang lebih tinggi dalam cecair. Tekanan di titik Y pula lebih rendah kerana berada pada bahagian yang lebih tinggi dalam tiub sifon (kedalaman rendah). Perbezaan tekanan ini menyebabkan air ditolak naik melalui tiub dan seterusnya mengalir keluar secara berterusan.

In a siphon, water flows from a region of higher pressure to a region of lower pressure. The water pressure at point X *is higher because point* X *is located at a higher depth in the liquid. The pressure at point* Y *is lower because it is located at a higher position in the siphon tube* (*lower depth*). *This pressure difference causes the water to be pushed up through the tube and continue flowing out continuously.*

26 C $V_{LRD} = \frac{R_{LDR}}{R_{LDR} + R_R} \times V$

$1.2 = \frac{R_{LDR}}{R_{LDR} + 10} \times 6$

27 C Prinsip Pascal diaplikasikan dalam sistem hidraulik. Daya input yang kecil digandakan menjadi daya output yang lebih besar untuk menurunkan pasir daripada pelonggok di kawasan pembinaan.
Pascal's principle is applied in hydraulic systems. A small input force is multiplied to become a larger output force to unload sand from the tipper at a construction area.

28 A Magnitud d.g.e. bertambah jika lebih banyak garisan medan magnet dipotong dalam suatu tempoh masa tertentu. Hukum Faraday menyatakan bahawa magnitud d.g.e. aruhan berkadar terus dengan kadar pemotongan fluks magnet. Bagi pergerakan relatif antara solenoid dengan magnet, d.g.e. aruhan bertambah apabila: (i) laju pergerakan relatif bertambah; (ii) bilangan lilitan solenoid bertambah; (iii) kekuatan medan magnet bertambah.
The magnitude of the e.m.f. *increases if more magnetic field lines are cut in a certain period of time. Faraday's law states that the magnitude of induced* e.m.f. *is directly proportional to the rate of cutting of magnetic flux. For the relative motion of a solenoid and magnet, the induced* e.m.f. *increases when*: (i) *the speed of relative motion increases*; (ii) *the number of turns of the solenoid increases*; (iii) *the strength of the magnetic field increases.*

29 D Kekuatan medan elektrik antara dua plat diberi oleh:
- E = V/d
- E = kekuatan medan elektrik
- V = voltan
- d = jarak antara plat

Dalam rajah:
- Jarak antara plat sama
- Voltan meningkat daripada 2 kV → 3 kV

Jadi, apabila voltan bertambah, kekuatan medan elektrik juga bertambah.
Apabila medan elektrik lebih kuat:
- daya elektrostatik pada bola lebih besar
- lebih banyak cas terkumpul pada plat logam
- bola bergerak lebih laju (2 m s^{-1} → 5 m s^{-1})

Maka, pernyataan yang betul ialah D: Kekuatan medan elektrik antara dua plat logam bertambah, bilangan cas pada plat logam bertambah.
The strength of the electric field between two plates is given by:
- E = V/d
- E = *strength of electric field*
- V= *voltage*
- d = *distance between the plates*

In the diagram:
- *The distance between the plates is the same.*
- *The voltage increases from* 2 kV *to* 3 kV.

Therefore, when the voltage increases, the strength of the electric field also increases.
When the electric field becomes stronger:
- *the electrostatic force acting on the ball becomes greater*,
- *more charges accumulate on the metal plates,*
- *the ball moves faster* (2 m s^{-1} → 5 m s^{-1}).

Hence, the correct statement is D: *The strength of the electric field between the two metal plates increases, the number of charges on the metal plates increases.*

30 A $\varepsilon = IR + Ir$

$3.0 = (0.7)(4.0) + 0.7r$

$r = 0.2857\ \Omega$

$\approx 0.29\ \Omega$

31 C $E = Pt$

$$= \frac{600}{1000} \times 0.5$$

$= 0.30$ kWh

32 A Apabila arus elektrik dalam konduktor bertambah, medan magnet di sekeliling konduktor juga menjadi lebih kuat. Hal ini menyebabkan interaksi antara medan magnet konduktor dengan medan magnet antara kutub magnet menjadi lebih kuat lalu menghasilkan daya, F yang lebih besar. Menambahkan jarak antara dua magnet akan mengurangkan kekuatan medan magnet. Mengurangkan diameter konduktor pembawa arus dan menggunakan konduktor pembawa arus yang lebih panjang pula akan meningkat rintangan dalam konduktor, maka arus elektrik dalam konduktor akan berkurang.

