

NANYANG JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION
Higher 2

CANDIDATE
NAME

Solution

CLASS

TUTOR'S
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PHYSICS

9749/01

Paper 1 Multiple Choice

24 September 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class, Centre number and index number in the spaces at the top of this page.

There are **thirty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of **15** printed pages.

Data

speed of light in free space
 permeability of free space
 permittivity of free space

elementary charge
 the Planck constant
 unified atomic mass constant
 rest mass of electron
 rest mass of proton
 molar gas constant
 the Avogadro constant
 the Boltzmann constant
 gravitational constant
 acceleration of free fall

$$c = 3.00 \times 10^8 \text{ m s}^{-1}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ H m}^{-1}$$

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ F m}^{-1}$$

$$(1 / (36\pi)) \times 10^{-9} \text{ F m}^{-1}$$

$$e = 1.60 \times 10^{-19} \text{ C}$$

$$h = 6.63 \times 10^{-34} \text{ J s}$$

$$u = 1.66 \times 10^{-27} \text{ kg}$$

$$m_e = 9.11 \times 10^{-31} \text{ kg}$$

$$m_p = 1.67 \times 10^{-27} \text{ kg}$$

$$R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$$

$$N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$$

$$k = 1.38 \times 10^{-23} \text{ J K}^{-1}$$

$$G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$$

$$g = 9.81 \text{ m s}^{-2}$$

Formulae

uniformly accelerated motion

work done on / by a gas
 hydrostatic pressure
 gravitational potential
 temperature

pressure of an ideal gas

mean translational kinetic energy of an ideal molecule

displacement of particle in s.h.m.

velocity of particle in s.h.m.

electric current

resistors in series

resistors in parallel

electric potential

alternating current/voltage

magnetic flux density due to a long straight wire

magnetic flux density due to a flat circular coil

magnetic flux density due to a long solenoid

radioactive decay

decay constant

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

$$W = p\Delta V$$

$$p = \rho gh$$

$$\phi = -Gm/r$$

$$T / \text{K} = T / ^\circ\text{C} + 273.15$$

$$p = \frac{1}{3} \frac{Nm}{V} \langle c^2 \rangle$$

$$E = \frac{3}{2} kT$$

$$x = x_0 \sin \omega t$$

$$v = v_0 \cos \omega t$$

$$= \pm \omega \sqrt{x_0^2 - x^2}$$

$$I = Anvq$$

$$R = R_1 + R_2 + \dots$$

$$1/R = 1/R_1 + 1/R_2 + \dots$$

$$V = \frac{Q}{4\pi\epsilon_0 r}$$

$$x = x_0 \sin \omega t$$

$$B = \frac{\mu_0 I}{2\pi d}$$

$$B = \frac{\mu_0 NI}{2r}$$

$$B = \mu_0 nI$$

$$x = x_0 \exp(-\lambda t)$$

$$\lambda = \frac{\ln 2}{t_{\frac{1}{2}}}$$

- 1 A single sheet of aluminium foil is folded twice to produce a stack of four sheets. The total thickness of the stack of sheets is measured to be (0.80 ± 0.02) mm. This measurement is made using a digital calliper with zero error of (-0.20 ± 0.02) mm.

What is the percentage uncertainty in the calculated thickness of a single sheet?

- A** 1.0% **B** 2.0% **C** 4.0% **D** 6.7%

Ans: C

$$4t = (1.00 \pm 0.04) \text{ mm}$$

$$t = (0.25 \pm 0.01) \text{ mm}$$

$$\frac{\Delta t}{t} \times 100\% = \frac{0.01}{0.25} \times 100\% \\ = 4.0\%$$

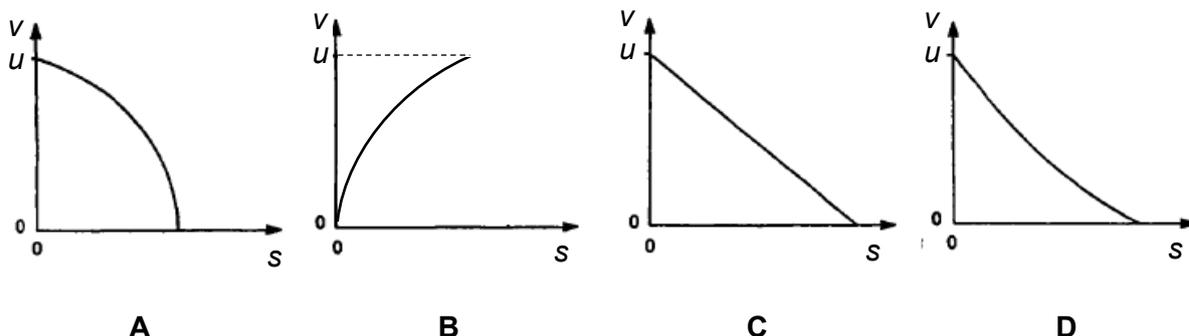
- 2 A voltmeter connected across a resistor in a circuit gives readings which have high precision but low accuracy.

Which of the following best describes the likely error in readings taken with this voltmeter?

	random error	systematic error
A	high	high
B	high	low
C	low	high
D	low	low

Ans: C

- 3 A stone falls vertically and strikes soft ground with speed u . The stone experiences constant deceleration until it comes to rest. Which graph shows the variation of speed v with distance s below the ground surface?



