Penyelesaian Lengkap

SET 4

KERTAS 1

1 A

2 D

3 D

4 B

5 B
$v^2 = u^2 + 2as$
$0 = 10^2 + 2(a)15$
$a = -\frac{10}{3}$
$F = ma = 1\ 200 \times -\frac{10}{3} = -4\ 000$ N

6 D

7 A
$u = 0$
$t = 5s \quad s_5 = ut + \frac{1}{2}at^2 = 0 + 12.5a$
$t = 6s \quad s_6 = 0 + 18a$
$a = 1.09\ \text{m s}^{-2}$

8 C

9 B

10 B
$Mg = \frac{mv^2}{r}$
$v^2 = \frac{Mgr}{m} = \left(\frac{M}{m}\right)(9.8)(0.5)$
$v = 2.7\ \text{m s}^{-1}$

11 C

12 A

13 D
$50 \times 5 \times 60 = m \times 3.36 \times 10^5$
$m = 0.0446$ kg $= 44.6$ g
Jisim air dalam beaker *B* /*Mass of water in beaker B*
$= 20 + 44.6 = 64.6$ g

14 A
Suhu *Y* is higher
Temperature of Y is higher

15 B
h = kedudukan imej di sebelah atas garis tebal
h = position of image of thick line
$1.3 = \frac{15}{15 - h}$
$h = 3.46$
$n_1 = \frac{12}{12 - h} = \frac{12}{12 - 3.46} = 1.4$

16 D

17 B

18 C
Apabila/*When* $u = 20$ cm, $v = 30$ cm.
Maka, apabila/*So when* $v = 20$ cm, $u = 30$ cm.
Objek digerakkan menjauhi kanta sejauh 10 cm
The object is moved away from the lens by 10 cm

19 B

20 C

21 A
$mg - 3g = (m + 3)2.5$
$m \times 9.8 - 3 \times 9.8 = 2.5m + 7.5$
$m = 5.1$ kg

22 A
$E = \frac{1}{2}kx^2$
$2E = \frac{1}{2}kx'^2$
Bahagi/*dividing* $\frac{1}{2} = \frac{x^2}{x'^2}$
$x' = 1.4x$
$\Delta x = 0.4$ cm

23 A

24 B
$W = \rho Vg = 6 \times 10^3 \times 0.0080 \times 9.8 = 470.4$ N
$F_B = \rho Vg = 1\ 000 \times 0.0080 \times 9.8 = 78.4$ N
$T + 78.4 = 470.4$
$T = 392$ N

25 D

26 D

27 D

28 B

29 C

30 D

31 C

32 B

33 A

34 A

35 B

36 A

Cacat jisim/*mass defect*
= 226.025 u – 222.018 u – 4.003 u
= 0.004 u = 0.004 × 1.66 × 10^{-27}
= 6.64 × 10^{-30} kg
Tenaga dibebaskan/*Energy released*
= mc^2
= 6.64 × 10^{-30} × $(3 \times 10^8)^2$
= 6.0 × 10^{-13} J

37 B

38 D

39 A

$$E_1 = \frac{nh}{\lambda} = \frac{100h}{250} = \frac{2}{5}$$

$$E_2 = \frac{nh}{\lambda} = \frac{250h}{750} = \frac{1}{3}$$

$$\therefore E_1 > E_2$$

40 B

Fungsi kerja/*Work function* = $\frac{hc}{\lambda_o}$

$$W + K_{\text{mak/}max} = E$$

$$W + K_{\text{mak/}max} = \frac{hc}{\lambda} - \frac{hc}{\lambda_o} = hc\left(\frac{1}{\lambda} - \frac{hc}{\lambda_o}\right)$$

$$= 6.63 \times 10^{-34} \times 3 \times 10^8\left(\frac{1}{3 \times 10^{-7}} - \frac{1}{4 \times 10^{-7}}\right)$$

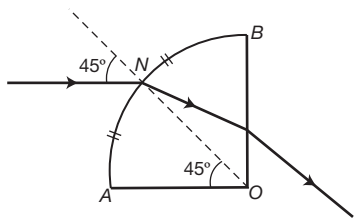
$$= 1.66 \times 10^{-19} \text{ J}$$

KERTAS 2

Bahagian A

1 (a)

(b)



(c) $n = \frac{\sin i}{\sin r}$

$$1.5 = \frac{\sin 45}{\sin r}$$

$$r = 28.1°$$

2 (a) $m = m_P + m_Q = \rho_P V_P + \rho_Q V_Q$
$= 0.4 \times 1 \times 1 \times 250 + 0.6 \times 1 \times 1 \times 750$
$= 550$ kg