When the electric current in the conductor increases, the magnetic field around the conductor also becomes stronger. This causes the interaction between the magnetic field of the conductor and the magnetic field between the poles of the magnets to become stronger, thus producing a larger force, F. *Increasing the distance between the two magnets will reduce the strength of the magnetic field. Reducing the diameter of the current-carrying conductor and using a longer current-carrying conductor will increase the resistance in the conductor, causing the electric current in the conductor to decrease.*

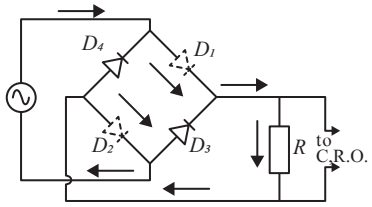
33 C Persamaan antara penjana arus terus dan penjana arus ulang-alik ialah kedua-duanya: (i) Menggunakan prinsip aruhan elektromagnet; (ii) Mempunyai gegelung yang diputarkan oleh daya luar untuk menghasilkan arus aruhan

The similarities between a direct current generator and an alternating current generator are that both: (i) *Use the principle of electromagnetic induction*; (ii) *Have a coil that is rotated by an external force to produce induced current*

34 C Cara-cara meningkatkan kecekapan transformer: (i) Menggunakan wayar kuprum yang lebih tebal supaya rintangan gegelung lebih kecil; (ii) Menggunakan teras besi berlamina yang terdiri daripada kepingan besi nipis yang dilekatkan bersama dengan bahan penebat; (iii) Menggunakan besi lembut sebagai teras. Besi lembut memerlukan jumlah tenaga yang lebih kecil untuk dimagnetkan; (iv) Gegelung sekunder dililit pada gegelung primer supaya semua fluks magnet yang dihasilkan oleh arus primer akan melalui gegelung sekunder.

Ways to increase efficiency of a transformer: (i) *Use thicker copper wire so that the resistance of the coil is smaller*; (ii) *Use a laminated iron core that consists of thin iron sheets glued together with insulation glue*; (iii) *Use soft iron as the core. Soft iron requires a smaller amount of energy to be magnetized*; (iv) *The secondary coil is wound on the primary coil so that all the magnetic flux produced by the primary current will pass through the secondary coil.*

35 A



Semasa separuh kitaran positif:
Diod D1(P) dan D2(Q) dipincang depan manakala D3 dan D4 dipincang songsang. Oleh itu, D1(P) dan D2(Q) membenarkan arus mengalir sementara D3 dan D4 menghalang arus daripada mengalir.

ADuring positive half cycle:
Diodes D1(P) *and* D2(Q) *are forward biased while* D3 *and* D4 *are reverse biased. Therefore,* D1(P) *and* D2(Q) *allow current to flow while* D3 *and* D4 *prevent current from flowing.*

36 B Plat atas disambung kepada terminal positif. Plat bawah disambung kepada terminal negatif. Sinar katod ialah aliran elektron yang bercas negatif. Elektron akan tertarik ke plat positif dan ditolak oleh plat negatif. Jadi, lintasan sinar katod akan membengkok ke atas menuju plat positif.

The upper plate is connected to the positive terminal. The lower plate is connected to the negative terminal. Cathode rays are streams of electrons, which carry negative charges. Electrons are attracted to the positive plate and repelled by the negative plate. Therefore, the cathode ray will bend upwards towards the positive plate.