Ans: A

Take downward as positive.

Below ground surface, acceleration is upward, which is thus negative.

Let this acceleration be $-\alpha$.

$$v^2 = u^2 + 2as$$

$$v = \sqrt{u^2 + 2as}$$

$$v = \sqrt{u^2 - 2\alpha s}$$

Using GC, the graph will give be similar to option A.

- 4 A particle X with kinetic energy E_k collides with a stationary particle Y. Both particles have the same mass.

After colliding, X and Y travel together as a single particle.

How much kinetic energy is lost in the collision?

- A** zero
 B $\frac{E_k}{4}$
 C $\frac{E_k}{2}$
 D $\frac{3E_k}{4}$

Ans: C

$$E_k = \frac{1}{2}mv^2$$

By principle of conservation of momentum,

$$mv + 0 = 2mv_f \rightarrow v_f = \frac{v}{2}$$

$$\text{loss in KE} = KE_i - KE_f$$

$$= \frac{1}{2}mv^2 - \frac{1}{2}(2m)\left(\frac{v}{2}\right)^2 = \frac{1}{2}mv^2 - m\left(\frac{v^2}{4}\right) = \frac{1}{4}mv^2 = \frac{E_k}{2}$$

- 5 A sphere of mass 3.0 kg travelling due North at 2.0 m s^{-1} collides with another sphere of mass 4.0 kg travelling due East at 2.0 m s^{-1} .

The magnitude of their resultant momentum after the collision will be

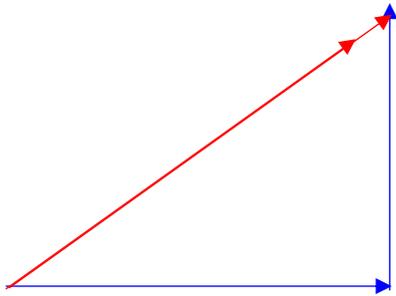
- A 2.0 kg ms^{-1} .
- B 10 kg m s^{-1} .
- C 14 kg m s^{-1} .
- D dependent on whether the the collision is elastic or inelastic.

Ans: B

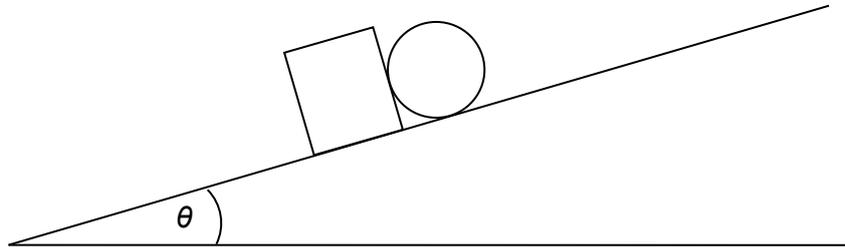
Using vector addition, resultant initial momentum = 10 kg m s^{-1}

Since the final momentum = initial momentum (PCOM),

Magnitude of resultant momentum after collision is 10 kg m s^{-1}



- 6 A block and a sphere of equal mass m are placed on an inclined plane. If the maximum frictional force that can exist between the block and the plane is equal to the weight of the block, and there is no frictional force between the sphere and the plane, what is the maximum angle θ at which the plane can be inclined before the block starts to slip?



- A 30° B 45° C 60° D 73°

Ans: A

Considering the net force on the block along the inclined plane,

$$W_{\text{block}} + F_{\text{by sphere on block}} - F_{\text{friction by plane on block}} = 0$$

$$mg \sin \theta + mg \sin \theta - f = 0$$

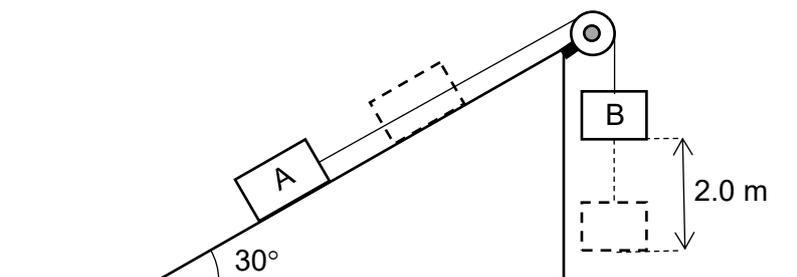
Since the frictional force is f , when the block just starts to slip, $f = mg$.

$$2mg \sin \theta - mg = 0$$

$$\sin \theta = 0.5$$

$$\theta = 30^\circ$$

- 7 Blocks A and B, of masses 4.0 kg and 6.0 kg respectively, are connected by a light cord passing over a light, frictionless pulley. Block A is held at rest on a rough slope inclined at 30° to the horizontal as shown.



When A and B are released, block A experiences a constant frictional force of 3.0 N.

What is the total kinetic energy of A and B when B has travelled 2.0 m downwards?

- A 39 J B 72 J C 78 J D 118 J

Ans: B

Loss in GPE of B = Gain in GPE of A + Gain in KE of A and B + Work done agst friction

$$6.0(9.81)(2.0) = 4.0(9.81)(2.0 \sin 30) + KE_{A+B} + 3.0(2.0)$$

$$KE_{A+B} = 72 \text{ J}$$

- 8 A wire is stretched elastically by a force of 200 N, causing an extension of 2.00 mm. The force is gradually increased to 250 N, and the wire remains within its elastic limit.