(b) (i) Jisim air disesarkan = jisim kiub terapung = 550 kg
Mass of water displaced = mass of floating cube = 550 kg

(ii) *Volume of water displaced*
$= h \times 1 \times 1 \text{ m}^3 = h \text{ m}^3$
$m = \rho V$
$550 = 1000 \times h$
$h = 0.55$ m

(iii) $h' = h$

3 (a) (i) Berkurang
Reduced

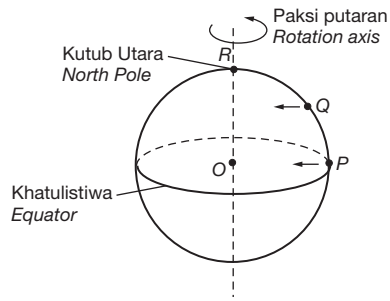
(ii) Medan magnet dari rod kuprum bertindih dengan medan magnet yang dikenakan untuk menghasilkan medan lastik dan daya paduan yang menghala ke atas, seterusnya mengurangkan berat rod kuprum.
The magnetic field of the copper rod overlaps with the applied magnetic field to produce an upwards catapult field and resultant force, thus, reducing the weight of the copper rod.

(b) Bacaan bertambah.
The reading increases.

(c) (i) 50 hertz
50 *hertz*

(ii) Bacaan adalah sama dengan *W* kerana medan lastik ke atas rod akan bertukar arah sebanyak 100 kali dalam masa satu saat, mengakibatkan daya paduan sifar.
The reading is equal to W because the catapult field on the rod changes its direction 100 *times in one second, resulting a zero resultant force.*

4 (a)



(b) Kerana *R* hanya berputar pada paksinya, tidak bergerak mengikuti satu lintasan bulatan seperti *P* dan *Q*.
Because R only rotates on its axis, it does not move in a circular path like P and Q.

(c) (i) $v = \frac{2\pi R}{T} = \frac{2 \times 3.14 \times (6.4 \times 10^6)}{24 \times 60 \times 60}$
$= 465 \text{ m s}^{-1}$

(ii) $W' = mg - F_C$
$= 5.00 \times 9.78 - 5.00 \times \frac{465^2}{6.4 \times 10^6}$
$= 48.73$ N

5 (a) Haba diperlukan untuk menaikkan suhu 1 kg suatu bahan sebanyak 1 °C.
The amount of heat needed to increase the temperature of 1 kg *substance by* 1 °C.

(b) (i) Kecerunan $AB >$ Kecerunan PQ
Gradient of $AB >$ Gradient of PQ

(ii) Kadar pemanasan ais lebih daripada air.
The rate of heating of ice is higher than that of water.

(iii) Masa yang diambil untuk DE melebihi BC
The time taken in DE is more than that of BC

(iv) Haba untuk meleburkan ais adalah jauh lebih kecil daripada haba diperlukan untuk menukarkan air kepada stim pada 100 °C.
The amount of heat needed to melt the ice is less than the amount of heat needed to change from water to steam at 100 °C.

(c) Untuk bekas X, haba diperlukan, $Q = mc\Delta\theta$
$= 1 \times 4200 \times 100 = 420000$ J
For container X, heat required = $Q=mc\Delta\theta$
$= 1 \times 4200 \times 100 = 420000$ J
Untuk bekas Y, $Q = ml_v$,
For container Y, $Q = ml_v$
$420000 = m \times 2.26 \times 10^6$
$m = 0.19$ kg
Jisim air dalam bekas $Y = 1.00 - 0.19 = 0.81$ kg
Mass of water in container Y = 1.00 – 0019 = 0.81 kg.

6 (a) Sama
Equal

(b) (i) Panjang turus udara dalam terperangkap oleh merkuri lebih pendek.
Air column trapped by mercury is shorter.

(ii) Tekanan udara terperangkap dalam oleh merkuri lebih tinggi.
The air pressure trapped by mercury is higher.

(c) Tekanan udara adalah lebih besar.
The air pressure is greater.

(d) Semakin kecil isi padu udara terperangkap, semakin tinggi tekanan udara.
The smaller the volume of trapped air the greater the air pressure.

(e) Hukum Boyle/*Boyle's law*

(f) $V_1 = 20$ cm, $P_1 = 76$ cm Hg,
$P_2 = 76 + 4 = 80$ cm Hg
$P_1V_1 = P_2V_2$
$(76)(20) = 80\ell$
$\ell = 19$ cm

7 (a) (i) Jarak objek, u dalam Rajah 7.2 adalah lebih daripada jarak objek dalam Rajah 7.1.
The object distance, u in Diagram 7.2 *is more than the object distance in Diagram* 7.1.