37 C Faktor penggandaan transistor, β diberi oleh:

$$\beta = \frac{I_C}{I_B}$$

Dalam graf ini, paksi-*y* ialah I_C dan paksi-*x* ialah I_B.
Maka:

$$\text{kecerunan} = \frac{I_C}{I_B} = \beta$$

The amplification factor of a transistor, β *is given by*:

$$\beta = \frac{I_C}{I_B}$$

In this graph, the y-axis represents I_C *and the x-axis represents* I_B.
Therefore:

$$\textit{gradient} = \frac{I_C}{I_B} = \beta$$

38 D Persamaan itu menunjukkan pereputan gama kerana nombor nukleon A dan nombor proton Z tidak berubah, cuma menghasilkan γ. Sinar gama mempunyai ciri:
✓ I Bersifat neutral
✗ II Mempunyai jisim yang besar → Salah, sinar gama tiada jisim
✗ III Elektron yang bergerak pantas → Perkara ini ialah ciri sinar beta
✓ IV Sinaran elektromagnet yang berfrekuensi tinggi
The equation shows gamma decay because the nucleon number A *and proton number* Z *remain unchanged, and only* γ *is produced. The characteristics of gamma rays are*:
✓ I *Neutral*
✗ II *Has large mass → Incorrect, gamma rays have no mass*
✗ III *Fast-moving electrons → This is a characteristic of beta rays*
✓ IV *High frequency electromagnetic radiation*

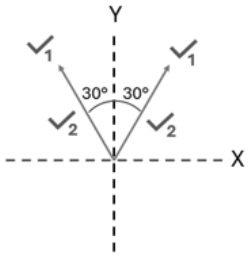
39 C Separuh hayat ialah masa yang diambil untuk keaktifan radioaktif berkurang kepada separuh daripada nilai asal.
Daripada graf:
- Pada masa 20 minit, keaktifan = 120 bilangan per saat
- Pada masa 80 minit, keaktifan = 60 bilangan per saat

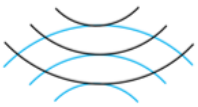
Keaktifan berkurang daripada 120 kepada 60 iaitu, separuh.
Maka separuh hayat = 80 − 20
= 60 minit
Half-life is the time taken for the activity of a radioactive substance to decrease to half of its actual value.
From the graph:
- *At* 20 *minutes, the activity* = 120 *counts per second*
- *At* 80 *minutes, the activity* = 60 *counts per second*

The activity decreases from 120 *to* 60*, which is half of the actual value.*
Therefore, the half-life = 80 − 20
= 60 *minutes*

40 B Daripada Rajah 31, semakin bertambah frekuensi ambang, semakin bertambah fungsi kerja.
From Diagram 31*, as threshold frequency increases, work function increases.*