What is the work done in stretching the wire from 200 N to 250 N?

- A 0.113 J B 0.225 J C 113 J D 225 J

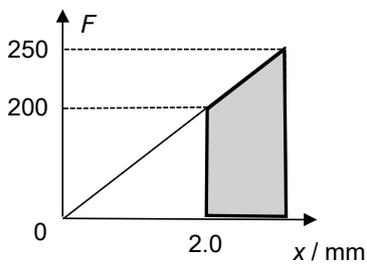
Ans: A

$$F = kx$$

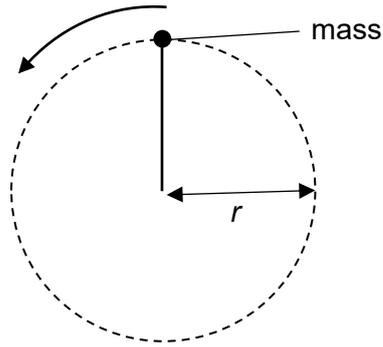
$$k = \frac{200}{0.002} = 100\,000 \text{ N m}^{-1}$$

Area under graph for additional extension

$$\begin{aligned} \text{work done} &= \frac{1}{2}(200 + 250)\left(\frac{250}{100000} - 0.002\right) \\ &= 0.113 \text{ J} \end{aligned}$$



- 9 A small mass is attached to a light string and rotates in a vertical circle of radius r .



Taking g to be acceleration of free fall, what is the centripetal acceleration of the mass when it is at the lowest point of motion if the speed of the mass at the highest point just allow the mass to complete the circular motion?

- A** g **B** $2g$ **C** $4g$ **D** $5g$

Ans: D

At the top of circle,

$$T + mg = 0 + mg = \frac{mv_{top}^2}{r}$$

$$v_{top}^2 = rg$$

By conservation of energy,

$$\frac{1}{2}mv_{top}^2 + mg(2r) = \frac{1}{2}mv_{bottom}^2$$

$$\frac{1}{2}(rg) + g(2r) = \frac{1}{2}v_{bottom}^2$$

$$v_{bottom}^2 = 5rg$$

$$a_c = \frac{v_{bottom}^2}{r} = 5g$$

- 10 Two satellites P and Q orbit the Earth due to the gravitational field of the Earth. P and Q are at distances R and $3R$ from the Earth's surface respectively, where R is the radius of the earth. The speed of P is v .

What is the speed of Q?

- A $\sqrt{\frac{1}{3}}v$ B $\sqrt{\frac{1}{2}}v$ C $\sqrt{2}v$ D $\sqrt{3}v$

Ans: B

Gravitational force provides for centripetal force.

$$F_G = F_C$$

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

$$v = \sqrt{\frac{GM}{r}}$$

$$v_P = \sqrt{\frac{GM}{2R}}$$

$$v_Q = \sqrt{\frac{GM}{4R}} = \left(\frac{1}{\sqrt{2}}\right) \sqrt{\frac{GM}{2R}} = \frac{1}{\sqrt{2}}v$$

Take note that the satellites are R and $3R$ from the surface of Earth, not the centre of the Earth.

- 11 Mars has a diameter that is approximately 0.5 times the diameter of the Earth, and the mass of Mars is 0.1 times the mass of the Earth.

Given that the gravitational potential at the Earth's surface is -63 MJ kg^{-1} .

What is an approximate value for the gravitational potential at the surface of Mars?

- A -13 MJ kg^{-1} B -25 MJ kg^{-1} C -95 MJ kg^{-1} D -320 MJ kg^{-1}

Ans: A

The gravitational potential at the surface of a planet is directly proportional to the planet's mass, and inversely proportional to its radius (or diameter).

$$\phi = -\frac{GM}{r}$$

$$\phi_{\text{earth}} = -\frac{GM_{\text{earth}}}{r_{\text{earth}}}$$

$$\phi_{\text{Mars}} = -\frac{G(0.1M_{\text{earth}})}{(0.5r_{\text{earth}})} = \frac{1}{5}(-63) = 12.6 \text{ MJ kg}^{-1}$$

Hence, the potential at Mars' surface is approximately -13 MJ kg^{-1} .

- 12 Container X contains neon and container Y contains argon. The two containers are identical, and the two gases are at the same temperature. The pressure in X is twice that in Y.

What is the ratio of the mean kinetic energy of a neon molecule to the mean kinetic energy of an argon molecule?

[The relative atomic masses of neon and argon are 20 and 40 respectively.]

- A 0.5 B 1 C 2 D 4

Ans: B

$$\frac{E_{k,X}}{E_{k,Y}} = \frac{\frac{3}{2}kT_X}{\frac{3}{2}kT_Y} = \frac{T_X}{T_Y} = 1$$

- 13 The density of helium at 150 kPa is 0.178 kg m⁻³. What is the root-mean-square speed of its particles?

