Yakin
Pustaka Yakin Pelajar Sdn. Bhd.

KERTAS SOALAN PEPERIKSAAN SEBENAR SPM 2021

FORMAT TERKINI

+3 SET KERTAS MODEL FORMAT INSTRUMEN SPM TERKINI

FIZIK
Bilingual

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 $r \geq R$, 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* $r \geq R$, *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*:

$$F = \frac{GMm}{r^2}$$
$$= \frac{(6.67 \times 10^{-11})(5.94 \times 10^{24})(54)}{(6.37 \times 10^{6})^2}$$
$$= 527.26 \text{ N}$$

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 is refraction. Wavelength decreases when depth decreases.

15 A Frekuensi gelombang ultrasonik melebihi 20 kHz 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 dekat menghasilkan imej yang besar, jarak objek yang jauh menghasilkan imej yang kecil.
Image from camera lens: *Object distance shorter produced bigger image*, *object distance longer 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 $F_x = 500 \text{ kos/cos } 60^o$
$= 250^o$

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 D $F_{net} = 1\,000 \sin 30^o + 850 - 150$
$= 500 \text{ N} + 850 \text{ N} - 150 \text{ N}$
$= 1\,200 \text{ N}$

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 A Penjana elektrik arus terus 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 (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*.

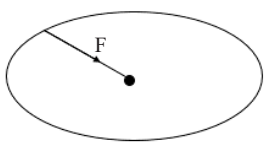
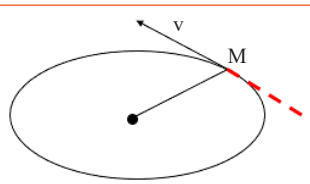
37 A Mengendalikan bahan radioaktif menggunakan lengan robotik mengurangkan risiko terdedah kepada bahan radioaktif.
Handling radioactive materials using robotic arms reduce the risks of being exposed to the radioactive materials.

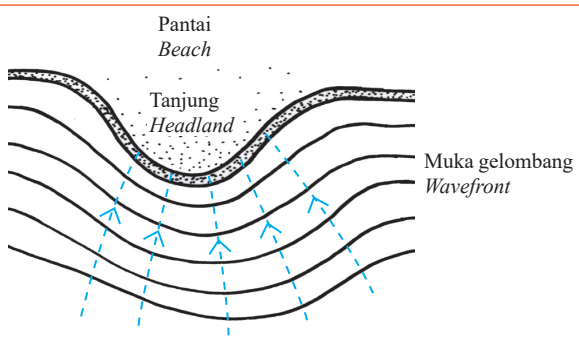
38 D Fungsi rod kawalan boron: Menyerap neutron berlebihan. Fungsi moderator grafit: Memperlahankan kelajuan neutron.
Function of the boron control rod: *Absorb the excessive neutron*. *Function of the graphite moderator*: *Slows down the speed of neutron*.

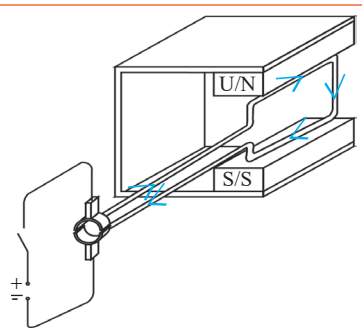
39 C Tenaga nuklear merupakan sumber tenaga bersih yang tidak memberi kesan kepada ekosistem dan jejak karbon.
Nuclear energy is clean and no effect to the ecosystem and carbon footprint.

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*	Markah total *Total marks*
1	(a)	(i)	✓ Haba pendam/*Latent heat*	1	
		(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	4
2	(a)		Frekuensi minimum untuk menghasilkan kesan fotoelektrik *Minimum frequency to produce photoelectric effect*	1	
	(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*)	1 1	
	(c)		Keamatan bertambah, bilangan elektron bertambah. *Intensity increases, number of electrons increases.*	2	5
3	(a)	(i)	Daya memusat/*Centripetal force*	1	
		(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	6
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*	Markah total *Total marks*
		(iii)	$\frac{5 \times 10^{-3}}{50 \times 10^{-6}} = 100$ (Gantian yang betul/*Correct substitution*) (Jawapan yang betul/*Correct answer*)	 1 1	
	(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* (Maksimum 3 markah/*Maximum 3 marks*)	 3	9
5	(a)		✓ gelombang melintang/*transverse wave*	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)	 (Minimum 2 garis melengkung yang menumpu ke arah tanjung dalam julat garis putus-putus) (*Minimum 2 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*	Markah total *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/ke kiri/ke dalam *Opposite direction/to the left/inwards*	1	
	(e)	(i)	 Arah arus betul pada mana-mana bahagian pada gegelung *Direction of current correct 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//berjisim kecil. *Heavy nucleus split into two nucleus of equal mass//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*)	1 1	
	(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
8	(a)		Pantulan dalam penuh/*Total internal reflection*	1	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
	(b)		$n = \frac{1}{\sin c}$ $1.5 = \frac{1}{\sin c}$ $c = 41.81^{o}$ (min. 2 t.p./*min. 2 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*	Markah total *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, min 2 t.p.) (*Correct answer with unit, min. 2 d.p.*)	1 1	
		(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*	Markah total *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*** $mgh = \frac{1}{2}mv^2$ $v = \sqrt{2gh}$ $= \sqrt{2 \times 9.81 \times 4}$ $= 8.86 \text{ m s}^{-1}$	2	
		(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, θ kecil / *Small angle, θ* — Daya tinggi / *High force* — 2 Kabel tidak kenyal / *Inelastic cable* — Daya seragam//Panjang kabel tetap//Kabel tidak menegang / *Uniform force//Length of cable remain//Cable not stretched* — 2 Tegangan maksimum tinggi / *High maximum tension* — Menampung daya tinggi//Tidak putus//Tahan lasak//Kuat / *Support high force//Not snap //Durable//Strong* — 2 Papan kayu / *Wooden plank* — Kurang tekanan//Tambah luas permukaan/ sentuhan. / *Less pressure//Increase surface/contact area* — 2 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.* — 2		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)	$P = I^2R$ $= 4.2^2 \times 57.6$ $= 1\,016.064 \text{ W}$ (min. 2 t.p./*min at 2 d.p.*)	2	
	(c)		– Tenaga elektrik ditukarkan kepada tenaga haba. *Electrical energy converted into heat energy.* – Elemen pemanas berbentuk gegelung. *Coiled shaped heating element.*		

<table>
<tr><th colspan="3">Soalan
Questions</th><th>Jawapan
Answers</th><th>Sub markah
Subs marks</th><th>Markah total
Total marks</th></tr>
<tr><td></td><td></td><td></td><td>– Panjang elemen pemanas bertambah, rintangan bertambah.
Length of heating element increases, resistance increases.
– Rintangan hasilkan 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.
(Max. 4m)</td><td>4</td><td rowspan="2">20</td></tr>
<tr><td></td><td>(d)</td><td></td><td>
<table>
<tr><th>Cadangan
Suggestions</th><th>Sebab
Reason</th></tr>
<tr><td>Bentuk dawai perintang – Bergelung
Shape of resistance wire – Coiled</td><td>Rintangan tinggi//Panjang//Banyak haba
Higher resistance//Long//More heat</td></tr>
<tr><td>Kerintangan dawai perintang – Tinggi
Resistivity of resistance wire – High</td><td>Lebih haba//Rintangan tinggi
More heat//High resistance</td></tr>
<tr><td>Bahan dawai perintang – Nikrom
Material of resistance wire – Nichrome</td><td>Takat lebur tinggi//Rintangan tinggi//Banyak haba
High melting point//High resistance//More heat</td></tr>
<tr><td>Bahan salutan luar – Keluli
Casing material – Steel</td><td>Tidak teroksida//Tahan suhu tinggi//Konduktor haba yang baik
Not oxidise//Withstand high temperature//Good heat conductor</td></tr>
<tr><td colspan="2">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.</td></tr>
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Bahagian C/*Section* C

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
11	(a)		Laju bendalir yang mengalir bertambah, tekanan berkurang *Speed of 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.* – Perbezaan tekanan. *Pressure difference.* – Daya angkat terhasil. *Lift force produced.* – Daya angkat > berat//daya paduan ke atas *Lift force/Lift > weight//resultant force upwards* (Max. 4m)	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*	1	
			– 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*	1	
			– Laju papan luncur pada Rajah 11.3 lebih tinggi//sebaliknya *Speed of surfboard in Diagram* 11.3 *is higher//vice versa*	1	
			– Ketinggian bertambah, daya geseran berkurang//sebaliknya *Height of surface increases, frictional force decreases//vice versa*	1	
			– Daya geseran berkurang, laju papan luncur bertambah *Water friction decreases, speed of the surface increases*	1	

(d)

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*
– Hidrofoil kuat/kukuh/aluminium/keluli/plastik fiber *Strong hydrofoil/Aluminium hydrofoil/Steel hydrofoil/fibre plastic hydrofoil*	Tidak pecah//Kuat//Kukuh//Tahan/Tidak karat *Not break//Strong//Durable//Not rust*
Bilangan hydrofoil ***Number of hydrofoil***	
– Hidrofoil banyak/lebih daripada 2 *Many hydrofoil/More than* 2	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//Tinggi/Berkuasa tinggi *Large//High*	Daya besar/tinggi//Lebih daya//Momentum/Tenaga tinggi//Daya apungan besar *Big/High force//More force//High momentum/energy//Great buoyant force*

Maks. 10 markah daripada mana-mana bahagian.
Max. 10 *marks from any parts.*

10 | 20

KERTAS MODEL SPM SET 1

KERTAS 1 / *Paper* 1

1 B Pertukaran unit km j^{-1} kepada m s^{-1}
Converting the unit of km h^{-1} *to* m s^{-1}

$$\frac{35 \times 1\,000}{60 \times 60} = 9.7 \text{ m s}^{-1}$$

2 A I ialah angkup vernier
is vernier calipers
II ialah pita pengukur yang digunakan untuk kuantiti asas untuk panjang
is measuring tape that are used for measure base quantities for length

3 D Ft = mv – mu
= jisim × halaju/*mass* × *velocity*
= kg m s^{-1}

Ns = kg m s^{-2} × s
= kg m s^{-1}

4 A Lima titik yang pertama sama jarak menunjukkan gerakan halaju seragam dan seterusnya mengalami nyahpecutan kerana jarak antara titik semakin berkurang
The first five points show uniform velocity motion and then decelerate as the distance between the points decreases

5 D Halaju motosikal semakin bertambah. Motosikal memecut secara seragam pada arah bertentangan iaitu ke kiri.
The speed of the motorcycle is increasing. A motorcycle accelerates uniformly in the opposite direction, i.e. to the left.