Bahagian A / *Section* A

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
1	(*a*)		Fotoelektron/Elektron *Photoelectron/Electron*	1	
	(*b*)		Frekuensi alur cahaya sama atau lebih besar daripada frekuensi ambang *Frequency of light same or greater than threshold frequency*		
	(*c*)	(i)	Bertambah *Increase*	1	
		(ii)	Lebih banyak fotoelektron/elektron/Y dipancarkan dari permukaan logam *More photoelectrons/electrons/*Y *emitted from the metal surface*	1	**4**
2	(*a*)		Kanta cembung atau penumpu *Convex or converging lens*	1	
	(*b*)		– Maya *Virtual* – Tegak *Upright*	2	
	(*c*)	(i)	$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ $\frac{1}{10} = \frac{1}{5} + \frac{1}{v}$ v = 10 cm	2	**5**
3	(*a*)		Daya paduan/bersih sifar *Zero resultant/net force*		
	(*b*)			2	
	(*c*)		Alternatif/ *Alternative* 1: $T \cos 30^0 + T \cos 30^0 = W$ $2T \cos 30^0 = 600$ $T = \frac{600}{2 \cos 30^0}$ $= 346.410$ N Alternatif/ *Alternative* 2: $T \sin 60^0 + T \sin 60^0 = W$ $2T \sin 60^0 = 600$ $T = \frac{600}{2 \cos 60^0}$ $= 356.410$ N	3	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
			Alternatif/ *Alternative* 3: $\frac{T}{\sin 30} = \frac{W}{\sin 120}$ $\frac{T}{\sin 30} = \frac{W}{\sin 120}$ $T = 346.410\ N$	3	
4	(*a*)		Gelombang membujur/mekanikal/progresif *Longitudinal/mechanical/progressive wave*	1	
	(*b*)		 – Lukis sekurang-kurangnya dua gelombang pantulan *Draw at least two reflected waves* – Jarak antara gelombang pantulan adalah sama *Distance between reflected waves is equal*	2	
	(*c*)		**Ciri/ *Characteristic*:** Frekuensi tinggi/Tenaga tinggi/Panjang gelombang pendek *High frequency/High energy/Short wavelength* **Sebab/ *Reason*:** Tenaga tinggi/Frekuensi tinggi/Boleh merambat atau bergerak jauh Panjang gelombang pendek/Kurang dibelaukan *High energy/High frequency/Can propagate or travel further/Short wavelength /Less diffracted*	2	
	(*d*)		$d = \frac{vt}{2}$ $= \frac{1500 \times .01}{2}$ $= 75\ m$	3	
	(*e*)		Mengesan, memeriksa atau mengimbas tisu dalam badan, organ dalaman atau fetus/Memecahkan, mengesan atau mengimbas batu karang/ Pengimejan organ dalaman badan *Detect, examine or scan tissue in body, internal organ or foetus/Break, detect or scan kidney stone/Imaging internal organ*	1	**9**
5	(*a*)		Perintang peka cahaya (PPC) *Light dependant resistor* (LDR)	1	
	(*b*)	(i)	Rajah 5.1 < Rajah 5.2/Sebaliknya *Diagram* 5.1 < *Diagram* 5.2/*Vice versa*	1	
		(ii)	Rajah 5.1 > Rajah 5.2/Sebaliknya *Diagram* 5.1 > *Diagram* 5.2/*Vice versa* **atau/ *or*** Rajah 5.1 arus tapak mengalir, Rajah 5.2 tiada arus tapak mengalir *Diagram* 5.1 *base current flow, Diagram* 5.2 *no base current flow*	1	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
		(iii)	Rajah 5.1 > Rajah 5.2/Sebaliknya *Diagram* 5.1 > *Diagram* 5.2/*Vice versa* **atau/** ***or*** Rajah 5.1 arus pengumpul mengalir, Rajah 5.2 tiada arus pengumpul mengalir *Diagram* 5.1 *collector current flow, Diagram* 5.2 *no collector current flow*	1	
	(*c*)	(i)	Arus tapak mengalir apabila rintangan perintang P rendah/Rintangan perintang P tinggi, arus tapak rendah/Sebaliknya *Base current flows when the resistance of resistor* P *low/Resistance of resistor* P *high, base current low/Vice versa*	1	
		(ii)	Arus tapak mengalir menyebabkan arus pengumpul mengalir/Arus tapak tinggi, arus pengumpul tinggi/Berkadar terus *Base current flow causes collector current flow/Base current high, collector current high/Directly proportional*	1	
	(*d*)		$\beta = \frac{I_C}{I_B}$ $\beta = \frac{60 \times 10^{-3}}{100 \times 10^{-6}}$ $= 600$	2	