- A 130 m s⁻¹ B 232 m s⁻¹ C 1300 m s⁻¹ D 1600 m s⁻¹

Ans: D

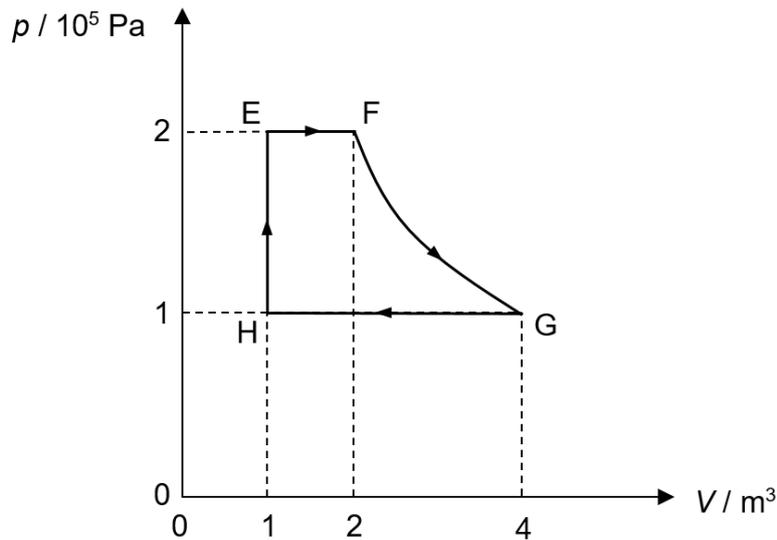
From the kinetic theory of gases,

$$p = \frac{1}{3} \frac{Nm}{V} \langle c^2 \rangle$$

$$p = \frac{1}{3} \rho \langle c^2 \rangle$$

$$c_{r.m.s.} = \sqrt{\frac{3p}{\rho}} = \sqrt{\frac{3(150 \times 10^3)}{0.178}} = 1600 \text{ m s}^{-1}$$

14 An ideal gas goes through the thermodynamic cycle EFGHE as shown.



Which of the following statements is correct?

- A After completing one cycle, there is net heat lost by the gas.
- B During process FG, there is no change in the internal energy of the gas.
- C During process HE, the gas loses heat.
- D The work done by the gas during process EF is equal in magnitude to the work done on the gas during process GH.

Ans: B

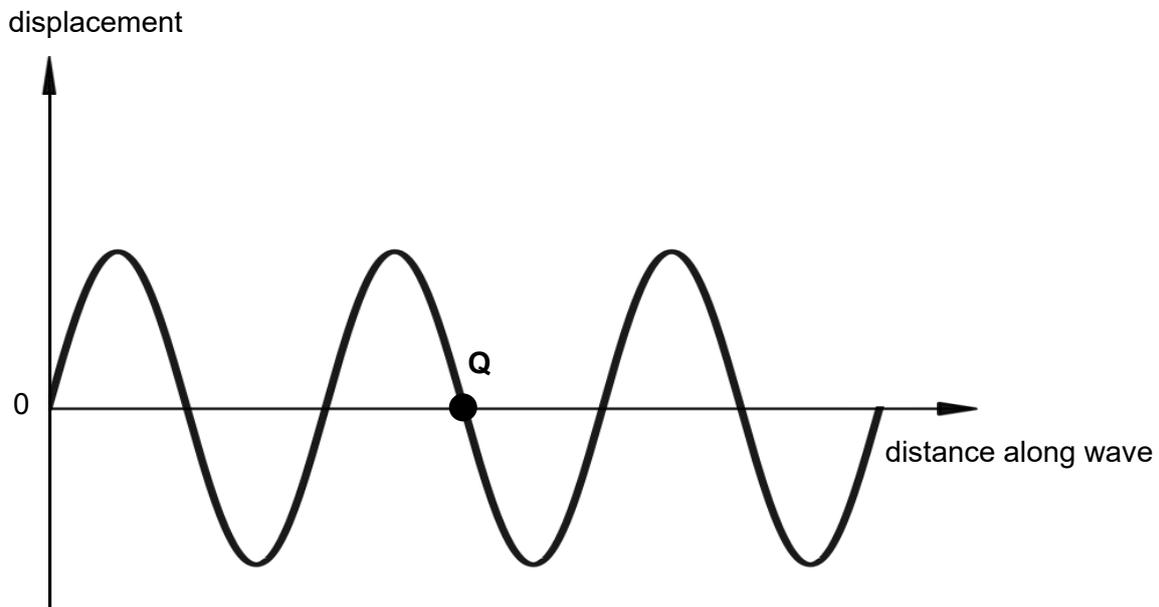
A is wrong. Net work done on gas is negative, in other words, there is a net work done by gas. As the change in internal energy is zero for one complete cycle, net work done by gas is equal to net heat gained by gas.

C is wrong. As work done on gas is zero, an increase in internal energy means that there is heat gained by gas.

D is wrong. Areas under the graph for EF and GH are different.

B is correct as FG is an isothermal process whereby temperature remains constant (since PV is unchanged)

- 15 This diagram shows the displacement-distance graph of a transverse wave at time, $t = 0$. Taking upwards as positive, point Q is a point on the wave and is travelling downwards at $t = 0$. Another point P is $\frac{7}{8}$ of a wavelength from point Q.