6 D Jisim besar, inersia besar
Bigger mass, bigger inertia

7 B Pecutan objek yang jatuh bebas disebabkan oleh daya tarikan graviti dinamakan pecutan graviti, g
The acceleration of a free falling object caused by gravitational force is known as gravitational acceleration, g

8 C Data yang diperlukan untuk menghitung jisim bumi
Data that are needed to calculate the mass of the earth
II Jejari orbit mana-mana satelit atau bulan
Radius of the orbit any satellite or the moon
III Tempoh pengedaran jasad
Period of revolution of the body

9 B $v = \sqrt{\frac{GM}{R + h}}$

$$= \sqrt{\frac{6.67 \times 10^{-11} \times 5.97 \times 10^{24}}{6.37 \times 10^{6} + 20.2 \times 10^{6}}}$$

$$= 3.87 \times 10^{3} \text{ m s}^{-1}$$

10 D Tempoh orbitnya ialah 24 jam, iaitu sama dengan tempoh putaran Bumi
Its orbital period is 24 hours, that is the same as the period of rotation of the Earth

11 D Muatan haba yang rendah akan cepat panas dan sejuk
Lower specific heat capacity became hot and cool faster

12 **C** Haba yang dihilangkan oleh air panas = haba yang diperoleh oleh air sejuk
Heat lost by hot water = heat gained by cold water

13 **D** $c = \frac{36\,000}{0.6 \times 30}$
$= 2\,000 \text{ J kg}^{-1} \text{ °C}^{-1}$

14 **B** Pelembapan ialah pengurangan amplitud suatu ayunan akibat kehilangan tenaga
Damping is the reduction in amplitude in an oscillating system due to loss of energy

15 **B** Pembiasan gelombang berlaku apabila menghampiri pantai kerana perbezaan kedalaman, maka halaju dan panjang gelombang berubah tetapi frekuensi malar
Wave refraction occurs when approaching the shore due to the difference in depth, so the velocity and wavelength change but the frequency is constant

16 **C** Pembelauan gelombang ialah penyebaran gelombang apabila gelombang itu merambat melalui suatu celah atau tepi suatu penghalang
Diffraction of waves is the spreading of waves when the waves propagate through a gap or the edge of a barrier

17 **B** $\lambda = \frac{ax}{D}$
$x = \frac{6.4 \times 10^{-7} \times 3}{0.4 \times 10^{-3}}$
$= 4.8 \times 10^{-3}$

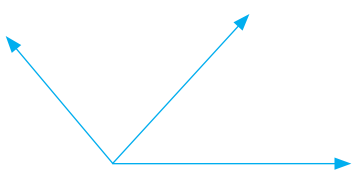
18 **C** $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$
$\frac{1}{f} = \frac{1}{10} + \frac{1}{20}$
$f = 6.67 \text{ cm}$

19 **B** Imej akhir yang terbentuk ialah dibesarkan, songsang dan maya
Final image formed is magnified, inverted and virtual

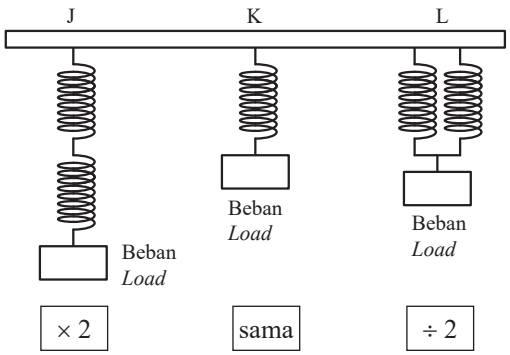
20 **B** Cermin bintik buta
Blind spot mirror
Cermin cembung diletakkan di selekoh tajam yang berbahaya untuk meluaskan medan penglihatan
A convex mirror is placed at sharp corners to widen the field of vision of the driver

21 **A** Daya pasukan merah lebih besar dari pasukan biru, maka 150 N bertindak ke arah pasukan Merah
The red team's force is greater than the blue teams, so 150 N *acts towards the Red team*

22 **A** Dua daya bertindak ke atas satu objek pada arah yang tidak berserenjang antara satu sama lain
Two forces act on an object in direction that are not perpendicular to each other



23 D



24 A P = hρg
dengan keadaan/*where*
h = kedalaman/*depth*
ρ = ketumpatan/*density*

25 B Daya apungan
Buoyancy force

26 D Tekanan gas, P = Tekanan atmosfera + Tekanan yang dikenakan oleh turus merkuri
Gas pressure, P = *Atmospheric pressure + Pressure exerted by mercury column*
P = 75 + 5
= 80 cm Hg

27 B Kuasa = $\frac{\text{Tenaga elektrik yang digunakan}}{\text{Masa yang diambil}}$

Power = $\frac{\textit{Energy used}}{\textit{time taken}}$

28 C E = Pt
= 1.2 × 20 × 24
= 576

100 unit pertama: 100 × 0.23 = 23
First 100 *units*
476 unit kedua : 476 × 0.25 = 119
Second 476 *units*

Kos Keseluruhan/*Total cost* = 23 + 119
= RM142.00

29 B V = IR
= 0.5(3)
= 1.5 V

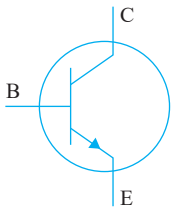
30 A Petua Genggaman Tangan Kanan
Right Hand Grip Rule

31 C Transfomer tidak berfungsi dengan bekalan kuasa arus terus kerana arus terus tidak menghasilkan arus ulang-alik untuk menghasilkan medan magnet yang berubah-ubah dari segi magnitud dan arah
Transformer does not work with a direct current power supply because direct current cannot produces an alternating current for producing a magnetic field that changes in magnitude and direction.

32 A Pancaran termion ialah pemancaran elektron bebas daripada permukaan logam yang dipanaskan
Thermionic emission is the emission of free electrons from a heated metal surface

33 C Mentol menyala kerana sambungan adalah pincang hadapan. Diod jenis-P disambung ke terminal positif dan jenis-N disambungkan kepada terminal negatif bateri.
The bulb lights up because the connection is forward bias. The P-type diode is connected to the negative terminal of a battery.

34 D Jenis npn / npn *type*



C: Pengumpul
Collector
B: Tapak
Base
E: Pengeluar
Emitter

35 A Nombor nukleon/*Nucleon number* = 210 − 206
= 4
Nombor proton/*Proton number* = 84 − 82
= 2
Zarah Alfa/*Alpha particle* = $_{2}^{4}\text{He}$

36 B $Q = mc^2$
$= 2.988 \times 10^{-28} \times (3 \times 10^{8})^2$
$= 2.69 \times 10^{-11}\text{J}$

37 B Rod pengawal/*Controls Rod*
- Berfungsi mengawal tindak balas dan menyerap neutron berlebihan
  Controls the reaction rate by absorbing excess neutrons
- Dibuat daripada boron dan kadmium
  Made of boron or cadmium

38 A Foton ialah tenaga cahaya yang wujud dalam bentuk paket tenaga
Light energy exists in the form of energy packets known as photon

39 C Semakin tinggi keamatan cahaya suatu jasad hitam, semakin banyak tenaga cahaya terpancar daripadanya
The higher the light intensity of a black body, the more light energy it emits

40 D $p = \dfrac{nhc}{\lambda}$

$n = \dfrac{p\lambda}{hc}$; $E = \dfrac{hc}{\lambda}$

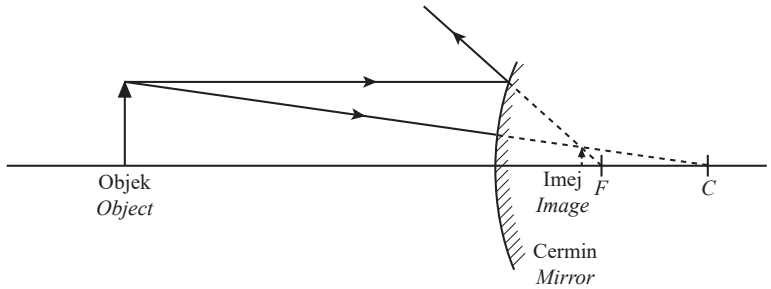
$= \dfrac{400}{4.91 \times 10^{-19}}$

$= 8.15 \times 10^{20}$

Bahagian A/*Section* A

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
1	(*a*)		✓ – kuantiti vektor *vector quantity*	1	
	(*b*)		Sesaran/*Displacement*	1	
	(*c*)		$s = \left[\frac{1}{2}(2+4) \times 10\right] + \left(\frac{1}{2} \times 2 \times 10\right) - \left(\frac{1}{2} \times 2 \times 10\right)$ $= 30$ m	1 1	4
2	(*a*)		Dua objek bersentuhan secara terma mencapai suhu yang sama, di mana haba bersih yang dipindahkan ialah sifar. *Two objects that are in thermal contact achieve the same temperature, where net heat transfer is zero.*	1	
	(*b*)	(i)	$Q = mc\theta$ $= 0.1 \times 4\,200 \times (100 - 55)$ $= 18\,900$ J	2	
		(ii)	Suhu berkurang//menurun//lebih rendah *Temperature decreases//lower*	1	
		(iii)	✓ – sama dengan jumlah haba yang dibebaskan oleh air didih. *equal to the amount of heat released by the boiled water.*	1	5
3	(*a*)		Daya semesta/Daya tarikan semula jadi antara mana-mana dua jasad *Universal force/Force of attraction between two bodies*	1	
	(*b*)	(i)	Berkadar terus *Directly proportional*	1	
		(ii)	Berkadar songsang *Inversely proportional*	1	
		(iii)	$\frac{(6.67 \times 10^{-11})(75)(55)}{(2.0)^2}$ $= 6.88 \times 10^{-8}$ N	2	
	(*c*)		Daya graviti tersebut mempunyai magnitud yang sangat kecil. *The gravitational force has a very small magnitude.*	1	6
4	(*a*)		Perintang Peka Cahaya (PPC) *Light Dependent Resistor* (*LDR*)	1	
	(*b*)	(i)	$V_{LM} = \frac{40}{40 + 10} \times 6$ $= 4.8$ V	2	
		(ii)	$I = \frac{4.8}{40}$ $= 0.12$ mA	2	
	(*c*)		– Rintangan *PPC* adalah sangat tinggi. *The resistance of LDR is very high.* – Voltan yang merentasi *PPC* adalah tinggi. *The voltage across LDR is high.* – Arus tapak akan mengalir. *Base current will flow.* – Transistor dihidupkan. *Transistor is switched on.*	4	9