	(*e*)		Saling tukar kedudukan P dan Q *Interchange the position of* P *and* Q	1	**9**
6	(*a*)		– Haba yang diserap atau diperlukan semasa pendidihan (cecair ke gas) bagi 1 kg bahan tanpa perubahan suhu/pada suhu tetap/malar/sama *Heat absorbed or required during boiling* (*liquid to gas*) *of* 1 kg *substance without change in temperature/at constant/fix/same temperature* – Haba yang dibebaskan, dilesapkan atau hilang semasa kondensasi (gas ke cecair) bagi 1 kg bahan tanpa perubahan suhu/pada suhu tetap/malar/sama. *Heat released, dissipated or lost during condensation* (*gas to liquid*) *of* 1 kg *substance without change in temperature/at constant/fix/same temperature.*	1	
	(*b*)	(i)	Rajah 6.1 > Rajah 6.2/Sebaliknya *Diagram* 6.1 > *Diagram* 6.2/*Vice versa*	1	
		(ii)	Rajah 6.1 = Rajah 6.2/Sama *Diagram* 6.1 = *Diagram* 6.2/*Same*	1	
		(iii)	Kes 1: 6.2 > 6.1 Kes 2: 6.1 > 6.2 Kes 3: 6.1 = 6.2	1	
	(*c*)	(i)	Haba bertambah/berkurang/berubah, haba pendam tentu pengewapan tidak berubah. *Heat increase/decrease/changed, latent heat of vaporisation unchanged.*	1	
		(ii)	Kes 1: (6.2 > 6.1) Semakin tinggi kuantiti haba semakin singkat masa mengukus *The higher the quantity of heat, the shorter the steaming time* Kes 2: (6.1 > 6.2) Semakin bertambah kuantiti haba, semakin bertambah masa mengukus/Sebaliknya *The quantity of heat increase, the steaming time increase/Vice versa*	1	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
			Kes 3: (6.1 = 6.2) Kuantiti haba tidak mempengaruhi masa mengukus/Kuantiti haba bertambah, masa mengukus tidak berubah *Quantity of heat does not affect steaming time/Quantity of heat increase, steaming time unchanged*		
	(*d*)		Q = ml $= (0.5)(2.26 \times 10^6)$ $= 1.13 \times 10^6$ J	3	**9**
7	(*a*)		Petua Tangan Kiri Fleming *Fleming's Left Hand Rule*	1	
	(*b*)		Keluar dari kertas *Out from paper*	1	
	(*c*)		Tenaga elektrik → Tenaga kinetik *Electrical energy → Kinetic energy*	1	
	(*d*)		Daya tinggi/Medan lastik kuat/Medan magnet paduan kuat *High force/Strong catapult field/Strong resultant magnetic field*	1	
	(*e*)	(i)	**Ciri/ *Characteristic*:** Kuprum/ *Copper* **Sebab/ *Reason*:** Rintangan atau kerintangan rendah/Arus tinggi/Daya tinggi/Kekuatan medan magnet tinggi *Low resistance or resistivity/High current/High force/High strength of magnetic field*	2	
		(ii)	**Ciri/ *Characteristic*:** s.w.g. rendah/Ketebalan tinggi *Low* s.w.g./*High thickness* **Sebab/ *Reason*:** Rintangan rendah/Arus tinggi/ Daya tinggi/ Kekuatan medan magnet tinggi *Low resistance/High current/High force/High strength of magnetic field*	2	
	(*f*)		d.g.e tinggi/Voltan tinggi/3.7 V *High* e.m.f./*High voltage*/3.7 V	1	**9**
8	(*a*)		Daya graviti per jisim/Berat per jisim/Daya per jisim disebabkan tarikan graviti *Gravitational force per mass/Weight per mass/Force per mass caused by gravitational pull*	1	
	(*b*)		$v = \sqrt{\frac{2GM}{r}}$ $= \sqrt{\frac{2(6.67 \times 10^{-11})(5.97 \times 10^{24})}{6.37 \times 10^6}}$ $= 11181.3789 \text{ m s}^{-1}$	2	
	(*c*)	(i)	**Ciri/ *Characteristic*:** Tinggi *High* **Sebab/ *Reason*:** Daya besar/Daya tujah tinggi/Pecutan tinggi/Tenaga tinggi *Large force/High thrust/High acceleration/High energy*	2	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
		(ii)	**Ciri/ *Characteristic*:** Rendah/Ringan *Low/Light* **Sebab/ *Reason*:** Pecutan tinggi/Inersia rendah *High acceleration/Low inertia*	2	
		(iii)	**Ciri/ *Characteristic*:** Tinggi *High* **Sebab/ *Reason*:** Daya besar/Daya tujah tinggi/Pecutan tinggi/Tenaga tinggi/Momentum besar *Large force/High thrust/High acceleration/High energy/Large momentum*	2	**9**