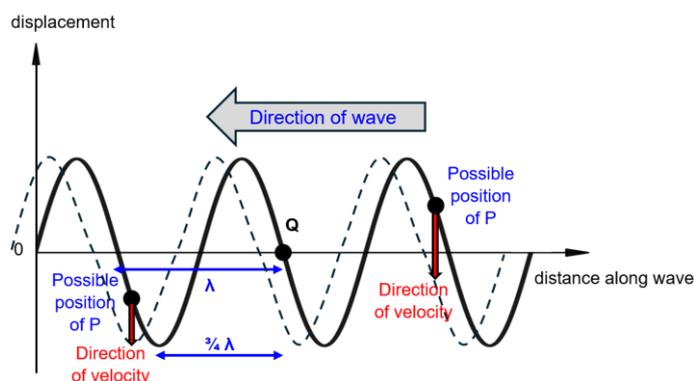


Which of the following descriptions shows a possible displacement and direction of velocity of point P?

	displacement	direction of velocity
A	positive	positive
B	positive	0
C	0	negative
D	negative	negative

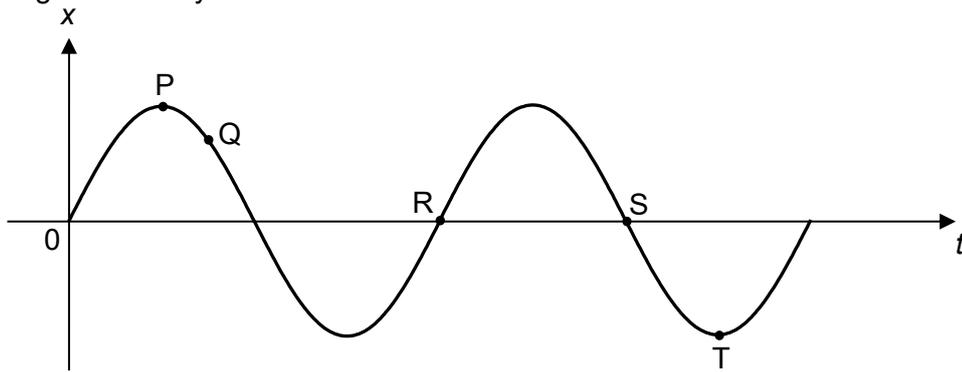
Ans: D

Since the point Q is travelling downwards at $t = 0$, it implies that the transverse wave is travelling towards the **left**.



Since P is $\frac{7}{8}$ of a wavelength away from Q, there are 2 possible positions it can be at as shown above. Some time later, the wave profile will be as shown by the dotted line. In order for this to happen, if P is on the left side of Q, it must move downwards and have a negative displacement from equilibrium at $t = 0$. On the other hand, if P is on the right side of Q, it must move downwards and have a positive displacement from equilibrium at $t = 0$.

16 The graph below shows the variation with time t of the displacement x of a simple harmonic oscillator oscillating horizontally.



Which statement is correct?

- A The phase difference between P and S is $\frac{\pi}{2}$ rad.
- B The acceleration at T is zero.
- C The potential energy of the oscillator is larger at Q compared to T.
- D The kinetic energy of the oscillator is larger at Q compared to R.

Ans: A

A-phase difference is $\frac{\Delta t}{T} \times 2\pi = \left(\frac{T}{4}\right) \times 2\pi = \frac{\pi}{2}$

B- at T acceleration is maximum (max. displacement)

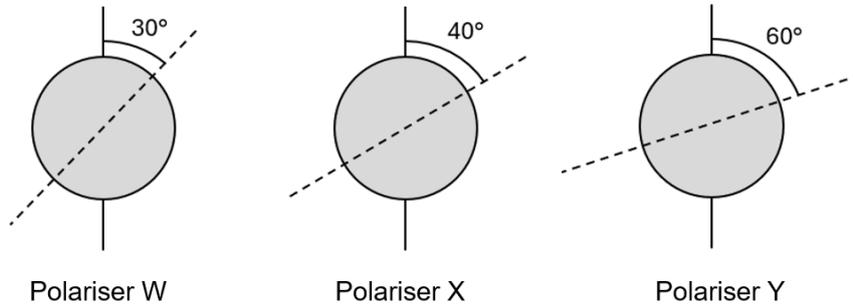
C-maximum PE at T (x_{\max}), lesser PE at Q

D-maximum KE at R (equilibrium position), lesser KE at Q

17 The diagram below shows three polarisers W, X and Y.

A beam of unpolarised light of intensity I_0 is incident normally onto the surface of polariser W, which then passes through polariser X and eventually emerges from polariser Y.

The axis of polarisation of each polariser is indicated by a dashed line.



What is the intensity of the light that emerges from polariser Y?

- A** $0.11 I_0$ **B** $0.32 I_0$ **C** $0.43 I_0$ **D** $0.64 I_0$

Ans: C

Using Malus' law, the intensity of transmitted light (I) through polarisers is proportional to $I_0 \cos^2 \theta$, where I_0 is the intensity of transmitted through the first polariser, θ is the angle between two polarisers.

Unpolarized light loses exactly half of its intensity after it passes through polariser W no matter what the direction of polarising for polariser X is: $0.50 I_0$.

The angle between polariser W and X is 10° , the transmitted intensity after X would be $0.50 I_0 \times \cos^2 (40^\circ - 30^\circ) = 0.48 I_0$.

The angle between polariser X and Y is 20° , the transmitted intensity after Y would be $0.48 I_0 \times \cos^2 (60^\circ - 40^\circ) = 0.43 I_0$.

- 18 A musical instrument is made using a long tube with a mouthpiece at one end. The other end is open and flared, as shown.