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
5	(*a*)		Cahaya dengan satu panjang gelombang//satu warna *The light which has single wavelength//one colour*	1	
	(*b*)		Interferens memusnah menghasilkan pinggir-pinggir gelap. *Destructive interference produces dark fringes.*	1	
	(*c*)		– Jarak antara dua pinggir berturutan bagi cahaya merah lebih jauh daripada cahaya biru. *The distance between two consecutive bright fringes for red light is further than blue light.* – Jarak antara dua pinggir berturutan bagi cahaya yang sama adalah sama. *The distance between two consecutive bright fringes for the same light are constant.*	2	
	(*d*)		Apabila panjang gelombang bertambah, jarak di antara pinggir-pinggir terang yang berturutan bertambah. *The longer the wavelength, the longer the distance between consecutive bright fringes.*	1	
	(*e*)	(i)	Jarak di antara pinggir-pinggir terang berturutan akan berkurang. *The distance between consecutive bright fringes will decrease.*	1	
		(ii)	Interferens gelombang *Interference of waves*	1	
	(*f*)		$x = \frac{1.5 \times 10^{-2}\ \text{m}}{3}$ $= 0.005\ \text{m}$ $\lambda = \frac{5.0 \times 10^{-4} \times 0.005}{3.0}$ $= 8.33 \times 10^{-7}\ \text{m}$	2	9
6	(*a*)		Alur elektron yang bergerak dengan kelajuan tinggi dalam vakum *Beams of electrons moving at high speed in a vacuum*	1	
	(*b*)	(i)	Voltan yang dibekalkan dalam Rajah 6(a) kurang daripada Rajah 6(b). *The voltage supplied in Diagram* 6(a) *is less than in Diagram* 6(b).	1	
		(ii)	Halaju elektron dalam Rajah 6(a) kurang daripada dalam Rajah 6(b). *The velocity of electron in Diagram* 6(a) *is less than in Diagram* 6(b).	1	
		(iii)	Keamatan tompok hijau dalam Rajah 6(a) kurang daripada dalam Rajah 6(b). *The intensity of green dot in Diagram* 6(a) *is less than in Diagram* 6(b).	1	
	(*c*)	(i)	Apabila voltan yang dibekalkan bertambah, halaju elektron bertambah. *When the voltage supplied increases, the velocity of electron increases.*	1	
		(ii)	Apabila halaju elektron bertambah, keamatan tompok hijau bertambah. *When the velocity of electron increases, the intensity of green dot increases.*	1	
	(*d*)		– Elektron terbebas daripada filamen yang dipanaskan melalui pancaran termion. *Electrons are emitted from the hot filament through thermionic emission.* – Elektron tertarik ke anod. *Electrons are attracted to the anode.* – Elektron menghentam skrin pendaflour.//Skrin pancarkan cahaya hijau.//Tenaga kinetik berubah kepada tenaga cahaya. *Electrons strike the fluorescent screen.//The screen emits green light.//Kinetic energy changes to light energy.*	3	9

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
7	(*a*)		Medan/Sudut penglihatan lebih luas *Wider field/angle of view*	1	
	(*b*)	(i)		2	
		(ii)	Diperkecilkan/Tegak/Maya *Diminished/Upright/Virtual* (Mana-mana dua/*Any two*)	1	
	(*c*)	(i)	Cembung/*Convex* Medan penglihatan lebih luas.//Cahaya boleh dipantulkan pada sudut yang lebih besar ke dalam mata pemerhati. *Wider field of view.//Light can be reflected at a larger angle into the observer's eye.*	2	
		(ii)	Jejari kelengkungan yang panjang/*Long radius of curvature* Diameter lebih besar.//Medan penglihatan lebih luas. *Bigger diameter.//Wider field of view.*	2	
	(*d*)		T	1	9
8	(*a*)		Prinsip Archimedes/*Archimedes' principle*	1	
	(*b*)		Daya apungan/*Buoyant force* Berat belon udara panas/*Weight of hot air balloon*	2	
	(*c*)	(i)	Size belon yang besar/*Big size of balloon* Menyesarkan isi padu udara yang besar//Daya apungan yang besar *To displace large volume of air//Large buoyant force*	2	
		(ii)	Tambah bilangan pembakar/*Add more number of burners* Dapat memanaskan udara dengan lebih cepat *To heat up the air faster*	2	
		(iii)	Jumlah berat belon yang lebih kecil/*Smaller total weight of balloon* Menghasilkan daya paduan ke atas yang lebih besar *To produce larger upward resultant force*	2	9

Bahagian B/*Section* B

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
9	(*a*)		Darjah kepanasan/*Degree of hotness*	1	
	(*b*)		– Apabila termometer diletakkan di bawah lidah pesakit, berlakunya sentuhan terma. *When a thermometer is placed below the patient's tongue, thermal contact occurs.* – Haba dari badan dipindahkan ke bebuli merkuri termometer. *Heat from the body is transferred to the mercury bulb of thermometer.*		

<table>
<tr><td></td><td></td><td></td><td>– Pengaliran haba berlaku sehingga mencapai keseimbangan terma.
Heat flow occurs until thermal equilibrium is achieved.
– Pengembangan merkuri yang disebabkan oleh penyerapan haba berhenti apabila mencapai keseimbangan terma.//Termometer menunjukkan suhu badan.
The expansion of mercury due to heat absorption stops when thermal equilibrium is achieved.//The thermometer shows the body temperature.</td><td>4</td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>$\theta = \frac{l_\theta - l_0}{l_{100} - l_0} \times 100°C$
$= \frac{12 - 5}{25 - 5} \times 100°C$
$= 35°C$</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>$\theta = 35 + 273$
$= 308\ K$</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Legap//Mempunyai takat didih tinggi//Boleh mengembang secara sekata
Opaque//Has high boiling point//Can expand uniformly</td><td>1</td><td></td></tr>
<tr><td></td><td>(d)</td><td></td><td>
<table>
<tr><th>Aspek
Aspect</th><th>Pilihan
Choice</th><th>Alasan
Reason</th></tr>
<tr><td>Cecair yang digunakan
Liquid used</td><td>Merkuri
Mercury</td><td>Pengembangan yang sekata/Legap
Uniform expansion/Opaque</td></tr>
<tr><td>Dinding bebuli kaca
Wall of glass bulb</td><td>Nipis
Thin</td><td>Peka dengan perubahan suhu
Sensitive to the changes in temperature</td></tr>
<tr><td>Diameter tiub kapilari
Diameter of capillary tube</td><td>Kecil
Small</td><td>Mudah untuk menunjukkan perubahan suhu
Easy to show changes in temperature</td></tr>
<tr><td>Panjang termometer
Length of thermometer</td><td>Panjang
Long</td><td>Menunjukkan julat bacaan suhu lebih besar
Show wider range of temperature readings</td></tr>
</table>
Pilihan/Choice : Y</td><td>10</td><td>20</td></tr>
<tr><td>10</td><td>(a)</td><td>(i)</td><td>Fenomena di mana suatu permukaan logam disinari oleh alur cahaya yang mempunyai frekuensi tertentu, elektron daripada logam itu dapat dipancar keluar.
A phenomenon where a metal surface is illuminated by a beam of light at a certain frequency, electrons can be emitted from the metal.</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>– Semakin tinggi frekuensi foton cahaya, semakin tinggi tenaga kinetik fotoelektron yang dipancarkan daripada permukaan logam.
The higher the frequency of the photon of light, the higher the kinetic energy of the photoelectrons emitted from the metal surface.
– Frekuensi minimum cahaya yang dapat mengeluarkan elektron dikenali sebagai frekuensi ambang, f_0 bagi suatu logam.
The minimum frequency of light needed for a metal to emit electrons is known as the threshold frequency, f_0 for the metal.
– Tenaga kinetik fotoelektron tidak bergantung pada keamatan cahaya. Keamatan cahaya yang bertambah tidak menghasilkan fotoelektron yang lebih bertenaga kinetik.
The kinetic energy of photoelectrons does not depend on the intensity of light. An increase in the light intensity does not produce photoelectrons with a higher kinetic energy.</td><td></td><td></td></tr>
</table>

Soalan *Questions*	Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
	– Fotoelektron dipancar secara serta-merta apabila permukaan logam disinari dengan cahaya. *Photoelectrons are emitted instantaneously when a metal surface is irradiated by light.*	4	
(*b*)	$\lambda = \frac{c}{f}$ $= \frac{3.0 \times 10^8}{5.0 \times 10^{14}}$ $= 6.0 \times 10^{-7}$ $= 600$ nm Syarat untuk elektron dipancarkan dari permukaan logam: *Conditions for electron to be emitted from a metal surface*: – Frekuensi sinar gelombang lebih tinggi daripada frekuensi ambang logam. *The wave radiation frequency is higher than the threshold frequency of metal.* **atau/*or*** – Panjang gelombang kurang daripada panjang gelombang ambang logam. *Wavelength is less than the threshold wavelength of the metal.* **Logam/Metal J (λ_0 = 480 nm)** Panjang gelombang sinar elektromagnet lebih daripada panjang gelombang ambang logam J, di mana frekuensinya kurang daripada frekuensi ambang logam J. Maka, tiada elektron dibebaskan dari permukaan logam J. *Wavelength of the electromagnetic ray is more than threshold wavelength of metal* J, *where its frequency is less than the threshold frequency of metal* J. *Hence, no electron is released from surface of metal* J. **Logam/*Metal* K (λ_0 = 688 nm)** Panjang gelombang sinar elektromagnet kurang daripada panjang gelombang ambang logam K, di mana frekuensinya lebih daripada frekuensi ambang logam K. Maka, elektron dibebaskan dari permukaan logam K. *Wavelength of the electromagnetic ray is less than threshold wavelength of metal* K, *where its frequency is more than the threshold frequency of metal* K. *Hence, electron is released from surface of metal* K.	5	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
	(*c*)				

Ciri-ciri *Characteristics*	Pilihan *Choice*	Penerangan *Explanation*
Sumber cahaya *Light source*	Inframerah *Infrared*	Kurang merbahaya/Kesan radiasi lebih kecil berbanding dengan ultraungu *Less harmful/Smaller radiation effect compared to ultraviolet*
Keamatan sumber cahaya *Light source intensity*	Rendah *Low*	Jimat tenaga *Energy saving*
Jenis sel foto *Types of photocell*	Semikonduktor *Semiconductor*	Bersaiz kecil/Penggunaan kuasa yang rendah *Small size/Less power consumption*
Fungsi kerja *Work function*	Rendah *Low*	Lebih cekap mengesan foton/ Lebih sensitif *More effective to detect photon/Higher sensitivity*

