RIVER VALLEY HIGH SCHOOL
JC2 PRELIMINARY EXAMINATIONS

H2 PHYSICS 9749 / 01
PAPER 1
19 SEPTEMBER 2024

1 HOUR

CANDIDATE NAME									
CENTRE NUMBER	S					**INDEX NUMBER**				
CLASS	2	3	J						

INSTRUCTIONS TO CANDIDATES

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

Read these notes carefully.
Write your name, class and index number above.

There are **thirty** questions in this section. Answer **all** questions. For each question, there are four possible answers, **A**, **B**, **C** and **D**. Choose the **one** you consider correct and shade your choice in **soft pencil** on the separate **Optical Answer Sheet**.

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

Any rough working should be done on the Question Paper.

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

Hand in the Optical Answer Sheet.

This document consists of **20** printed pages.

Data

speed of light in free space,	c	=	3.00×10^{8} m s^{-1}
permeability of free space,	μ_0	=	$4\pi \times 10^{-7}$ H m^{-1}
permittivity of free space,	ε_0	=	8.85×10^{-12} F m^{-1}
			$(1/(36\pi)) \times 10^{-9}$ F m^{-1}
elementary charge,	e	=	1.60×10^{-19} C
the Planck constant,	h	=	6.63×10^{-34} J s
unified atomic mass constant,	u	=	1.66×10^{-27} kg
rest mass of electron,	m_e	=	9.11×10^{-31} kg
rest mass of proton,	m_p	=	1.67×10^{-27} kg
molar gas constant,	R	=	8.31 J K^{-1} mol^{-1}
the Avogadro constant,	N_A	=	6.02×10^{23} mol^{-1}
the Boltzmann constant,	k	=	1.38×10^{-23} J K^{-1}
gravitational constant,	G	=	6.67×10^{-11} N m^2 kg^{-2}
acceleration of free fall,	g	=	9.81 m s^{-2}

Formulae

uniformly accelerated motion	$s = ut + \frac{1}{2}at^2$
	$v^2 = u^2 + 2as$
work done on/by a gas	$W = p\Delta V$
hydrostatic pressure	$p = \rho gh$
gravitational potential	$\phi = -Gm/r$
temperature	$T / \mathrm{K} = T / ^\circ\mathrm{C} + 273.15$
pressure of an ideal gas	$p = \frac{1}{3}\frac{Nm}{V} < c^2 >$
mean translational kinetic energy of an ideal gas molecule	$E = \frac{3}{2}kT$
displacement of particle in s.h.m.	$x = x_0 \sin \omega t$
velocity of particle in s.h.m.	$v = v_0 \cos \omega t$
	$= \pm\omega\sqrt{x_0^2 - x^2}$
electric current	$I = Anvq$
resistors in series	$R = R_1 + R_2 + \ldots$
resistors in parallel	$1/R = 1/R_1 + 1/R_2 + \ldots$
electric potential	$V = \frac{Q}{4\pi\varepsilon_0 r}$
alternating current/voltage	$x = x_0 \sin \omega t$
magnetic flux density due to a long straight wire	$B = \frac{\mu_0 I}{2\pi d}$
magnetic flux density due to a flat circular coil	$B = \frac{\mu_0 NI}{2r}$
magnetic flux density due to a long solenoid	$B = \mu_0 nI$
radioactive decay	$x = x_0 \exp(-\lambda t)$
decay constant	$\lambda = \frac{\ln 2}{t_{\frac{1}{2}}}$

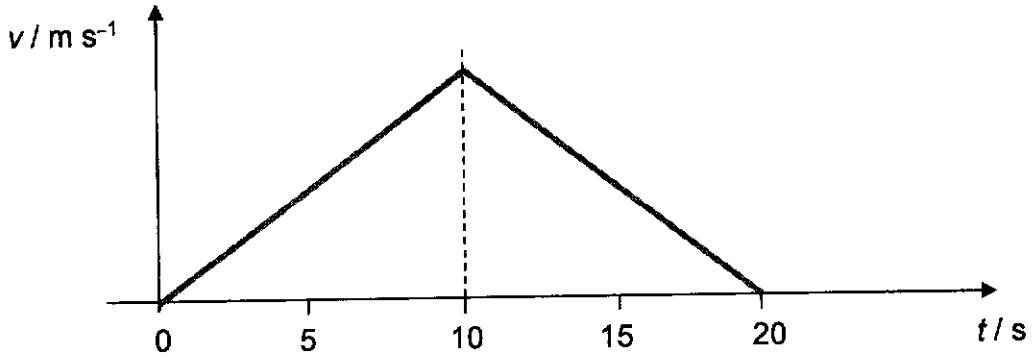
For each question, there are four possible answers, **A**, **B**, **C** and **D**. Choose the **one** you consider correct and shade your choice in **soft pencil** on the separate **Answer Sheet**.