A musician maintains stationary sound waves with a node at the mouthpiece and an antinode at the other end. The fundamental frequency of sound that the instrument can produce is 80 Hz.

Which different frequencies of sound can be produced by the instrument?

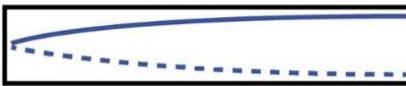
- A 160 Hz, 240 Hz, 320 Hz
- B 160 Hz, 320 Hz, 640 Hz
- C 240 Hz, 400 Hz, 720 Hz
- D 240 Hz, 320 Hz, 480 Hz

Ans: C

Since the situation is a one end open, one end closed pipe of length L ,

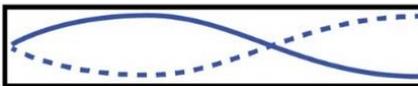
Fundamental harmonic: $\lambda = 4L \rightarrow f = 80\text{Hz}$

1/4 wave



1st Overtone: $\lambda = (4/3)L \rightarrow f = 3 \times 80\text{Hz} = 240\text{ Hz}$

3/4 waves



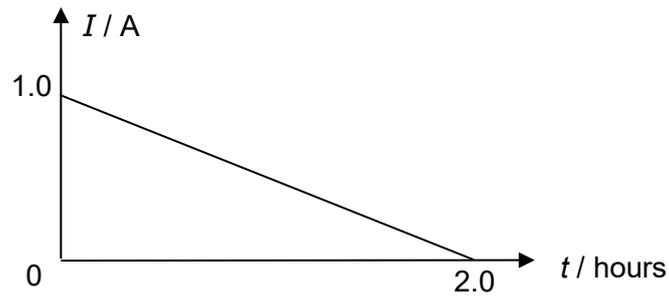
2nd Overtone: $\lambda = (4/5)L \rightarrow f = 5 \times 80\text{Hz} = 400\text{ Hz}$

5/4 waves



We can see that subsequent overtones are just odd-integer multiples of the fundamental frequency, in other words: $f, 3f, 5f, 7f, 9f, \dots, (2n+1)f$ are all possible solutions.

- 19 A portable fan battery is charged by connecting it to a constant potential difference of 6.0 V. The variation with time t of the current I through the battery is as shown.



What is the energy transferred to the battery during the time of 2.0 hours shown in the graph?

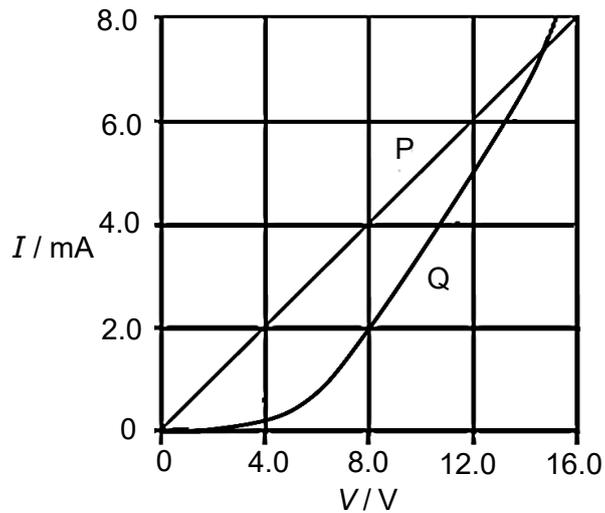
- A** 360 J **B** 720 J **C** 22 000 J **D** 43 000 J

Ans: C

$$Q = \text{Area under graph} = \frac{1}{2}(1.0)(2.0 \times 3600) = 3600 \text{ C}$$

$$\text{Energy transferred i.e. work done on charge} = QV = 3600(6.0) = 21600 \text{ J}$$

20 The I - V characteristics of two electrical components P and Q are shown below.



Which of the following statements is correct?

- A P is an ohmic conductor and Q is a filament.
- B Resistance of Q is always larger than resistance of P.
- C At 2.0 mA, the power dissipated through Q is twice that of P.
- D At the point where the two lines intersect the resistance of Q is approximately twice that of P.

Ans: C

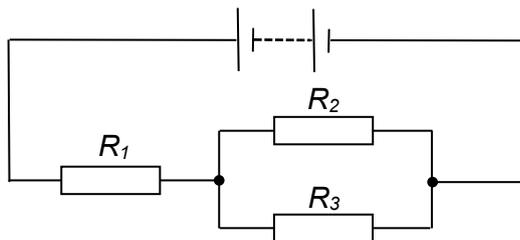
Option A: Q is a semi-conductor diode, not filament

Option B: Resistance of Q becomes smaller than P beyond $V \approx 14$ V.

Option C: V_Q is twice V_P at 2.0 mA. Since $P = IV$, P_Q is twice P_P .

Option D: At intersection, resistance of both are equal since V and I are the same.

- 21 The diagram shows a network of three identical resistors connected to a battery of negligible internal resistance.



What is the ratio of $\frac{\text{power dissipated in } R_1}{\text{power dissipated in } R_2}$?