Pilihan/*Choice* : U — Sub markah: 10 — Markah total: 20

Bahagian C/*Section* C

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
11	(*a*)	(i)	Bilangan ayunan penuh dalam satu saat *Number of complete oscillations in one second*	1	
		(ii)	– Getaran tala bunyi menggetarkan zarah-zarah udara di sekeliling. *Vibration of the tuning fork vibrates air particles around it.* – Apabila tala bunyi bergerak keluar, kawasan mampatan terhasil. *When the tuning fork moves outward, compression region is produced.* – Apabila tala bunyi bergerak ke dalam, kawasan regangan terhasil. *When the tuning fork moves inward, rarefaction region is produced.* – Satu siri mampatan dan regangan terhasil dan tenaga dipindahkan. *A series of compression and rarefaction is produced and energy is transferred.*	4	
	(*b*)		– Amplitud getaran $d_1 < d_2$ *Amplitudes of vibration* $d_1 < d_2$ – Nilai puncak $a_1 < a_2$ *Peak values* $a_1 < a_2$ – Semakin tinggi nilai-nilai puncak, semakin tinggi amplitud gelombang bunyi.//Apabila nilai-nilai puncak bertambah, amplitud bertambah. *The higher the peak values, the higher the amplitude of sound waves.//When the peak values increases, the amplitude increases.* – Semakin tinggi nilai-nilai puncak, semakin tinggi kenyaringan bunyi. *The higher the peak values, the higher the loudness of the sound.* – Semakin tinggi amplitud gelombang, semakin tinggi kenyaringan bunyi.//Kenyaringan bunyi berkadar terus dengan amplitud gelombang. *The higher the amplitude of the wave, the higher the loudness of the sound.// The loudness of the sound is directly proportional to the amplitude of the wave.*	5	

Soalan *Questions*	Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
(*c*)		10	20

Aspek *Aspect*	Modifikasi *Modification*	Penerangan *Explanation*
Jenis gelombang dipancar *Types of wave transmitted*	Gelombang mikro *Microwave*	Boleh merambat jauh ke satelit// Tenaga tinggi//Frekuensi tinggi *Able to propagate far to the satellite// High energy//High frequency*
Kedudukan penerima *Position of receiver*	Di bahagian atas dron *On the top of the drone*	Mudah terima pantulan daripada satelit *Easy to receive reflection from the satellite*
Bilangan bilah kipas *Number of propellers*	Banyak *More*	Daya angkat lebih tinggi *Higher or greater lift force*
Saiz tangki baja *Size of fertiliser tank*	Besar *Big*	Kuantiti baja lebih banyak// Semburan kawasan yang lebih luas *More quantity of fertiliser//Wider spray area*
Komponen tambahan *Additional component*	Kamera *Camera*	Dapat meninjau keadaan tanaman/ kawasan pertanian *Can inspect the condition of crops/ agricultural area*
	GPS	Boleh mengukur luas/jarak/lokasi *Able to measure the area/distance/ location*

KERTAS MODEL SPM SET 2

KERTAS 1 / *Paper* 1

1 **B** Pecutan/*Acceleration*, $a = \frac{v - u}{t}$

$= \frac{l}{t}$

2 **D** Kecerunan graf/*Gradient of graph*, $m = \frac{0 - 10}{5 - 0}$

$= -2$

Pintasan paksi-*y*/*y*-*intercept* = 10

Persamaan garis lurus/*Linear equation*:

$y = mx + c$

$P = -2Q + 10$

3 **B** Gerakan ke bawah/*Downward motion* → Halaju bertambah/*Velocity increases*

Gerakan ke atas/*Upward motion* → Halaju berkurang/*Velocity decreases*

4 **A** Hidangan mengekalkan keadaan asal iaitu pegun di atas meja.

The dishes remain its initial state at rest on the table.

5 **A** Masa hentaman berbeza, maka semua kuantiti yang melibatkan masa akan berbeza.
The time of impact is different, hence all quantities involve time will be different.

6 **B** Hukum Gerakan Newton Kedua, F = ma
Newton's Second Law of Motion, F = ma

7 **C** Apabila masa hentaman dipanjangkan, daya impuls yang terhasil dikurangkan.
When the time of impact is prolonged, the impulsive force produced is decreased/lowered.

8 **C** Halaju lepas/*Escape velocity*, $v = \sqrt{\frac{2Gm}{r}}$

9 **A** Objek dengan muatan haba tentu tinggi perlu serap lebih banyak haba untuk tingkatkan suhu.
An object with a higher specific heat capacity requires to absorb more heat to raise its temperature.

10 **D**
$$Pt = mc\theta$$
$$(1\,000)(3 \times 60) = (2)(c)(80 - 30)$$
$$c = 1\,800 \text{ J kg}^{-1} \text{ °C}^{-1}$$

11 **D** Ais melebur dan mengukus makanan melibatkan haba pendam tentu, iaitu perubahan fasa bahan pada suhu tetap.
Melting of ice and steaming food involve specific latent heat, which is the change of phase at constant temperature.

12 **A** Tekanan berkurang apabila naik ke permukaan, maka isi padu gelembung bertambah.
Pressure decreases when rises to the water surface, hence the volume of bubble increases.

13 **C** Jarak mengufuk ayunan tidak berubah, maka tempoh ayunan tidak berubah.
The horizontal distance of oscillation is constant, hence the period of oscillation is constant.

14 **A** Kawasan X ialah kawasan dalam, panjang gelombang dan laju gelombang adalah tinggi.
Region X is a deep region, the wavelength and the speed of the wave is high.

15 **D** Ketuhar gelombang mikro menggunakan gelombang mikro untuk memasak.
Microwave oven uses microwave to cook food.

16 **C**
$$\frac{\sin i}{\sin r} = \frac{\text{Kedalaman sebenar/}\textit{Real depth}\text{ (H)}}{\text{Kedalaman ketara/}\textit{Apparent depth}\text{ (h)}}$$
$$\frac{\sin 50°}{\sin 35°} = \frac{H}{2.0}$$
$$H = 2.67 \text{ m}$$

17 **D**
$$n = \frac{1}{\sin c}$$
$$1.52 = \frac{1}{\sin c}$$
$$c = 41.14°$$
i = 45°, di mana i > c, maka pantulan dalam penuh berlaku.
i = 45°, *where* i > c, *hence total internal reflection occurs.*

18 **C**
$$\frac{v}{u} = \frac{h_i}{h_o}$$
$$\frac{20}{10} = \frac{4}{h_o}$$
$$h_o = 2 \text{ cm}$$

19 B A – Kanta objektif dan kanta mata kedua-dua kanta cembung.
Objective lens and eyepiece are both convex lenses.
B – Kuasa kanta objektif < kuasa kanta mata
Power of objective lens < power of eyepiece
C, D – Pelarasan normal, $L = f_o + f_e$
Normal adjustment, $L = f_o + f_e$

20 D Kapal terbang mengalami pecutan pada ketinggian malar, maka tujahan > seretan, daya angkat = berat
The aeroplane experiences acceleration at a constant altitude, where thrust > drag, lift force = weight

21 B
$$F_{net} = ma$$
$$60 \text{ kos}/\cos 30° = 2.0a$$
$$a = 25.98 \text{ m s}^{-2}$$

22 C Kapal terapung pegun di laut: Daya apungan = Berat kapal
A ship floating at rest on the sea: Buoyant force = Weight of the ship

23 A Spring S: sesiri/*series*, pemanjangan/*extension* = 3x
Spring T: selari/*parallel*, pemanjangan/*extension* = $\frac{x}{3}$
Spring U: kombinasi/*combination*, pemanjangan/*extension* = $\frac{x}{2} + x$

24 B Apabila kedalaman bertambah, tekanan bertambah.
When depth increases, pressure increases.

25 A $P_X = P_{atm} + h\rho g$
$P_Y = P_{atm}$
$P_Z = P_{atm} - h\rho g$

26 A $P_{gas} = P_{atm} - h\rho g$
Tekanan atmosfera > tekanan gas, cecair X ditolak ke bawah.
Atmospheric pressure > gas pressure, liquid X *is pushed down the column.*

27 C Jengkaut menggunakan aplikasi sistem hidraulik.
An excavator applies hydraulic system.

28 C Ion positif mempunyai jisim yang lebih besar, maka nyalaan lilin tersebar ke plat K lebih besar.
Positive ions have greater mass, hence the spread of flame towards plate K *is bigger.*

29 D Litar bersiri: V berkadar terus dengan R.
Series circuit: V *is directly proportional to* R.

30 B $E = Pt$
$= 0.06 \text{ kW} \times 0.5$ jam/*hour*
$= 0.03$ kWj/kWh

31 C Gunakan petua tangan kiri Fleming.
Use Fleming's left-hand rule.

32 A Solenoid: Gunakan petua genggaman tangan kanan, Q ialah kutub Utara.
Solenoid: Use the right-hand grip rule. Q *is North pole.*
Bar magnet: Menurut Hukum Lenz, magnet yang bergerak masuk ke dalam solenoid mempunyai kekutuban sama.
Magnet bar: According to Lenz Law, magnet that moves into solenoid have same polarity.

33 A Transformer unggul/*Ideal transformer*:

$$I_P V_P = I_S V_S$$
$$I_p(240) = 48$$
$$I_P = 0.2 \text{ A}$$

34 A Ciri-ciri elektron: Bercas negatif, bergerak dalam garis lurus, dipesongkan oleh medan elektrik dan medan magnet
Characteristics of electrons: *Negative charges*, *travel in a straight line*, *deflected by electric and magnetic fields*

35 B Diod dipincang songsang, arus tidak mengalir. Menyongsangkan sambungan bateri akan menjadikan diod dipincang depan.
Diode is reversed biased, *current does not flow*. *Reversing the connection of the battery will turn the diode to forward biased*.

36 B Litar dipincang songsang, arus tapak tidak mengalir dan transistor dimatikan.
Circuit is reverse biased, *base current does not flow and transistor is switched off*.

37 A $T_{\frac{1}{2}} = 15$ min

Bilangan separuh hayat dalam satu jam/*Number of half-life in one hour* $= 4\ T_{\frac{1}{2}}$
800 g → 400 g → 200 g → 100 g → 50 g

38 D Dua nukleus ringan bergabung membentuk elemen baharu dan mengeluarkan tenaga nuklear.
Two lighter nuclei combined producing a new element and releases nuclear energy.

39 A
$$P = nhf$$
$$10 = n(6.63 \times 10^{-34})(5.49 \times 10^{14})$$
$$n = 2.75 \times 10^{19} \text{ foton/}photon$$

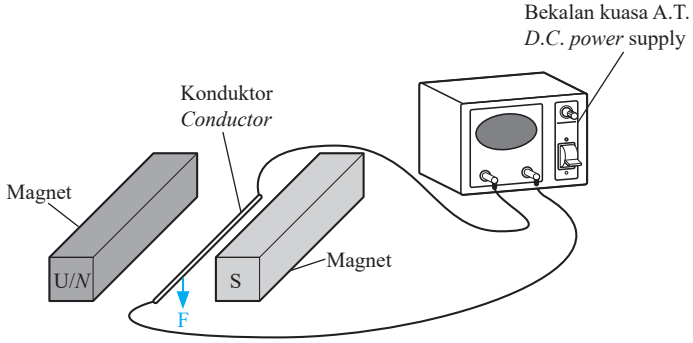
40 C Frekuensi foton yang disinarkan lebih rendah daripada frekuensi ambang platinum.
The frequency of photon irradiated is lower than the threshold frequency of platinum.