1 An alternative form of the unit of resistance, the ohm (Ω), is V A^{-1}.

Which of the following examples shows a similar correct alternative form of unit?

	Unit	Alternative form
A	Newton (N)	kg m s^{-1}
B	Hertz (Hz)	s^{-2}
C	Joule (J)	N m^{-1}
D	Tesla (T)	kg A^{-1} s^{-2}

2 A drone descends from a height for 20 s. The variation with time *t* of the vertical speed *v* of the drone is shown.



What is the ratio of $\frac{\text{distance travelled between 0 to 20 s}}{\text{distance travelled between 5 to 15 s}}$?

A 1.1 **B** 1.3

C 1.5 **D** 2.0

3 A ball is thrown upwards at an angle to the horizontal with an initial speed. Assuming that air resistance is not negligible, which of the following statement is incorrect?

A The path of the ball is asymmetrical about a vertical line passing through the highest point.

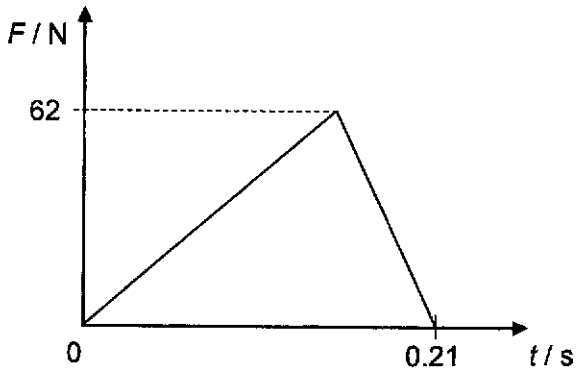
B Horizontal range of the ball is shorter than the case with negligible air resistance.

C The maximum height reached by the ball is smaller than the case with negligible air resistance.

D The time taken for the flight up to the highest point is longer than the time taken for the flight down.

4 The graph below shows the variation with time of the force exerted by a baseball pitching machine that throws baseballs of mass 150 g from rest.

What is the velocity of a ball immediately after leaving the machine?



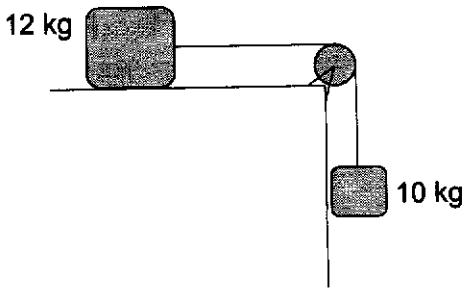
A 13 m s^{-1}

B 43 m s^{-1}

C 87 m s^{-1}

D 295 m s^{-1}

5 A block of mass 12 kg lies on a frictionless horizontal table. A rope connects the 12 kg block to another block of mass 10 kg that hangs freely via a frictionless pulley as shown in the diagram below. The system is then released from rest.



What is the tension in the rope?

A 4.5 N

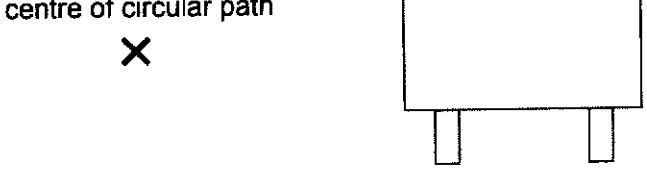
B 16 N

C 54 N

D 98 N

6 A train moving at 57.8 km h^{-1} travels around a circular curve at constant speed. An object hung from a string in the train makes an angle of 3.80° with the vertical. What is the radius of the circular path?

centre of circular path



Rear view of train

A 24.6 m

B 34.0 m

C 396 m

D 5130 m

7 Given that the mass of Earth is 5.97×10^{24} kg, what is the speed of a satellite in a geostationary orbit about Earth?