Bahagian B / *Section* B

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
9	(*a*)		Sesaran 20 m dalam 1 saat/Sesaran 20 m per unit masa *Displacement* 20 m *in* 1 *second/Displacement* 20 m *per unit time*	1	
	(*b*)	(i)	$a = \frac{v - u^3}{t}$ $= \frac{40 - 20}{4}$ $= 5 \text{ m s}^{-2}$	2	
		(ii)	**Sesaran/ *Displacement*,** $s = \frac{1}{2}(8 + 4)(20) + (20 \times 10)$ $= 320 \text{ m}$ **Halaju purata/ *Average velocity*,** $v = 320/10$ $= 32 \text{ m s}^{-1}$	3	
	(*c*)		– Jisim besar *Big mass* – Inersia tinggi *High inertia* – Momentum ke hadapan besar *Large forward momentum* – Momentum berkadar terus dengan jisim/Momentum = jisim × halaju *Momentum is directly proportional to mass/Momentum = mass × velocity* – Daya ke hadapan besar *Large forward force* – Daya bertentangan arah besar/Daya geseran besar/Daya geseran besar diperlukan untuk memberhentikan kereta api *Large force in opposite direction/Large frictional force/Large frictional force is needed to stop the train*	4	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
	(*d*)		<table><tr><th>Ciri-ciri *Characteristics*</th><th>Sebab *Reason*</th></tr><tr><td>Bentuk kepala kereta api: *Shape of the head of the train*: Aerodinamik *Aerodynamic*</td><td>Kurang rintangan udara/Kurang seretan atau geseran/Daya paduan ke hadapan lebih besar/Pecutan tinggi *Reduce air resistance/Reduce drag or friction/Larger forward resultant force/ High acceleration*</td></tr><tr><td>Ketumpatan bahan badan kereta api: *Density of the material body of the train*: Rendah *Low*</td><td>Ringan/Jisim rendah/Inersia kecil/ Pecutan tinggi *Light/Low mass/Low inertia/High acceleration*</td></tr><tr><td>Kuasa enjin kereta api: *Engine power of the train:* Tinggi *High*</td><td>Daya besar/Tujahan tinggi/Tenaga atau kerja besar/Pecutan tinggi/ Momentum besar/Perubahan momentum dan impuls *Large force/High thrust/Large energy or work/High acceleration/Large momentum/ High change of momentum and impulse*</td></tr><tr><td>Jenis arus bekalan kuasa: *Type of current of power supply*: Arus ulang alik *Alternating current*</td><td>Beza keupayaan (Voltan) boleh dinaikkan atau diturunkan/Enjin atau transformer dihidupkan, diaktifkan, berfungsi atau beroperasi/Medan magnet berubah/Hasilkan voltan output *Potential difference (Voltage) can be increased or reduced/Engine or transformer is on, activate, function or operate/Changing of magnetic field/ Produced output voltage*</td></tr><tr><td>L</td><td>Bentuk kepala kereta api aerodinamik, ketumpatan bahan badan kereta api rendah, kuasa enjin kereta api tinggi dan jenis arus bekalan kuasa arus ulang alik. *Shape of the head of the train aerodynamic, density of the material body of the train low, engine power of the train high and type of current of power supply is alternating current*</td></tr></table>	10	**20**
10	(*a*)	(i)	Ukuran bagi keupayaan konduktor untuk menentang pengaliran arus/ Rintangan konduktor bagi seunit per 1 m panjang *Measure of a conductor's ability to oppose the flow of current/Resistance of conductor in a unit per* 1 m *length*	1	
		(ii)	$R = \frac{\rho l}{A}$ $= \frac{[1.68 \times 10^{-8}(0.07)]}{(3.142)(0.38 \times 10^{-3})^2}$ $= 2.59199 \times 10^{-3}\ \Omega$	3	