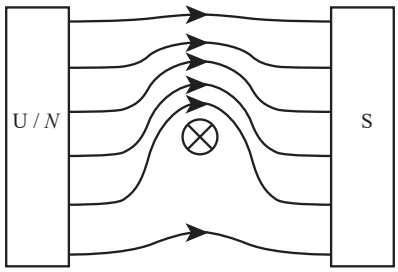
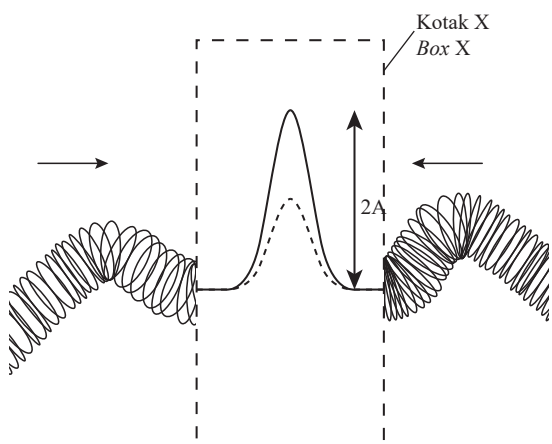
KERTAS 2 / *Paper* 2

Bahagian A/*Section* A

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
1	(*a*)		✓ – kuantiti vektor *vector quantity*	1	4
	(*b*)		$T = \frac{24}{20}$ $= 1.2$ s	2	
	(*c*)		Bertambah/*Increases*	1	
2	(*a*)		– Mempunyai tenaga dan momentum/*It has energy and momentum* – Bergerak dengan kelajuan cahaya dalam vakum *Moves with speed of light in vacuum* – Tidak mempunyai cas elektrik/*It has no electric charge* (Mana-mana satu/*Any one*)	1	
	(*b*)		– Tidak/*No* – Keseluruhannya dilihat sebagai kesan gelombang *Is wholly seen as waves effect*	2	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
	(*c*)		$n = \frac{P\lambda}{hc}$ $= \frac{(1 \times 10^{3})(6.7 \times 10^{-2})}{(6.63 \times 10^{-34})(3 \times 10^{8})}$ $= 3.37 \times 10^{26}$ foton per saat/*photons per second*	2	5
3	(*a*)	(i)	Barometer merkuri/*Mercury barometer*	1	
		(ii)	Mempunyai ketumpatan tinggi//Legap//Tidak melekat pada tiub kaca *Has higher density//Opaque//Does not stick to the glass tube* (Mana-mana satu/*Any one*)	1	
	(*b*)	(i)	76 cm Hg	1	
		(ii)	$P = \rho gh$ $= (13\,600)(9.81)(0.76)$ $= 1.01 \times 10^{5}$ Pa	2	
		(iii)	Berkurang/*Decreases*	1	6
4	(*a*)		Nukleus tidak stabil/*Unstable nuclei*	1	
	(*b*)	(i)	$^{214}_{83}Bi \rightarrow {}^{210}_{81}T1 + {}^{4}_{2}He$	1	
		(ii)	Bi ialah nukleus yang tidak stabil//Untuk menjadi lebih stabil *Bi is an unstable nucleus//To become more stable*	1	
		(iii)	Zarah alfa/*Alpha particles* = 2, Zarah beta/*Beta particles* = 3	1	
	(*c*)		X: 82, Y: 4	2	
	(*d*)		$N = \left(\frac{1}{2}\right)^{n} N_{o}$ $= \left(\frac{1}{2}\right)^{5} (200)$ $= 6.25$ g **atau / *or*** Bilangan separuh hayat/*Number of half-life*, $T_{\frac{1}{2}}$ $= \frac{98.5}{19.7}$ $= 5$ Maka/*Hence*, 200 g → 100 g → 50 g → 25 g → 12.5 g → 6.25 g	3	9
5	(*a*)		Imej yang tidak dapat ditayangkan pada skrin *Image that cannot be cast on a screen*	1	
	(*b*)	(i)	Ketebalan kanta dalam Rajah 5(b) > Rajah 5(a). (atau sebaliknya) *The thickness of the lens in Diagram* 5(b) > *Diagram* 5(a). (*vice versa*)	1	
		(ii)	Jarak fokus kanta dalam Rajah 5(b) < Rajah 5(a). (atau sebaliknya) *The focal length of the lens in Diagram* 5(b) < *Diagram* 5(a). (*vice versa*)	1	
		(iii)	Saiz imej yang terbentuk dalam Rajah 5(b) > Rajah 5(a). (atau sebaliknya) *The size of the image formed in Diagram* 5(b) > *Diagram* 5(a). (*vice versa*)	1	
	(*c*)	(i)	Semakin bertambah ketebalan kanta, semakin berkurang jarak fokus kanta. (atau sebaliknya) *The thickness of the lens increases, the focal length of the lens decreases*. (*vice versa*)	1	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
		(ii)	Semakin bertambah ketebalan kanta, semakin bertambah saiz imej yang terbentuk. (atau sebaliknya) *The thickness of the lens increases, the size of the image formed increases.* (*vice versa*)	1	
	(*d*)		Saiz imej tidak berubah, kecerahan imej berkurang. *The size of the image unchanged, the brightness of the image decreases.*	2	
	(*e*)		Pembiasan/*Refraction*	1	9
6	(*a*)		Daya per unit luas/*Force per unit area*	1	
	(*b*)	(i)	Kedalaman pili dari permukaan air dalam Rajah 6(b) > Rajah 6(a). (atau sebaliknya) *The depth of the tap from the water surfacein Diagram* 6(b) > *Diagram* 6(a). (*vice versa*)	1	
		(ii)	Tekanan air pada pili dalam Rajah 6(b) > Rajah 6(a). (atau sebaliknya) *The water pressure at the tap in Diagram* 6(b) > *Diagram* 6(a). (*vice versa*)	1	
		(iii)	Jarak mengufuk pancutan air dalam Rajah 6(b) > Rajah 6(a). (atau sebaliknya) *The horizontal distance of the water spurts out in Diagram* 6(b) > *Diagram* 6(a). (*vice versa*)	1	
	(*c*)	(i)	Semakin bertambah kedalaman air, semakin bertambah tekanan air. (atau sebaliknya) *When the depth of the water increases, the water pressure increases.* (*vice versa*)	1	
		(ii)	Semakin bertambah tekanan air, semakin bertambah jarak mengufuk pancutan air. (atau sebaliknya) *When the water pressure increases, the horizontal distance of the water spurts out increases.* (*vice versa*)	1	
	(*d*)	(i)	Bertambah/*Increases*	1	
		(ii)	Tekanan bertambah./*Pressure increases.*//$P = P_{atm} + h\rho g$	2	9
7	(*a*)		Kawasan di sekitar magnet yang merasai daya magnet *A region around the magnet which experiences the magnetic force*	1	
	(*b*)	(i)		1	
		(ii)	Peraturan tangan kiri Fleming/*Fleming's left-hand Rule*	1	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
		(iii)		1	
	(*c*)	(i)	Banyak/*More* Kekuatan medan magnet bertambah.//Magnitud daya bertambah.//Arus bertambah. *Stronger magnetic field.//Magnitude of force increases.//Current increases.*	2	
		(ii)	Banyak/*More* Magnitud daya bertambah. *Magnitude of force increases.*	2	
	(*d*)		U	1	9
8	(*a*)	(i)	Gelombang melintang//Gelombang progresif *Transverse waves//Progressive waves*	1	
		(ii)	$v = f\lambda$ $= 6 \times 7.5$ $= 45 \text{ cm s}^{-1}$	2	
	(*b*)	(i)		1	
		(ii)	Interferens membina/*Constructive interference*	1	
	(*c*)	(i)	Di kawasan teluk/*At the bay* Air lebih tenang.//Tenaga gelombang lebih rendah. *The water is calmer.//Waves energy is low.*	2	
		(ii)	Benteng dengan celah/lekuk/tinggi/kuat/*Barrier with slit/dent/high/strong* Pembelauan berlaku.//Gelombang tersebar.//Amplitud berkurang.//Tenaga berkurang. *Diffraction occurs.//Waves spread.//Amplitude decreases.//Energy decreases.*	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>Markah total
Total marks</th></tr>
<tr><td>9</td><td>(a)</td><td></td><td>Prinsip Pascal/Pascal Principle</td><td>1</td><td rowspan="5">20</td></tr>
<tr><td></td><td>(b)</td><td></td><td>– Daya yang dikenakan pada omboh kecil dengan luas permukaan kecil menghasilkan tekanan tinggi, $P = \frac{F}{A}$.
Force applied to the small piston with a small surface area, produces high pressure, $P = \frac{F}{A}$.
– Tekanan dipindahkan secara seragam pada semua arah dalam bendalir.
Pressure is transmitted uniformly in all direction throughout the fluid.
– Pada omboh besar, tekanan bertindak pada luas permukaan omboh besar, menghasilkan daya angkat yang besar, F = PA.
At the large piston, pressure acts on the surface area of the large piston, a larger lifting force is produced, F = PA.
– Apabila luas keratan rentas bertambah, daya angkat bertambah.
When the cross-sectional area increases, the lifting force increases.</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>M1: Jenis bendalir – Minyak
Type of fluid – Oil</td><td>M2: Tidak boleh dimampatkan.
Cannot be compressed.</td></tr><tr><td>M3: Kadar didih bendalir hidraulik – Rendah
Rate of boiling of hydraulic fluid – Low</td><td>M4: Tidak mudah tersejat.
Not easily vaporised.</td></tr><tr><td>M5: Luas keratan rentas omboh induk– Kecil
Cross-sectional area of master piston – Small</td><td>M6: Menghasilkan tekanan yang besar.
Produces high pressure.</td></tr><tr><td>M7: Luas keratan rentas omboh hamba – Besar
Cross-sectional area of slave piston – Big</td><td>M8: Menghasilkan daya yang besar.
Produces high force.</td></tr><tr><td>M9: Pilih L.
Choose L.</td><td>M10: Kombinasi M1, M3, M5, M7 atau M2, M4, M6 dan M8.
Combination of M1, M3, M5, M7 or M2, M4, M6 and M8.</td></tr></table></td><td>10</td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td>$P = \frac{F}{A}$
$= \frac{30\ N}{3\ cm^2}$
$= 10\ N\ cm^{-2}$</td><td>2</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>F = PA
$= 10\ N\ cm^{-2} \times 12\ cm^2$
$= 120\ N$</td><td>3</td></tr>
<tr><td>10</td><td>(a)</td><td></td><td>Suhu kedua-dua objek yang bersentuhan terma adalah sama dan kadar pemindahan/pengaliran haba bersih adalah sifar.
Temperature of both objects in thermal contact are the same, and the net rate of heat transfer/flow is zero.</td><td>1</td><td></td></tr>
</table>