(ii) Jarak imej, v dalam Rajah 7.2 adalah kurang daripada jarak imej dalam Rajah 7.1.
The image distance, v in Diagram 7.2 *is less than the image distance in Diagram* 7.1.

(iii) Saiz imej dalam Rajah 7.2 adalah kecil daripada saiz imej dalam Rajah 7.1.
The size of image in Diagram 7.2 *is smaller than the size of image in Diagram* 7.1.

(iv) Apabila jarak objek bertambah, jarak imej berkurang dan pembesaran imej juga berkurang.
When the object distance increases, the image distance decreases and the image magnification also decreases.

(b) (i) $v = 30$ cm

(ii) Gerakkan kanta menjauhi objek sehingga imej tajam terbentuk.
Move the lens further from the object until a sharp image is formed.

(iii) $u = 30$ cm

(c) (i) Frekuensi/*Frequency*

(ii) $n = 1.75$

(iii) Merah/*Red*

8 (a) Prinsip Keabadian Tenaga.
Principle of Conservation of Energy.

(b) $mgh = m'c\theta$
$300 \times 10 \times 6 = 0.5 \times 4200 \times \theta$
$\theta = 8.6$ °C

(c) Haba terhasil akibat geseran takal dan sedikit haba diserap oleh roda dayung.
Heat is generated due to friction of the pulley and some heat is absorbed by the paddle wheels.

(d) (i) Tapak periuk kuprum digunakan kerana ia cepat dipanaskan (kerana muatan haba tentunya rendah) dan ia konduktor haba yang baik.
Copper base is used because it heats up quickly (because of low specific heat capacity) and it is a good heat conductor

(ii) Badan aluminium digunakan untuk mengurangkan berat periuk.
Aluminium body is used to reduce the weight of the pot.

(iii) Pemegang kayu digunakan kerana tidak mudah dipanaskan kerana muatan haba tentu tinggi.
Wooden handle is used because they are not easily heated up due to its high specific heat capacity

(e) Periuk Q is chosen.
Pot Q is chosen.

Bahagian B

9 (a) (i) Berat adalah tarikan graviti terhadap satu jasad.
Weight is the force of gravity on an object.

(ii) Penyataan adalah betul.
Jika Bumi adalah sfera sempurna, Kutub Utara dan Khatulistiwa berjarak sama dari pusat Bumi. Daya graviti terhadap Josephine itu adalah sama jika Bumi tidak berputar pada paksinya. Tetapi Josephine di Khatulistiwa berputar bersama dengan putaran Bumi pada paksinya, manakala Josephine di Kutub Utara tidak. Daya memusat diperlukan untuk Josephine berputar bersama dengan Bumi. Daya itu merupakan sebahagian daya graviti. Justeru itu, berat Josephine di Khatulistiwa adalah kurang.
The statement is correct.
If the Earth is a perfect sphere, the North Pole and the Equator are at the same distance from the centre of the Earth. The gravitational force on Josephine is the same if the Earth does not rotate on its axis. But Josephine on the Equator rotate together with the rotation of Earth on its axis, while Josephine on the North Pole does not. Centripetal force is required for Josephine to rotate along with the Earth, and that comes from the gravitational force. Thus, Josephine's weight is less.

(b) Tempoh orbit satelit seharusnya 24 jam supaya ia sama dengan tempoh putaran Bumi pada paksinya. Ini merupakan satu syarat untuk satelit perhubungan. Arah edaran satelit seharusnya dari barat ke timur, iaitu searah dengan putaran Bumi pada paksinya. Orbit satelit harus sama satah dengan Khatulistiwa untuk memastikan satelit kelihatan tidak bergerak kepada pemerhati di atas permukaan Bumi. Tiga satelit diperlukan untuk memastikan pembawa gelombang boleh sampai ke seluruh permukaan Bumi. Sistem satelit *Q* dipilih kerana satelitnya bertempoh 24 jam, beredar dari barat ke timur dengan satah putaran sesatah dengan Khatulistiwa dan mempunyai tiga buah satelit.