- A** 1 **B** 2 **C** 4 **D** 9

Ans: C

$$\text{Total resistance of } R_2 \text{ and } R_3 = \left(\frac{1}{R} + \frac{1}{R}\right)^{-1} = \left(\frac{2}{R}\right)^{-1} = \frac{1}{2}R$$

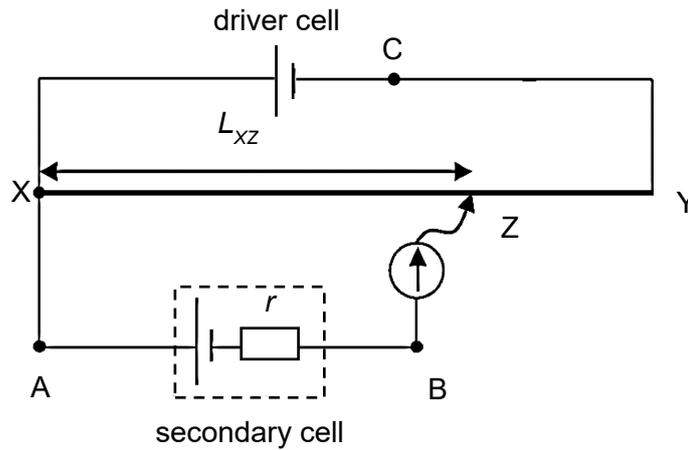
$$I = \frac{E}{R_{\text{total}}} = \frac{E}{R + \frac{1}{2}R}$$

$$\text{p.d. across } R_1, V_1 = \frac{E}{R + \frac{1}{2}R} (R) = \frac{2}{3}E$$

$$\text{p.d. across } R_2, V_2 = E - \frac{2}{3}E = \frac{1}{3}E$$

$$\frac{P_1}{P_2} = \frac{\frac{V_1^2}{R}}{\frac{V_2^2}{R}} = \frac{2^2}{1^2} = 4$$

22 A typical potentiometer circuit is shown.



Which of the following does **not** increase the balance length L_{XZ} ?

- A decreasing the e.m.f. of the driver cell.
- B increasing the e.m.f. of the secondary cell.
- C adding a fixed resistor in series with the driver cell at point C.
- D decreasing the internal resistance of the secondary cell.

Ans: D

Option A: this decreases V_{XY} . L_{XZ} has to increase in order for V_{XZ} to still be equal to e.m.f of secondary cell.

Option B: this means L_{XZ} has to increase to increase V_{XZ} to match e.m.f of secondary cell.

Option C: this causes the same effect as in option A.

Option D: at balance length, the current is through secondary cell is zero, thus V_{AB} will still be equal to the e.m.f. of the secondary cell. Thus L_{XZ} does not change.

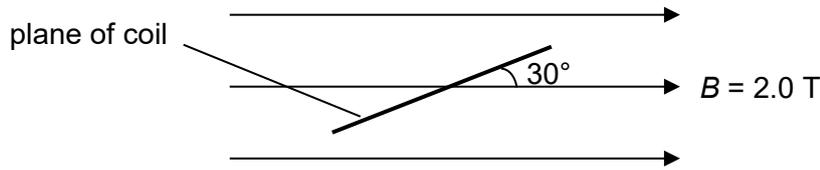
23 In the direction opposite of an electric field line, which of the following must be true?

- A The potential must decrease.
- B The potential must increase.
- C The electric field strength must decrease.
- D The electric field strength must increase.

Ans: B

Electric potential decreases along the direction of electric field strength.

- 24 A square coil of 10 turns with sides of 5.0 cm is placed so that the plane of the coil makes an angle of 30° with the direction of a uniform magnetic field B of flux density 2.0 T. A current of 15 A is passed through the coil.



What is the magnitude of the torque acting on the square coil?

- A 0.19 N m B 0.33 N m C 0.38 N m D 0.65 N m

Ans: D

Total torque,

$$\tau = F \times d$$

$$= NBILd$$

$$= 10 \times 2.0 \times 15 \times \frac{5.0}{100} \times \frac{5.0}{100} \cos 30^\circ$$

$$\approx 0.65 \text{ Nm}$$

- 25 A flat circular coil of 120 turns, each of area 0.070 m^2 , is placed with its axis parallel to a uniform magnetic field. The flux density of the field is changed steadily from 80 mT to 20 mT over a period of 4.0 s.

What is the e.m.f. induced in the coil during this time?

- A 0 mV B 1.1 mV C 130 mV D 500 mV

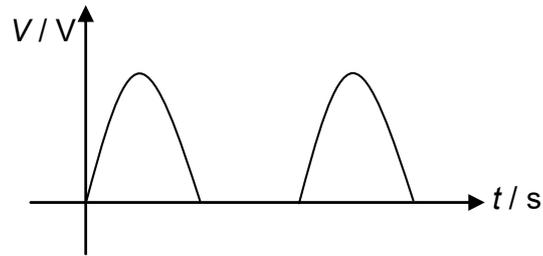
Ans: C

Axis of coil parallel to magnetic field \rightarrow magnetic field lines are normal to the area enclosed by coil

$$\text{Emf} = \frac{d\phi}{dt} = NA \frac{dB}{dt} = 120 \times 0.070 \times \frac{(80 - 20) \times 10^{-3}}{4.0}$$

$$= 0.126 \text{ V} \approx 130 \text{ mV}$$

26 The figure belows shows a varying voltage.



The r.m.s. value of this rectified voltage is 100 V. The peak voltage is

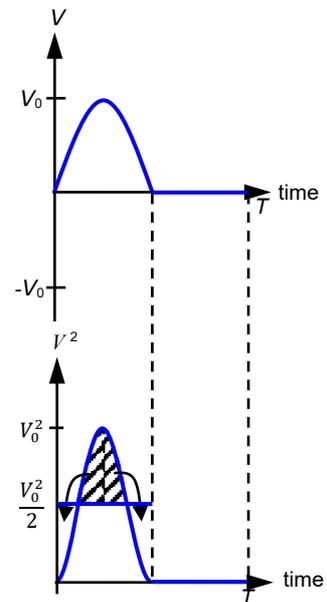
- A** 50 V **B** 71 V **C** 141 V **D** 200 V