<table>
<tr><th colspan="3">Soalan
Questions</th><th>Jawapan
Answers</th><th>Sub markah
Subs marks</th><th>Jumlah markah
Total marks</th></tr>
<tr><td></td><td></td><td>(iii)</td><td>$p = \frac{v^2}{R}$
$= \frac{10^2}{2.59199 \times 10^{-3}}$
$= 38\ 580.34013$ W</td><td>2</td><td rowspan="5"></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>V = E/Q dan/ and I = Q/t
V = E/It</td><td>2</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>P = VIt/t atau/ or P = VI
P = (V/R)(Vt/t) atau/ or P = (V/R)V</td><td>2</td></tr>
<tr><td></td><td>(c)</td><td></td><td>
<table>
<tr><th>Ciri-ciri/ Characteristics</th><th>Sebab/ Reason</th></tr>
<tr><td>Kerintangan elemen pemanas:
Resistivity of heating element:
Tinggi/Besar/Bertambah
High/Large/Increase</td><td>Rintangan tinggi/Banyak haba
High resistance/More heat</td></tr>
<tr><td>Nilai pemalar spring:
Spring constant value:
Besar
Large</td><td>Daya besar/Halaju tinggi/Masa roti ke atas atau keluar singkat/Tenaga keupayaan kenyal atau kinetik tinggi/Menahan daya tinggi
Large force/High velocity/Short time for bread to move upward/High elastic potential or kinetic energy/Withstand high force</td></tr>
<tr><td>Ketebalan dawai spring:
Thickness of spring wire:
Besar
Large</td><td>Pemalar spring besar/Daya besar/Halaju tinggi/Masa roti ke atas atau keluar singkat/Tenaga keupayaan kenyal atau kinetik tinggi/Kekerasan spring atau kekenyalan spring tinggi/Menahan daya tinggi
Large spring constant/Large force/High velocity/Short time for bread to move upwards/High elastic potential or kinetic energy/High stiffness of spring/High elasticity of spring/Withstand high force</td></tr>
<tr><td>Kekuatan medan magnet:
Strength of magnetic field:
Kuat
Strong</td><td>Daya besar/tinggi/kuat
Large/high/strong force</td></tr>
<tr><td>Y</td><td>Kerintangan elemen pemanas tinggi/besar/bertambah, nilai pemalar spring besar, ketebalan dawai spring besar dan kekuatan medan magnet kuat
Resistivity of heating element high/large/increase, spring constant value large, thickness of spring wire large and strength of magnetic field strong</td></tr>
</table>
</td><td>10</td><td>20</td></tr>
</table>

Bahagian C / *Section* C

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*
11	(*a*)		Prinsip Archimedes *Archimedes' principle*	1	
	(*b*)		– Suhu udara di dalam tanglung tinggi *The temperature of air in the lantern is high* – Ketumpatan udara di dalam tanglung rendah *The density of the air inside the lantern is low* – Daya apungan/Daya julangan/Tujah ke atas terhasil *Buoyant force/Upthrust is produced* – Daya apungan, $F = \rho gV$ *Buoyant force,* $F = \rho gV$ – Daya apungan lebih besar daripada berat tanglung/Daya paduan atau bersih ke atas *Buoyant force is greater than the weight of the lantern/Upward resultant or net force* [Mana-mana **empat** jawapan diterima] [*Any* **four** *answers accepted*]	4	
	(*c*)	(i)	– Suhu udara di dalam tanglung udara panas Q lebih tinggi daripada tanglung udara panas P/Sebaliknya *The temperature of air in sky lantern* Q *is higher than sky lantern* P/*Vice versa* – Ketumpatan udara di dalam tanglung udara panas Q lebih rendah daripada tanglung udara panas P/Sebaliknya *The density of air in sky lantern* Q *is lower than sky lantern* P/*Vice versa* – Daya apungan yang dialami oleh tanglung udara panas Q lebih tinggi daripada tanglung udara panas P/Sebaliknya *The buoyant force experienced by sky lantern* Q *is higher than sky lantern* P/*Vice versa*	3	
		(ii)	– Semakin bertambah suhu udara di dalam tanglung udara panas, semakin berkurang ketumpatan udara di dalam tanglung udara panas/Sebaliknya *The higher the temperature of air in the sky lantern, the lower the density of air in the sky lantern/Vice versa* – Semakin berkurang ketumpatan udara di dalam tanglung udara panas, semakin bertambah daya apungan di dalam tanglung udara panas/Sebaliknya *The lower the density of air in the sky lantern, the higher the buoyant force of air in the sky lantern/Vice versa*	3	