A 1.66×10^{3} m s^{-1}

B 3.07×10^{3} m s^{-1}

C 2.00×10^{7} m s^{-1}

D 4.22×10^{7} m s^{-1}

8 A uniform spherical planet of mass 1.30×10^{22} kg has a diameter of 2380 km. A space probe of mass 5500 kg is launched from the surface to a height of 240 km.

What is the increase in gravitational potential energy of the space probe?

A 1.84×10^{8} J

B 6.73×10^{8} J

C 3.34×10^{9} J

D 4.01×10^{9} J

9 In the derivation of the relationship between the pressure, the number density of molecules and the mean square speed of the molecules of an ideal gas, which of the following is **NOT** an essential assumption?

A There are no intermolecular forces of attractions.

B The volume of the molecules are small when compared to the volume of the container.

C The molecules are in continuous random motion and all collisions are elastic.

D The average kinetic energy of a molecule is directly proportional to the temperature of the gas.

10 A polystyrene cup contains a mass of 130 g of water at 50 °C. A cube of ice of mass 20 g and temperature 0 °C is placed in the water. The water is stirred until the temperature is homogenous.

Assuming negligible heat loss to the cup and surroundings, what is the final temperature of the water?

specific heat capacity of water = 4.2×10^3 J kg^{-1} K^{-1}
specific latent heat of fusion of ice = 3.3×10^5 J kg^{-1}

A 3 °C

B 18 °C

C 33 °C

D 38 °C

11 In microwave ovens, water molecules in food are set into resonance when microwaves of a fixed frequency are incident on them. This causes the molecules to receive energy and hence warms up the food. In order to warm up the food faster, one can

A increase the frequency of the incident microwave while keeping its amplitude fixed.

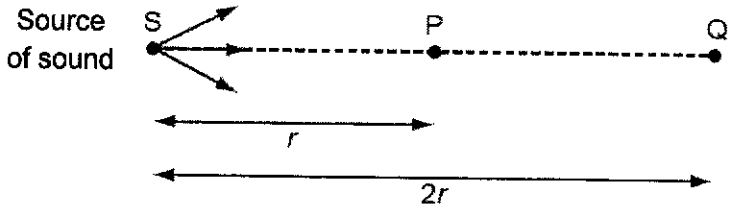
B increase the frequency and amplitude of the incident microwave.

C increase the amplitude of the incident microwave while keeping its frequency fixed.

D keep both frequency and amplitude of the microwave the same as before but increase the frequency of the water molecules.

12 Sound is emitted from a point source S. At point Q, air molecules oscillate with amplitude 6.0 μm.

What is the amplitude of oscillation of air molecules at P?



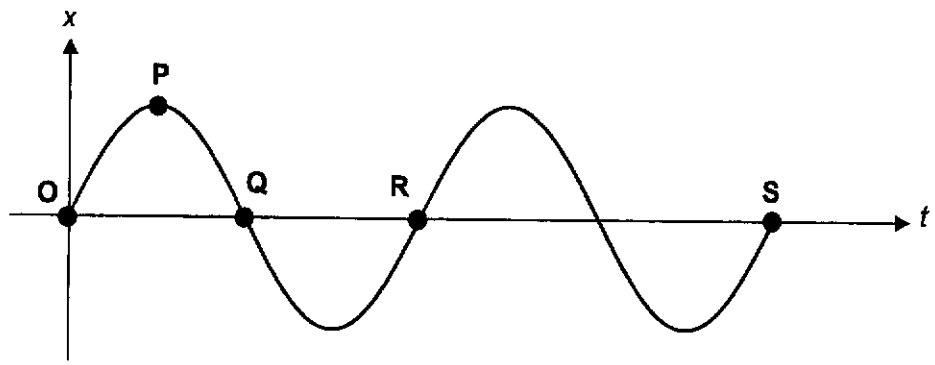
A 0.75 μm

B 1.5 μm

C 3.0 μm

D 12.0 μm

13 The graph below shows the variation with time t of the displacement x of a particle on a progressive wave.



Which statement below is true?