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
	(*b*)	(i)	– Haba dipindahkan dari blok logam K yang panas ke air yang sejuk. *Heat is transferred from hot metal block* K *to cold water.* – Merkuri mengembang./Isi padu merkuri bertambah. *Mercury expands./Volume of mercury increases.* – Suhu termometer sama dengan suhu air. *The temperature of thermometer equals to the temperature of water.*	3	20
		(ii)	Bagi mengelakkan haba hilang ke persekitaran. *To prevent heat lost to the surroundings.*	1	
	(*c*)	(i)	$\theta = 50°C - 30°C$ $= 20°C$	5	
		(ii)	$Q = mc\theta$ $= (0.1)(4\ 200)(20)$ $= 8\ 400$ J		
		(iii)	Haba dibebaskan oleh blok logam K = Haba diserap oleh air *Heat released by metal block* K *= Heat absorbed by water* $mc\theta = 8\ 400$ $0.6 \times c \times (130 - 50) = 8\ 400$ $c = 175$ J kg^{-1} °C^{-1}		
	(*d*)		**Cadangan/*Suggestion*** / **Sebab/*Reason*** M1: Muatan haba tentu badan – Rendah *Specific heat capacity of body – Low* / M2: Cepat panas//Suhu naik dengan cepat *Heat up quickly// Temperature rises quickly* M3: Muatan haba tentu pemegang – Tinggi *Specific heat capacity of handle – High* / M4: Lambat panas//Suhu naik dengan perlahan *Heat up slowly//Temperature rises slowly* M5: Permukaan badan – Gelap *Body surface – Dark* / M6: Serap haba dengan baik// Pemantul haba yang lemah *Good heat absorber//Poor heat reflector* M7: Bentuk pemegang – Langsing *Shape of handle – Slim* / M8: Memberi cengkaman kuat// Elakkan tergelincir *Provide strong grip//Prevent slipping* M9: Pilih model Z. *Choose model Z.* / M10: Kombinasi M1, M3, M5, M7 atau M2, M4, M6 dan M8. *Combination of* M1, M3, M5, M7 *or* M2, M4, M6 *and* M8.	10	

Bahagian C/*Section* C

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
11	(*a*)		12 J tenaga dihasilkan dalam 1 saat apabila beroperasi pada 6 V. 12 J *of energy is produced in* 1 *second when being operated at* 6 V.	1	
	(*b*)	(i)	– Rajah 11.1(a) ialah litar bersiri, Rajah 11.1(b) ialah litar selari. *Diagram* 11.1(a) *is a series circuit*, *Diagram* 11.1(b) *is a parallel circuit*. – Kecerahan mentol dalam Rajah 11.1(b) > Rajah 11.1(a). (atau sebaliknya) *The brightness of the bulbs in Diagram* 11.1(b) > *Diagram* 11.1(a). (*vice versa*) – Arus yang mengalir dalam litar Rajah 11.1(b) > Rajah 11.1(a). (atau sebaliknya) *The current flows in the circuit in Diagram* 11.1(b) > *Diagram* 11.1(a). (*vice versa*)		
		(ii)	– Litar selari, kecerahan mentol bertambah. *Parallel circuit*, *the brightness of the bulbs increases*. – Semakin berkurang rintangan berkesan, semakin bertambah arus yang mengalir. (atau sebaliknya) *The effective resistance decreases*, *the current flows in the circuit increases*. (*vice versa*)	5	
	(*c*)		– Panjang filamen lebih tinggi. *Length of filament is higher*. – Rintangan filamen lebih tinggi/bertambah. *Resistance of filament is higher/increases*. – Hasilkan tenaga haba yang banyak/tinggi. *Produces more/higher heat energy*. – Tenaga haba ditukarkan kepada tenaga cahaya. *Heat energy is converted to light energy*.	4	
	(*d*)		**Cadangan/*Suggestion*** / **Sebab/*Reason*** M1: Bahan pemanas – Nikrom/Tungsten *Material of heater – Nichrome/Tungsten* M2: Rintangan tinggi//Haba tinggi *High resistance//High heat* M3: Diameter dawai pemanas – Kecil *Diameter of heater wire – Small* M4: Rintangan tinggi//Haba tinggi *High resistance//High heat* M5: Takat lebur pemanas – Tinggi *Melting point of heater – High* M6: Tidak mudah lebur/cair *Does not melt easily* M7: Kadar pengoksidaan/pengaratan pemanas – Rendah *Rate of oxidation/rusting of heater – Low* M8: Tidak mudah karat//Tidak rapuh//Tahan lama *Does not easily rust//Not corrode//Long lasting* M9: Guna termostat. *Use thermostat*. M10: Kawal suhu. *Controls temperature*.	10	20

KERTAS MODEL SPM SET 3

KERTAS 1 / *Paper* 1

1 **A** Berat/*Weight* = N, Daya/*Force* = N, Tekanan/*Pressure* = Pa

2 **C** Kuantiti asas: Jarak, jisim, masa, arus elektrik, suhu termodinamik, keamatan berluminositi dan kuantiti bahan
Base quantities: *Length*, *mass*, *time*, *electric current*, *thermodynamic temperature*, *luminous intensity and amount of substance*

3 **D** Neraca spring digunakan untuk mengukur berat.
Spring balance is used to measure weight.

4 **C** Merujuk kepada graf Hukum Boyle, graf garis lurus P melawan $\frac{1}{V}$ yang bermula dari asalan menunjukkan P berkadar songsang dengan V.
Referring to the graph for Boyle's Law, a straight line graph of P *against* $\frac{1}{V}$ *which started from the origin shows that* P *is inversely proportional to* V.

5 **B** $a = \frac{v - u}{(n - 1)t}$

$= \frac{\frac{5}{0.02} - \frac{2}{0.02}}{(5 - 1) \times 0.02}$

$= 1\,875 \text{ cm s}^{-2}$

6 **B** Sesaran/*Displacement*, s
= Garis lurus/*Straight line of* PS
$= \sqrt{6^2 + 8^2}$
= 10 km

7 **B** Bola mengalami jatuh bebas mengikut pecutan graviti Bumi di mana halajunya bertambah. Menurut $E_k = \frac{1}{2} mv^2$, apabila halaju bertambah, tenaga kinetik bertambah.
The ball experienced free fall following the Earth's gravitational acceleration where its velocity increases. *According to* $E_k = \frac{1}{2} mv^2$, *when velocity increases*, *kinetic energy increases*.

8 **B** Kedudukan KL menunjukkan halaju malar iaitu pecutan sifar.
Position KL *shows uniform velocity where acceleration is zero*.

9 **C** Daya boleh mengubah laju, bentuk, saiz dan arah pergerakan sesuatu objek, tetapi bukan jisimnya.
A force can change the speed, *shape*, *size and direction of motion of an object*, *but not its mass*.

10 **B** Hukum Kepler Ketiga/*Kepler's Third Law*: $T^2 \propto r^3$

11 **D** Laju linear/*Linear speed*, $v = \sqrt{\frac{Gm}{r}}$

$= \sqrt{\frac{(6.67 \times 10^{-11})(5.98 \times 10^{24})}{(6.37 \times 10^6 + 613 \times 10^3)}}$

$= 7.56 \times 10^3 \text{ m s}^{-1}$

12 **C** Satelit geopegun sentiasa ditarik ke arah graviti Bumi.
Geostationary satellite is always pulled towards the Earth's gravity.

13 C Apabila keseimbangan terma dicapai, kadar bersih aliran haba antara dua jasad yang bersentuhan terma adalah sifar dan suhu kedua-dua jasad adalah sama.
When thermal equilibrium is reached, the net flow of heat between the two bodies is zero and the temperature of both bodies are equal.

14 D
$$Pt = mc\theta$$
$$(1\,000)(60) = (3)(400) \times \theta$$
$$\theta = 50°C$$
Suhu akhir, T
Final temperature, T
= 25°C + 50°C
= 75°C

15 B Menurut Hukum Charles, isi padu berkadar terus dengan suhu bagi gas berjisim malar pada tekanan tetap. Pertambahan suhu menyebabkan pertambahan tenaga kinetik molekul udara.
According to Charles Law, volume is directly proportional to the temperature for a fixed mass gas at a constant pressure. The increasing in temperature causes the increasing in kinetic energy of the air molecules.

16 D
$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$
$$\frac{210}{300} = \frac{230}{T_2}$$
$$T_2 = 328.57\ K$$
$$= (328.57 - 273)°C$$
$$= 55.57°C$$

17 B Ciri-ciri pantulan gelombang bunyi: Frekuensi, panjang gelombang dan laju gelombang tidak berubah, sudut tuju = sudut pantulan
Characteristics of reflection of sound wave: The frequency, wavelength and speed of waves unchanged, angle of incidence = angle of reflection

18 B Aplikasi sinaran ultraungu: bahan pengeras dalam tampalan gigi, mengesan keaslian wang kertas, rawatan jaundis pada bayi, penyulingan air minuman, pensterilan alatan pembedahan dan makanan, perangkap serangga
Applications of ultraviolet radiation: hardening material for tooth filling, determine the authenticity of currency notes, treatment of jaundice in babies, purification of drinking water, sterilisation of surgical instruments and food, insect traps

19 C Kuasa pembesaran teleskop/*Magnifying power of telescope*:
$$M = \frac{f_o}{f_e}$$
$f_o = 15\ f_e$, diberi/*given* $f_o + f_e = 80$ cm, maka/*hence* $f_o = 75$ cm, $f_e = 5$ cm

20 C Cermin cekung ialah cermin penumpu. Sinar cahaya selari yang mengenai permukaan cermin akan dipantulkan ke titik fokus di hadapan cermin.
Concave mirror is a converging mirror. Parallel light rays directed at its surface will be reflected to the focal point in front of the mirror.

21 B Indeks biasan medium X/*Refractive index of medium* X
$$n = \frac{\sin i \text{ (medium kurang tumpat/}\textit{less dense medium}\text{)}}{\sin r \text{ (medium lebih tumpat/}\textit{denser medium}\text{)}}$$
$$= \frac{\sin 70°}{\sin 40°}$$
$$= 1.46$$

22 A Tekanan cecair bertambah dengan pertambahan kedalaman, $P = \rho gh$.
The pressure in liquid increases when the depth increases, $P = \rho gh$.