Soalan *Questions*	Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*

(*d*)

Cadangan/ *Suggestion*	Sebab/ *Reason*
Bahan belon: *Material of balloon*: Nilon/Poliester/Kuat *Nylon/Polyester/Strong*	Kuat/Tidak koyak/Tahan haba/Tahan lasak/Ketumpatan rendah/Kalis air/Jisim rendah/Ringan *Strong/Not tear/Heat resistant/Durable/Low density/Waterproof/Low mass/Light*
Bahan belon: *Material of balloon*: Ketumpatan rendah/ Ringan *Low density/Light*	Ringan/Jisim rendah *Light/Low mass*
Bahan belon: *Material of balloon*: Kekenyalan tinggi/ Kenyal *High elasticity/Elastic*	Kurang meregang/Bentuk kekal atau tidak berubah/Tidak koyak *Less stretch/Maintain the shape/Not tear*
Bahan belon: *Material of balloon*: Tebal *Thick*	Kurang meregang/Tidak koyak *Less stretch/Not tear*
Saiz belon: *Size of balloon*: Besar *Large*	Sesar isi padu udara besar/Sesar lebih udara/Daya apungan atau daya julangan besar/Daya paduan atau bersih tinggi *Displace large volume of air/Displace more air/Buoyant force or upthrust high/High resultant or net force*
Bilangan pembakar: *Number of burners*: Banyak/Lebih daripada dua *Many/More than two*	Suhu dalam belon tinggi/Ketumpatan udara di dalam belon rendah/Cepat panas *High temperature in the balloon/Low density of air in the balloon/Hot quickly*
Jenis gas pembakar: *Type of fuel gas*:	Propana/Butana/Gas petroleum cecair/ LPG *Propane/Butane/Liquefied petroleum gas*/LPG
Bahan bakul: *Material of basket*: Rotan/Gentian karbon/ Aluminium/Karbon komposit/Kuat *Rattan/Carbon fibre/ Aluminium/Composite carbon/Strong*	Ketumpatan rendah/Jisim rendah/Ringan/ Serap hentakan/Kuat/Tahan Lasak/Tidak patah atau pecah/Menampung jisim besar/ Menampung beban atau berat yang lebih *Low density/Low mass/Light/Absorb impact/ Strong/Durable/Not break/Support big mass/ Support more load or weight*
Bahan bakul: *Material of basket*: Ketumpatan rendah/ Jisim rendah *Low density/Low mass*	Jisim rendah/Ringan *Low mass/Light*

10

Soalan *Questions*	Jawapan *Answers*	Sub markah *Subs marks*	Jumlah markah *Total marks*

Cadangan/ *Suggestion*	Sebab/ *Reason*
Saiz bakul: *Size of basket*: Besar *Large/Big*	Muatan besar atau banyak *Big or more load capacity*
Alatan tambahan: *Additional equipment*: Kabel/tali keselamatan *Safety cable/rope*	Kawal pergerakan/kedudukan/ketinggian belon *Control the balloon movement/position/height*
Alatan tambahan: *Additional equipment*: Injap payung terjun *Parachute valve*	Lepaskan atau keluarkan udara panas/ Mengurangkan suhu udara di dalam belon/ Menambahkan ketumpatan udara di dalam belon *Release hot air/Reduce temperature of air in the balloon/Increase density of air in the balloon*
Alatan tambahan: *Additional equipment*: Bahan/alas lembut di bawah bakul *Soft material/cushion below basket*	Masa hentaman, hentakan, perlanggaran atau impak bertambah/Daya impuls berkurang *Time of impact or collision increase/Impulsive force decrease*

20