Ans: D

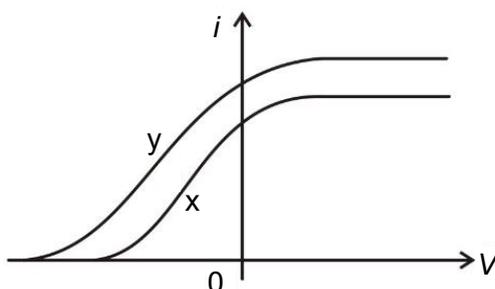
$$\text{Area under } V^2\text{-}t \text{ graph for one period} = \frac{V_0^2}{2} \times \frac{T}{2} = \frac{V_0^2 T}{4}$$

$$\text{RMS} = \sqrt{\frac{\left(\frac{V_0^2 T}{4}\right)}{T}} = \frac{V_0}{2} = 100$$

$$\text{So } V_0 = 200 \text{ V}$$



- 27 The figure shows the variation of the photoelectric current i with voltage V between the electrodes in a photocell for two different radiations, x and y.



The intensity and the frequency of radiation x are I_x and f_x while the intensity and the frequency of radiation y are I_y and f_y . Which of the following shows the relationship between the intensities and frequencies of x and y?

- A $I_x > I_y, f_x > f_y$ B $I_x > I_y, f_x < f_y$
 C $I_x < I_y, f_x > f_y$ D $I_x < I_y, f_x < f_y$

Ans: D

$$hf = eV_s + \Phi,$$

$$f_x < f_y \text{ since } V_{sx} < V_{sy}$$

$$\text{Since } i_x < i_y, I_x < I_y$$

- 28 An electron of mass m and charge e is accelerated from rest through an electric field of potential difference V .

What is the frequency of a photon whose wavelength is equal to the de Broglie wavelength of this electron?

- A $\frac{c\sqrt{2meV}}{h}$ B $\frac{h}{\sqrt{2meV}}$ C $\frac{hc}{eV}$ D $\frac{eV}{h}$

Ans: A

Loss in EPE = Gain in KE

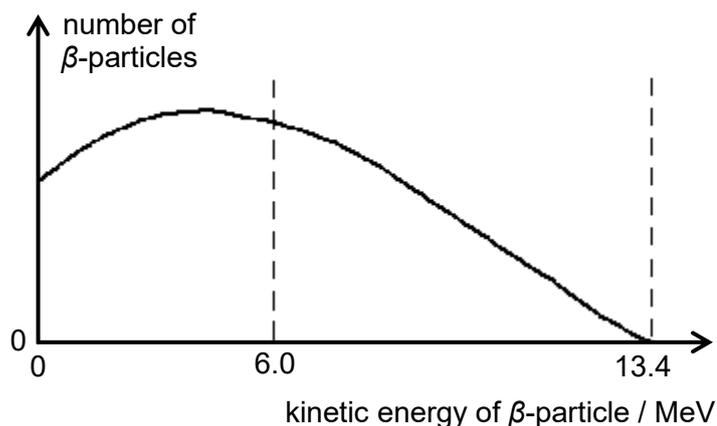
$$eV = \frac{p^2}{2m}$$

$$p = \sqrt{2meV}$$

$$\lambda = \frac{h}{\sqrt{2meV}}$$

$$f = \frac{c}{\lambda} = \frac{c\sqrt{2meV}}{h}$$

29 The beta spectrum for ^{12}B decay is as shown below.



The kinetic energy of an emitted β -particle is 6.0 MeV. What is the approximate energy of the associated neutrino?

- A 4.0 MeV B 6.0 MeV C 7.4 MeV D 13.4 MeV

Ans: C

Based on COE and COM, the kinetic energy of the daughter nuclei is negligible hence the total energy released is shared between β particle and neutrino. Since the highest possible KE of β particle is 13.4 MeV, i.e. when neutrino has zero KE, hence the total energy released by the reaction is also 13.4 MeV, and this value is fixed for this particular reaction. Thus, when an emitted β particle has KE of 6.0 MeV, the associated neutrino must have $13.4 - 6.0 = 7.4$ MeV of energy.

30 A radioactive source in the laboratory has a half-life of 10 days. The count rate was measured to be 100 Bq initially. 20 days later, the count rate was found to be 34 Bq. What is the count rate in the laboratory without the source?

- A 9 B 12 C 17 D 22

Ans: B

$$(C - C_{\text{background}}) = \frac{1}{4} (C_0 - C_{\text{background}})$$

$$(34 - C_{\text{background}}) = \frac{1}{4} (100 - C_{\text{background}})$$

$$C_{\text{background}} = 12 \text{ days}$$

End of Paper