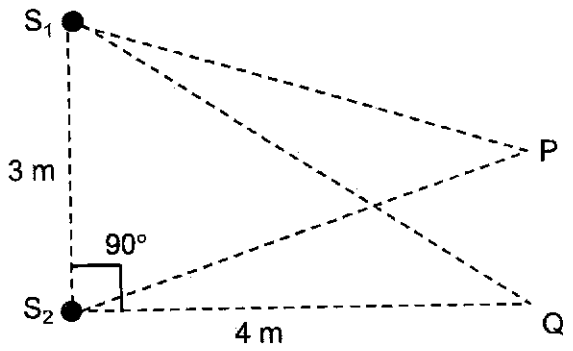
A OS represents two wavelengths.

B At P, the acceleration of the particle is zero.

C The phase difference between Q and R is 180°.

D The kinetic energy of the particle is higher when it is at Q than when it is at R.

14 Two sources of waves, S_1 and S_2, are situated as shown in the figure below. Individually, each source emits waves of intensity I.



Equidistant from S_1 and S_2, a detector at P registers a steady minimum wave intensity. The same detector registers the next steady minimum intensity when it moves to point Q. Which of the following statements is false about the two sources of waves?

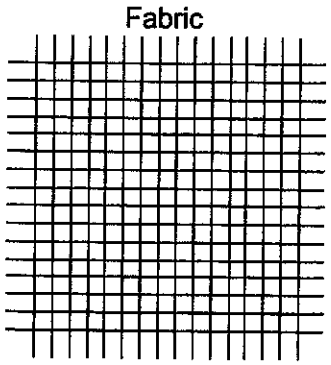
A The two sources of waves have the same amplitude.

B The two sources of waves are coherent.

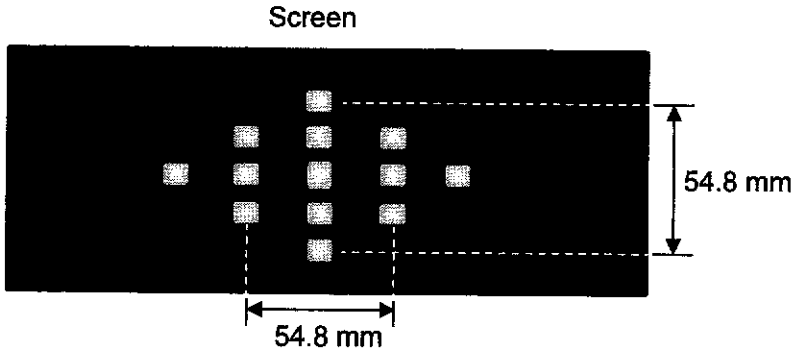
C The two sources of waves have a phase difference of π radians.

D The waves from the two sources have a wavelength of 2 m.

15 A fabric consists of closely-spaced horizontal and vertical threads as shown.



When a laser with a wavelength of 685 nm is incident on the fabric, a diffraction pattern is observed on a screen placed at a distance of 2.00 m away, as shown below.



The separation between the **horizontal** threads of the fabric is

A 2.50×10^{-5} m

B 5.00×10^{-5} m

C 1.00×10^{-4} m

D 9.48×10^{-4} m

16 A charged oil droplet of mass m is falling, initially freely, in a vacuum between two horizontal metal plates that are separated by a distance x.

A potential difference (p.d.) V is then applied across the plates. This results in the oil droplet continuing to accelerate downwards but with a reduced acceleration a.

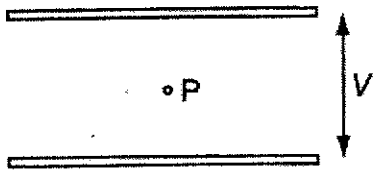
The polarity of the applied p.d. is then reversed so that the direction of the electric force on the droplet is reversed. This results in the downwards acceleration of the oil droplet increasing to $7a$.

What is the magnitude of the charge on the oil droplet?

A $\frac{max}{V}$ **B** $\frac{3max}{V}$

C $\frac{6max}{V}$ **D** $\frac{7max}{V}$

17 A small positively charged particle P is balanced halfway between two horizontal plates when a potential difference V is applied between the plates.