The satellite orbital period should be 24 *hours so that it is equal to the period of rotation of the Earth on its axis. The direction of orbit of the satellite should be from west to east, which is the direction of the rotation of the Earth on its axis. The plane of orbit of the satellite should be the same as the Equator to ensure that satellites appear to be motionless to observers on Earth's surface. Three satellites are required to ensure that wave carriers can reach the entire surface of the Earth. System satellite Q is chosen because the period of satellite is* 24 *hours, orbits from west to east with the same plane as the plane of Equator and has three satellites.*

(c) $U_P = \dfrac{GMm}{r}$

$= -\dfrac{(6.67 \times 10^{-11})(5.97 \times 10^{24})(5)}{6.38 \times 10^{6}}$

$= -312\,068\,182$ J

$U_Q = -\dfrac{(6.67 \times 10^{-11})(5.97 \times 10^{24})(5)}{6.38 \times 10^{6} + 2000}$

$= -311\,970\,386$ J

$\Delta U = -311\,970\,386 - (-312\,068\,182)$

$= 97\,796$ J

$PE_P = 0$

$PE_Q = mgh = 5(9.8)(2000) = 98\,000$ J

$\Delta PE = 98\,000 - 0 = 98\,000$

ΔU hampir sama dengan ΔPE

ΔU *almost the same as* ΔPE

$U_P = \dfrac{GMm}{r}$

$= -\dfrac{(6.67 \times 10^{-11})(5.97 \times 10^{24})(5)}{6.38 \times 10^{6}}$

$= -312\,068\,182$ J

$U_Q = -\dfrac{(6.67 \times 10^{-11})(5.97 \times 10^{24})(5)}{6.38 \times 10^{6} + 2000}$

$= -311\,970\,386$ J

$\Delta U = -311\,970\,386 - (-312\,068\,182)$

$= 97\,796$ J

$PE = mgh$

$= 5(9.8)(2000)$

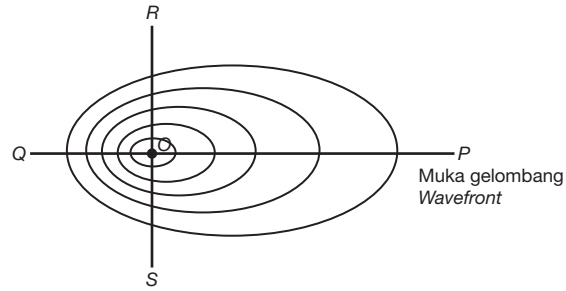
$= 98\,000$ J

10 (a) Pusat peranginan seharusnya ditempatkan di teluk kerana air lebih tenang dengan amplitud ombak yang lebih kecil.
Pemecah ombak (tembok penahan) seharusnya bercerun kerana kecerunan mengurangkan laju ombak.
Permukaan seharusnya tidak rata dan dilitupi batu-batu besar untuk menyerap tenaga ombak dengan lebih berkesan.
Pemecah ombak seharusnya cukup tinggi dan menghalang ombak daripada memercik.

Model *P* dipilih kerana ia berada di teluk. Pemecah gelombang adalah tinggi, curam dan permukaannya tidak rata.

The resort should be located along the bay because it is calmer with smaller wave amplitude.
Breakwater should be sloped as it reduces the speed of the waves.
The surface should be uneven and covered with huge rocks to absorb the wave energy more effectively.
Breakwater should be high enough to prevent the waves from splashing over.
Model P is chosen because it is located at the bay with breakwater that is tall, sloped and with uneven surface.

(b)



Halaju gelombang air bergantung kepada kedalaman air.
Dalam arah *OP*, kedalaman air meningkat. Oleh itu, laju gelombang air meningkat dari *O* ke *P*, $v = f\lambda$. Oleh sebab frekuensi adalah malar, semakin tinggi halaju, semakin besar panjang gelombang. Maka, panjang gelombang bertambah dari *O* ke *P*.
Dalam arah *OQ*, kedalaman air berkurang. Oleh itu, panjang gelombang berkurang dari *O* ke *Q*.
Dalam arah *OR* dan *OS*, kedalaman air tidak berubah, maka laju dan panjang gelombang kekal malar.
Velocity of water waves depends on the depth of water.
In the OP direction, the depth of water increases.
Hence, the speed of water waves increases from O to P, $v = f\lambda$. *As the frequency is constant, the greater the velocity, the longer the wavelength. Thus, the wavelength increases from O to P.*
In the OQ direction, the depth decreases. Hence, the wavelength decreases from O to Q.
In the OR and OS direction, the depth of water does not change, so the velocity and wavelength remain constant.

(c) $x_1 = \dfrac{\lambda_1 D}{a} = \dfrac{v_1 D}{f_1 a}$

$x_2 = \dfrac{\lambda_2 D}{a} = \dfrac{v_2 D}{f_2 a}$

Sebab/*Since* $x_1 = x_2$

$\dfrac{v_1}{f_1} = \dfrac{v_2}{f_2}$

$\dfrac{9}{5} = \dfrac{6}{f_2}$

$f_2 = 3.3$ Hz

Bahagian C

11 (a) Pecutan ialah kadar perubahan halaju.
Acceleration is the rate of change of velocity.