23 B Tekanan cecair dipengaruhi oleh ketumpatannya. Daripada $P = \rho gh$, ketumpatan cecair bertambah, tekanan cecair bertambah. Air menolak minyak zaitun ke bawah menunjukkan tekanannya lebih tinggi daripada minyak zaitun, maka ketumpatan air lebih tinggi daripada minyak zaitun. Tekanan atmosfera bertindak di kedua-dua tiub-U yang terbuka.
Pressure in liquid is affected by its density. From $P = \rho gh$, *when density increases, pressure in liquid increases. The water pushes the olive oil downwards showing that its pressure is higher than the olive oil, hence the density of water is higher than olive oil. Atmospheric pressure acts on both open ends of the U-tube.*

24 D Apabila halaju purata molekul gas bertambah, kadar perlanggaran molekul gas dengan dinding dalam bekas bertambah, maka tekanan bertambah.
When the average velocity of gas molecules increases, the rate of collision between the gas molecules and the inner wall of the container increases, hence the pressure increases.

25 C Sistem hidraulik mengaplikasikan prinsip Pascal di mana tekanan yang dikenakan oleh daya kecil F pada piston J dipindahkan secara seragam ke seluruh bahagian bendalir, maka tekanan di omboh J = tekanan di omboh K, dan beban W yang lebih besar daripada daya F mampu diangkat.
A hydraulic system uses Pascal's principle where the pressure exerted by a small force F *at piston* J *will be transmitted uniformly throughout the fluid, hence the pressure at piston* J = *the pressure at piston* K, *and load* W *which is greater than force* F *is able to be lifted.*

26 B Daya apungan bertambah apabila ketumpatan air bertambah, $F_B = \rho gV$
Buoyant force increases when the density of water increases, $F_B = \rho gV$

27 D Prinsip kerja Bernoulli melibatkan halaju dan tekanan bendalir di mana apabila halaju bendalir bertambah, tekanan pada bendalir berkurang dan sebaliknya.
Working principle of Bernoulli's involves the velocity and the pressure of fluid in which when the velocity of fluid increases, its pressure decreases and vice versa.

28 B Apabila rintangan dalam litar berkurang, maka arus yang mengalir bertambah, bacaan ammeter bertambah.
When the resistance in the circuit decreases, the current flow increases, ammeter reading increases.

29 B Apabila suis ditutup, litar menjadi lengkap. Beza keupayaan berkurang akibat rintangan dalam sel kering.
When the switch is switched on, the circuit is completed. Potential difference decreases due to the internal resistance in the dry cells.

30 D Tenaga elektrik dipindahkan melalui kabel pada beza keupayaan yang tinggi dan arus yang rendah untuk mengurangkan kehilangan kuasa dalam kabel semasa pemindahan.
Electrical energy transmitted through the cables at high potential difference and low current to reduce power dissipated in the cables during transmission.

31 C $\frac{24\text{ W}}{P_{input}} \times 100\% = 40\%$, $P_{input} = 60\text{ W}$

32 B Dawai kuprum mempunyai rintangan yang rendah, teras besi lembut mudah dimagnet dan dinyahmagnet, manakala teras berlamina mengurangkan arus pusar.
Copper wire has low resistance, soft iron core is easily magnetised and demagnetised, while laminated core reduces eddy current.

33 D Menggunakan nisbah beza keupayaan/*Using the ratio of potential difference*,

$$\frac{1}{5} = \frac{1\,000}{R_M}$$

$R_M = 5\,000\ \Omega$

34 D Diod P akan menjadi pincang songsang dalam kedua-dua hala, maka arus tidak dapat mengalir.
Diode P *will become reverse biased in both ways, hence current will not flow.*

35 B Masa/*Time* = 80 min
1 200 → 600 → 300 → 150 → 75
Separuh hayat/*Half-life*, $T_{\frac{1}{2}}$
$= \frac{80}{4}$
= 20 min

36 D Zarah alfa/*Alpha particle*, $\alpha = {}^{4}_{2}\text{He}$
Zarah beta/*Beta particle*, $\beta = {}^{0}_{-1}\text{e}$

37 A Rod pengawal yang diperbuat daripada boron atau kadmium mengawal kadar tindak balas berantai dengan menyerap neutron berlebihan.
Control rods made from boron or cadmium control the rate of chain reaction by absorbing excess neutrons.

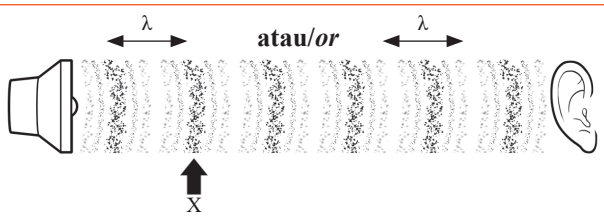
38 D Memperkenalkan teori kuantum di mana tenaga cahaya wujud dalam bentuk paket tenaga yang diskrit.
Introduced quantum theory where light energy exists in a form of discrete energy packet.

39 A Berdasarkan teori kuantum Max Planck dan Albert Einstein, tenaga cahaya wujud dalam bentuk paket tenaga yang diskrit yang dikenali sebagai foton.
Based on Max Planck and Albert Einstein's quantum theory, light energy exists in a form of discrete energy packet known as photon.

40 A
$E = W + K$
$4.96 = 4.36 + K$
$K = 0.6$ eV

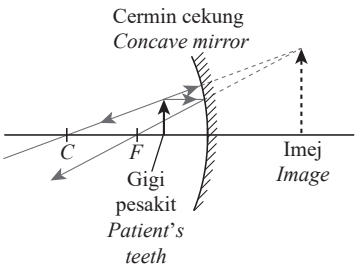
KERTAS 2 / *Paper* 2

Bahagian A/*Section* A

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
1	(*a*)		✓ – gelombang membujur *longitudinal wave*	1	
	(*b*)	(i)	Mampatan/*Compression*	1	
		(ii)		1	
	(*c*)		Bertambah/*Increases*	1	4
2	(*a*)		Kuasa dua tempoh orbit sesuatu planet berkadar terus dengan kuasa tiga jejari orbitnya. *The square of the period of a planet is directly proportional to the cube of the radius of its orbit.*	1	
	(*b*)		– Jejari orbit Bumi/*Radius of orbit of Earth* – Tempoh orbit Bumi/*Orbital period of Earth* – Tempoh orbit Zuhrah/*Orbital period of Venus*	2	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
	(*c*)		$\frac{T_1^2}{r_1^3} = \frac{T_2^2}{r_2^3}$ $\frac{1.00^2}{(1.50 \times 10^{11})^3} = \frac{0.20^2}{r_2^3}$ $r_2^3 = \frac{(1.50 \times 10^{11})^3 \times 0.20^2}{1.00^2}$ $r_2 = 5.13 \times 10^{10}$ m	2	5
3	(*a*)		Kuantiti/Jumlah haba yang 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)	Muatan haba tentu cecair S lebih rendah daripada cecair R. *Specific heat capacity of liquid* S *is lower than liquid* R.	1	
		(ii)	Q = Pt = (1 000)(8 × 60) = 480 000 J = 4.8×10^5 J	2	
		(iii)	Q = mcθ 480 000 = m(3 400)(75 − 25) m = 2.82 kg	2	6
4	(*a*)	(i)	Diod/*Diode*	1	
		(ii)	Menyala/*Lights up*	1	
		(iii)	Diod dipincang hadapan.//Lapisan susutan kecil. *Diode is forward biased.//Depletion layer is small.*	1	
	(*b*)	(i)	Bertambah/*Increases*	1	
		(ii)	Kecerunan/*Gradient*, k $= \frac{1.00 - 0.5}{0.8 - 0.6}$ $= \frac{0.5}{0.2}$ $= 2.4\ AV^{-1}$	2	
		(iii)	Rintangan/*Resistance*, R $= \frac{1}{\text{Kecerunan/}Gradient}$ $= \frac{1}{2.4\ AV^{-1}}$ $= 0.42\ VA^{-1}$	2	
		(iv)	I berkadar terus dengan V.//Kecerunan adalah malar.//Graf garis lurus bermula dari asalan. I *is directly proportional to* V.//*Gradient is constant.//The straight line graph passes through the origin.*	1	9
5	(*a*)		Tolakan dan tarikan ke atas objek/*Push and pull on an object*	1	
	(*b*)	(i)	Kedudukan akhir peti kayu dalam Rajah 5(a) > Rajah 5(b). (atau sebaliknya) *The final position of the wooden crate in Diagram* 5(a) > *Diagram* 5(b). (*vice versa*)	1	
		(ii)	Sudut daya dalam Rajah 5(a) < Rajah 5(b). (atau sebaliknya) *The angle of force in Diagram* 5(a) < *Diagram* 5(b). (*vice versa*)	1	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
		(iii)	Pecutan peti kayu dalam Rajah 5(a) > Rajah 5(b). (atau sebaliknya) *The acceleration of the wooden crate in Diagram* 5(a) > *Diagram* 5(b). (*vice versa*)	1	
	(*c*)	(i)	Semakin berkurang sudut daya, semakin jauh kedudukan akhir peti kayu. (atau sebaliknya) *When the angle of force decreases, the final position of the wooden crate is further*. (*vice versa*)	1	
		(ii)	Semakin berkurang sudut daya, semakin bertambah pecutan peti kayu. (atau sebaliknya) *When the angle of force decreases, the acceleration of the wooden crate increases*. (*vice versa*)	1	
	(*d*)		$F_{net} = ma$ $300 \text{ kos/cos } 20° - 120 = 70a$ $281.91 - 120 = 70a$ $a = 2.31 \text{ m s}^{-2}$	3	9
6	(*a*)		Dua sumber gelombang yang mempunyai frekuensi yang sama dan sefasa/beza fasa yang sama. *Two sources of waves that have same frequency and in phase/constant phase difference*.	1	
	(*b*)	(i)	Jarak antara dua pembesar suara dalam Rajah 6(a) > Rajah 6(b). (atau sebaliknya) *The distance between the two loudspeakers in Diagram* 6(a) > *Diagram* 6(b). (*vice versa*)	1	
		(ii)	Jarak antara dua bunyi kuat berturutan dalam Rajah 6(a) < Rajah 6(b). (atau sebaliknya) *The distance between two consecutive loud sounds in Diagram* 6(a) < *Diagram* 6(b). (*vice versa*)	1	
		(iii)	Jarak gelombang bunyi dalam Rajah 6(a) = Rajah 6(b). (atau sebaliknya) *The wavelength of sound waves in Diagram* 6(a) = *Diagram* 6(b). (*vice versa*)	1	
	(*c*)		Semakin bertambah jarak antara dua pembesar suara, semakin berkurang jarak antara dua bunyi kuat berturutan. (atau sebaliknya) *When the distance between the two loudspeakers increases, the distance between two consecutive loud sounds decreases*. (*vice versa*)	1	
	(*d*)		Interferens/*Interference*	1	
	(*e*)	(i)	– Bunyi kuat – Interferens membina//Puncak bertemu dengan puncak// Lembangan bertemu dengan lembangan *Loud sounds – Constructive interference//Crest meets crest//Trough meets trough* – Bunyi lemah – Interferens memusnah//Puncak bertemu dengan lembangan *Soft sounds – Destructive interference//Crest meets trough*	2	
		(ii)	Berkurang/*Decreases*	1	9
7	(*a*)		Pantulan/*Reflection*	1	