When V is increased, P rises towards the upper plate.

When V is decreased, P falls towards the lower plate.

Which statement is correct?

A Decreasing V increases the electric potential energy and decreases the gravitational potential energy of the particle.

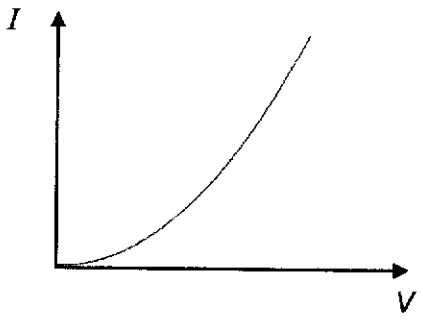
B Decreasing V increases both the electric and the gravitational potential energy of the particle.

C Increasing V increases both the electric and the gravitational potential energy of the particle.

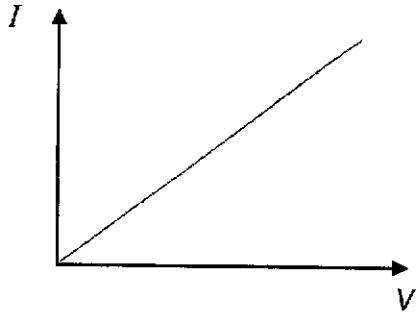
D The change of electric potential energy of the particle must equal the change of gravitational potential energy of the particle.

18 Which of the following graphs correctly shows the variation with the potential difference V across a negative temperature coefficient (NTC) thermistor of the current I through it?

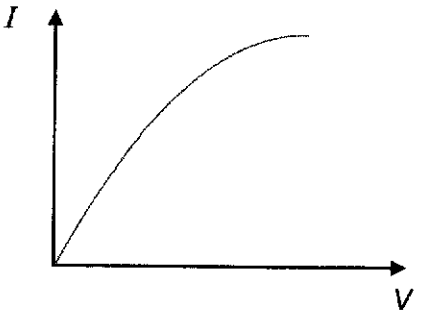
A



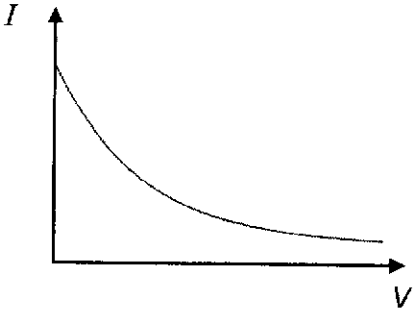
B



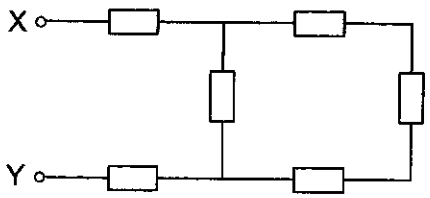
C



D



19 6 identical resistors of resistance R are set up across points X and Y as shown in the diagram below. What is the effective resistance across X and Y in terms of R?



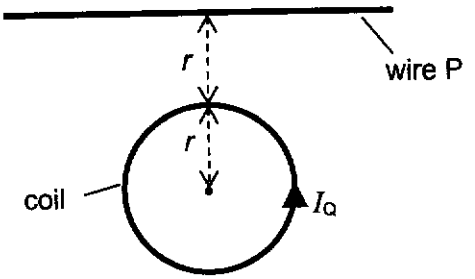
A 1.50 R

B 2.75 R

C 3.33 R

D 5.00 R

20 A coil Q of a single turn and radius r, carries an anti-clockwise current I_Q and lies flat on the table. A long straight wire P carrying current I_P is placed on the same table such that its perpendicular distance from the centre of coil Q is $2r$.



Which of the following will cause the resultant magnetic field at the centre of coil Q to be zero?