(b) (i) Jisim troli dalam Rajah 11.2 adalah lebih.
Kecuraman carta detik dalam Rajah 11.2 adalah kurang.
The mass of trolley in Diagram 11.2 *is more.*
The slope of the ticker chart in Diagram 11.2 *is less.*

(ii) Semakin curam carta detik semakin besar pecutan.
Pecutan troli berkurang apabila jisimnya bertambah.
The steeper the ticker charts the greater the acceleration.
The acceleration of the trolley decreases as its mass increases.

(iii) Hukum Newton kedua.
Newton's second law.

(c) (i) Beza jisim pasangan beban adalah sama untuk kedua-dua situasi.
The mass difference of the pair of loads is the same for both situation.

(ii) Pecutan a_1 adalah lebih daripada pecutan a_2. Walaupun beza jisim adalah sama, daya paduan yang menyebabkan sistem memecut melalui takal adalah sama. Tetapi, jumlah jisim yang memecut dalam Rajah 11.3 adalah lebih kecil. Memandangkan daya paduan sama, $a \propto \frac{1}{m}$, maka pecutan sistem untuk Rajah 11.3 adalah lebih tinggi.
Acceleration a_1 *is more than acceleration* a_2*. Even though the mass difference is the same, the resultant force that causes the system to accelerate through the pulley is the same. But, the amount of mass that accelerates in Diagram* 11.3 *is smaller. Since the resultant force is the same* $a \propto \frac{1}{m}$*, the acceleration of the system for the Diagram* 11.3 *is higher.*

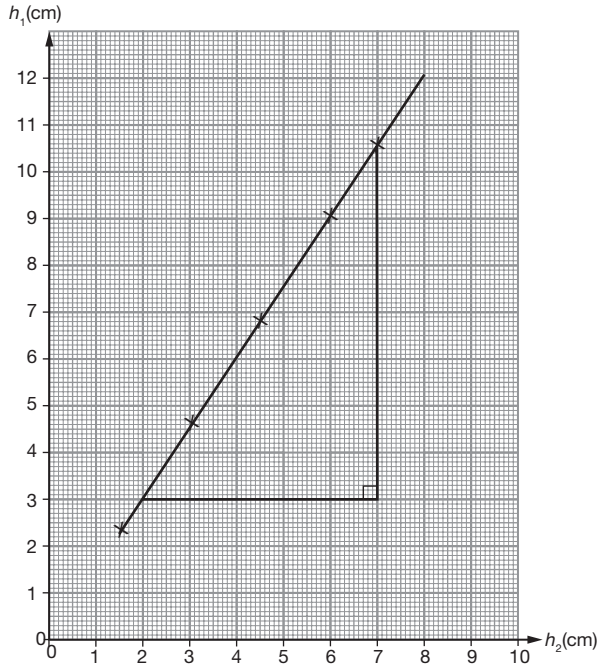
(d) Masa tindak balas helikopter seharusnya pendek sebaik sahaja menerima signal supaya ia boleh mengikut arahan secepat mungkin.
Jisim seharusnya sekecil mungkin supaya ia boleh memecut dengan kadar yang lebih tinggi.
Helikopter seharusnya aerodinamik untuk mengurangkan rintangan udara terhadap pergerakannya.
Bahan untuk helikopter seharusnya kuat supaya ia tidak mudah dirosakkan sekiranya berlaku kejatuhan.
Kuasa helikopter seharusnya tinggi supaya ia cepat naik dan boleh terbang dengan lebih laju dengan tujahan ke hadapan yang lebih besar.
(Kuasa = Seretan udara × Halaju)
The response time of the helicopter should be short as soon as it receives the signal so that it can follow the instructions as quickly as possible.
The mass should be as small as possible so that it can accelerate at a higher rate.
Helicopter should be aerodynamic to reduce air resistance against its motion.
The material for the helicopter should be strong so that it is not easily damaged in the event of a fall.
The power of the helicopter should be high so that it can moves up quickly and can fly faster with greater forward thrust.
(Power = Air drag × velocity)

KERTAS 3

(a) (i) h_1
(ii) h_2

(b)

h_1 (cm)	h_2 (cm)
2.3	1.5
4.5	3.0
6.8	4.5
9.0	6.0
11.3	7.5



(d) $m = 1.50$
(e) $\rho = 1.2$ g cm^{-3}
(f) Sama aras dengan setiap meniscus untuk mengelakkan ralat paralaks.
Same level with each meniscus to avoid parallax error.