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
	(*b*)	(i)		2	
		(ii)	Maya//Tegak//Dibesarkan *Virtual//Upright//Magnified* (Mana-mana satu/*Any one*)	1	
	(*c*)	(i)	Di titik fokus pemantul/*At the focal point of the reflector* Cahaya/Haba difokus/ditumpu. *Light/Heat is focused/converged.*	2	
		(ii)	Besar/*Large* Lebih banyak cahaya/haba dikumpul/dipantul. *More light/heat is collected/reflected.*	2	
	(*d*)		Q	1	9
8	(*a*)		Proses di mana nukleus yang tidak stabil menjadi lebih stabil dengan memancarkan sinaran radiaoktif. *A process in which an unstable nuclei becomes more stable by emitting radioactive radiation.*	1	
	(*b*)	(i)	Cacat jisim/*Mass defect*: $m = 230.0331 - (226.0254 + 4.003)$ $= 4.7 \times 10^{-3}$ u.j.a./a.m.u. atau/*or* $= 7.802 \times 10^{-30}$ kg	2	
		(ii)	Tenaga nuklear dibebaskan/*Nuclear energy released*: $E = mc^2$ $= (7.802 \times 10^{-30})(3 \times 10^{8})^2$ $= 7.0218 \times 10^{-13}$ J	2	
	(*c*)	(i)	Air berat/*Heavy water* Muatan haba tentu tinggi//Serap banyak haba *High specific heat capacity//Absorb more heat*	2	
		(ii)	Rod boron/kadmium//Teras grafit/*Boron/Cadmium rod//Graphite core* Menyerap neutron yang berlebihan//Memperlahankan gerakan neutron *Absorb excess neutrons//Slow down the neutrons*	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>Markah total
Total marks</th></tr>
<tr><td rowspan="5">9</td><td>(a)</td><td>(i)</td><td>Kuantiti jirim yang terkandung dalam sesuatu objek
Amount of matter in an object</td><td>1</td><td rowspan="5">20</td></tr>
<tr><td></td><td>(ii)</td><td>– Jisim kapal kargo adalah besar.
The mass of the cargo ship is large.
– Inersia kapal kargo adalah besar.
The inertia of the cargo ship is large.
– Apabila jisim bertambah, inersia bertambah.
When the mass increases, inertia increases.
– Kapal kargo susah dihentikan.
The cargo ship is difficult to be stopped.</td><td>4</td></tr>
<tr><td>(b)</td><td>(i)</td><td>$150\ \text{km j}^{-1}/\text{km h}^{-1}$
$= \frac{150 \times 1\,000\ \text{m}}{3\,600\ \text{s}}$
$= 41.67\ \text{m s}^{-1}$</td><td rowspan="3">5</td></tr>
<tr><td></td><td>(ii)</td><td>$a = \frac{v - u}{t}$
$= \frac{41.67 - 0}{10 \times 60}$
$= 0.069\ \text{m s}^{-2}$</td></tr>
<tr><td></td><td>(iii)</td><td>$s = (ut + \frac{1}{2}at^2) + vt$
$= [0 + \frac{1}{2}(0.069)(600)^2] + (150 \times 7\,200)$
$= 1.092 \times 10^6\ \text{m}$</td></tr>
<tr><td></td><td>(c)</td><td colspan="3">
<table>
<tr><th colspan="2">Ciri-ciri/Characteristics</th><th colspan="2">Sebab/Reason</th></tr>
<tr><td>M1:</td><td>Bentuk kapal selam – Aerodinamik
Shape of submarine – Aerodynamic</td><td>M2:</td><td>Mengurangkan rintangan air
Reduce water resistance</td></tr>
<tr><td>M3:</td><td>Saiz tangki balast – Besar
Size of ballast tank – Large</td><td>M4:</td><td>Daya apungan besar
Large buoyant force</td></tr>
<tr><td>M5:</td><td>Jenis sumber tenaga – Nuklear
Type of energy sources – Nuclear</td><td>M6:</td><td>Hasilkan tenaga tinggi/Tahan lama
Produce high energy/Long lasting</td></tr>
<tr><td>M7:</td><td>Kadar pengoksidaan – Rendah
Rate of oxidation – Low</td><td>M8:</td><td>Tahan karat//Tidak karat//Tahan lama
Prevent rusting//Not rusty//Long lasting</td></tr>
<tr><td>M9:</td><td>Pilih K.
Choose K.</td><td>M10:</td><td>Kombinasi M1, M3, M5, M7 atau M2, M4, M6 dan M8.
Combination of M1, M3, M5, M7 or M2, M4, M6 and M8.</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>Markah total
Total marks</th></tr>
<tr><td>10</td><td>(a)</td><td></td><td>Suis automatik//Pembesar arus
Automatic switch//Current amplifier</td><td>1</td><td rowspan="5"></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>– Ada bacaan pada mikroammeter, tiada bacaan pada miliammeter.
Microammeter shows a reading, milliammeter shows no reading.
– Tiada bacaan pada kedua-dua mikroammeter dan miliammeter.
Both microammeter and milliammeter show no reading.</td><td>2</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>– Arus tapak, I_B mengalir.//Perubahan yang kecil pada arus tapak, I_B.
Base current, I_B flows.//Small change in base current, I_B.
– Arus pengumpul, I_C yang besar mengalir.
Large collector current, I_C flows.</td><td>2</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>Pembesaran arus/Current amplification:
$\beta = \frac{I_C}{I_B}$
$= \frac{5.7 \times 10^{-3}}{60 \times 10^{-6}}$
$= 95$</td><td rowspan="2"></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Arus pengeluar/Emitter current:
$I_E = I_B + I_C$
$= (60 \times 10^{-6}) + (5.7 \times 10^{-3})$
$= 5.76 \times 10^{-3}$ A</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>M1: Terminal JK – Termistor
JK terminal – Thermistor</td><td>M2: Peka terhadap haba//Apabila suhu tinggi, rintangan rendah
Sensitive to heat//When the temperature is high, resistance is low</td></tr>
<tr><td>M3: Terminal LM – Perintang
LM terminal – Resistor</td><td>M4: Menghadkan I_B
To limit I_B</td></tr>
<tr><td>M5: Terminal XY – Gegelung
XY terminal – Coil</td><td>M6: Melengkapkan litar kedua// Menambahkan voltan
Complete the secondary circuit// Increase the voltage</td></tr>
<tr><td>M7: Terminal PQ – Sel 2
PQ terminal – Cell 2</td><td>M8: Arus dapat mengalir dari pengumpul ke pengeluar pada transistor
Current is able to flow from the collector to the emitter in transistor</td></tr>
<tr><td>M9: Pilih V
Choose V</td><td>M10: Kombinasi M1, M3, M5, M7 atau M2, M4, M6 dan M8.
Combination of M1, M3, M5, M7 or M2, M4, M6 and M8.</td></tr>
</table>
</td><td>10</td><td>20</td></tr>
</table>

Bahagian C/*Section* C

Soalan *Questions*			Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
11	(*a*)	(i)	Aerofoil//Bentuk larus/*Aerofoil//Streamlined shape*	1	
		(ii)	– Halaju udara di bahagian atas sayap lebih tinggi. (atau sebaliknya) *The velocity of air above the wing is higher*. (*vice versa*) – Tekanan di bahagian bawah sayap lebih tinggi. (atau sebaliknya) *The pressure below the wing is higher*. (*vice versa*) – Perbezaan tekanan udara adalah besar. *The difference in pressure is large.* – Daya angkat terhasil.//Daya angkat = Perbezaan tekanan × Luas permukaan *Lift force is produced.//Lift force = Pressure difference × Area* (Mana-mana tiga/*Any three*)	3	
	(*b*)	(i)	– Sudut serang dalam Rajah 10.2(a) > Rajah 10.2(b). (atau sebaliknya) *The attack angle in Diagram* 10.2(a) > *Diagram* 10.2(b). (*vice versa*) – Jarak mendarat dalam Rajah 10.2(a) < Rajah 10.2(b). (atau sebaliknya) *The landing distance in Diagram* 10.2(a) < *Diagram* 10.2(b). (*vice versa*) – Ketinggian maksimum dalam Rajah 10.2(a) < Rajah 10.2(b). (atau sebaliknya) *The maximum height in Diagram* 10.2(a) < *Diagram* 10.2(b). (*vice versa*) – Apabila sudut serang bertambah, jarak mendarat berkurang. (atau sebaliknya) *When the attack angle increases*, *the landing distance decreases*. (*vice versa*) – Apabila ketinggian maksimum bertambah, jarak mendarat bertambah. (atau sebaliknya) *When the maximum height increases*, *the landing distance increases*. (*vice versa*)	5	
		(ii)	Prinsip Bernoulli/*Bernoulli's Principle*	1	

Soalan *Questions*	Jawapan *Answers*	Sub markah *Subs marks*	Markah total *Total marks*
(*c*)		10	20

Pengubahsuaian/*Modifications*	Penerangan/*Explanation*
M1: Permukaan papan luncur licin *The surface of surfing board is smooth*	M2: Untuk mengurangkan rintangan air *To reduce water resistance*
M3: Bentuk papan luncur aerodinamik *The shape of surfing board is aerodynamic*	M4: Untuk mengurangkan rintangan air *To reduce water resistance*
M5: Ketumpatan papan luncur rendah *The density of surfing board is small*	M6: Ringan//Jisim yang rendah *Light//Low mass*
M7: Bahan papan luncur komposit//gentian kaca *Material of surfing board is composite//fibre glass*	M8: Kuat//Tidak mudah patah *Strong//Does not break easily*
M9: Bahan layar kalis air *Material of sail is waterproof*	M10: Tidak serap air//Tidak basah *Does not absorb water//Does not get wet*
M11: Bahan layar kuat//nilon *Material of sail is strong// nylon*	M12: Tidak mudah koyak//Tahan lama *Does not tear easily//Long lasting*
M13: Ketumpatan layar rendah *Density of sail is low*	M14: Tidak mudah koyak//Tahan lama *Does not tear easily//Long lasting*
M15: Saiz layar besar *Size of sail is big*	M16: Daya besar untuk menentang angin/air *Large force to resist the wind/ water*