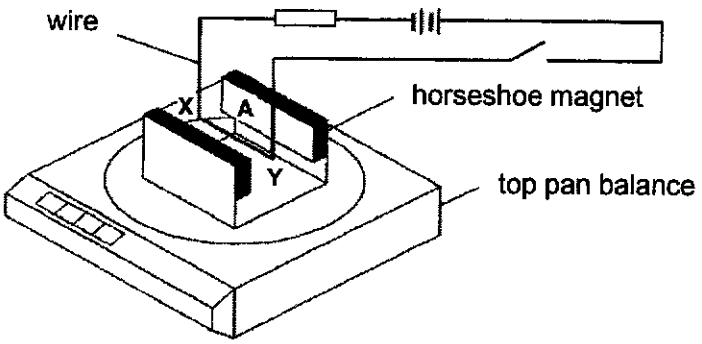
A I_P to the right, $I_P = 2\pi I_Q$

B I_P to the left, $I_P = 2\pi I_Q$

C I_P to the right, $I_Q = 2\pi I_P$

D I_P to the left, $I_Q = 2\pi I_P$

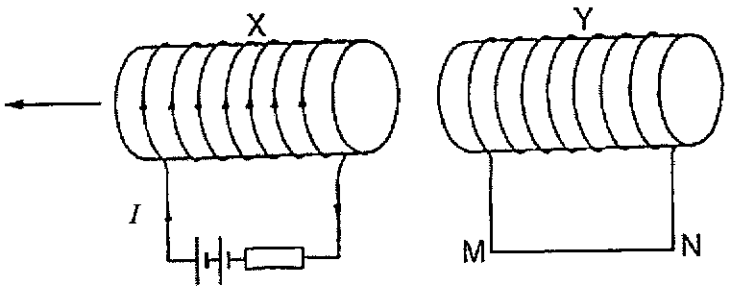
21 A horseshoe magnet rests on a top-pan balance with a wire XY suspended between the poles of the magnet. The wire is not in contact with the horseshoe magnet and is a part of the circuit as shown. When the switch is closed, the reading on the balance increases.



Which one of the following correctly gives the direction of the magnetic force on wire XY and the magnetic pole of face **A** of the horseshoe magnet?

	direction of magnetic force on wire XY	magnetic pole of face **A** of the horseshoe magnet
A	upwards	North pole
B	upwards	South pole
C	downwards	North pole
D	downwards	South pole

22 X and Y are solenoids wound on cardboard tubes, X carries constant current I as shown below and moves with constant speed away from Y among the common axis of the two tubes.

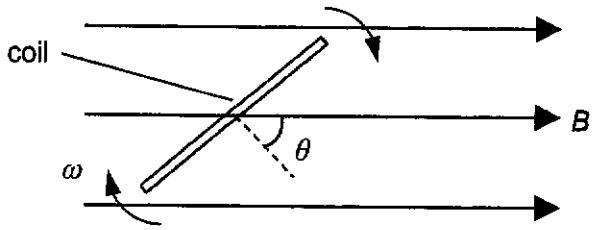


As a result of electromagnetic induction, a current will flow in the straight wire MN and there will be a force between X and Y.

Which one of the following correctly describes both the current and the force?

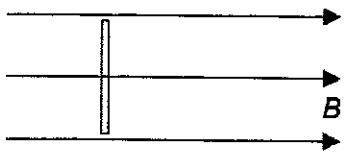
	nature and direction of current in straight wire MN	nature of force
A	diminishing, N to M	attraction
B	diminishing, M to N	repulsion
C	constant, N to M	repulsion
D	constant, M to N	attraction

23 A circular coil rotates with a constant angular velocity about a diametrical axis perpendicular to a uniform magnetic field. At which of the following orientations of the coil is the induced e.m.f. in the coil a maximum?

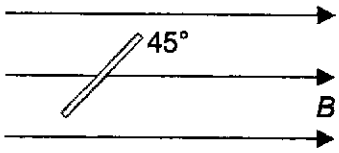


A

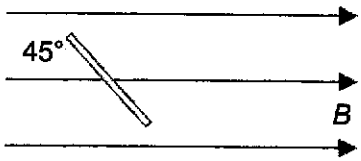
B



C



D



24 A power plant sends an average of 120 kW of electric power to a town by electrical cables. The cables have a total resistance of 3.0 Ω.

What is the power lost in the cables if the power was transmitted at a voltage of 6.0 kV?

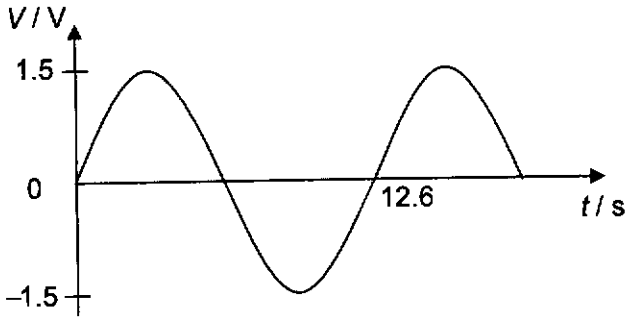
A 20 W

B 130 W

C 1200 W

D 1.2×10^7 W

25 The variation of an alternating voltage V with time t is shown in the graph below. Which expression best represents V in terms of t?



A $V = 1.5 \sin(0.499t)$

B $V = 1.5 \sin(2.01t)$

C $V = 3.0 \sin(0.249t)$

D $V = 1.5 \sin(12.6t)$

26 Which of the following statements about the photoelectric effect is true?

A Photoelectrons are not emitted as long as intensity of illumination is low.

B Doubling the frequency radiation will double the stopping potential.

C For a particular clean metal surface, there will be a minimum wavelength below which no emission of photoelectrons will occur.

D Increasing the intensity of incident monochromatic light increases the photo-current.

27 In an atom, an electron is moving with a speed of 2.0×10^6 m s^{-1} with an uncertainty of 0.005%.

What is the minimum uncertainty with which the location of the electron can be located?

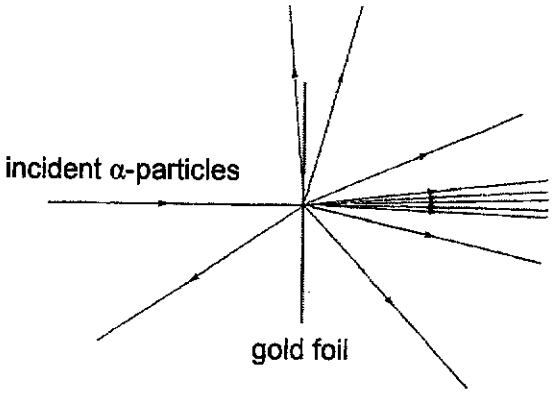
A 2.7×10^{-23} m

B 3.6×10^{-10} m

C 7.3×10^{-6} m

D 0.15 m

28 A thin gold foil is bombarded with α-particles as shown.

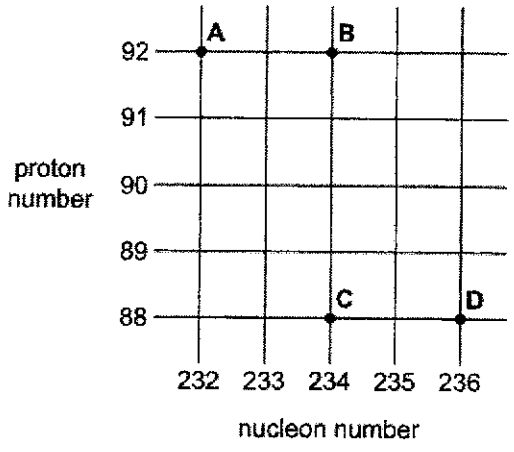


Which explanation best explains the corresponding observation?

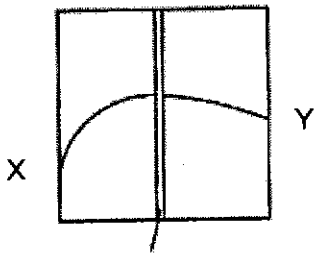
	Observation	Explanation
A	Most of the particles undergo little to no deflection.	The electrostatic repulsion acting on them is only along the direction of initial velocity.
B	Most of the particles undergo little to no deflection.	The mass of the nucleus is too little.
C	A tiny fraction of the particles is scattered at large angles.	The nucleus is mostly empty space.
D	A tiny fraction of the particles is scattered at large angles.	Bulk of the mass of the atom is concentrated in a very small positively charged region.

29 $^{234}_{90}Th$ decays by β^- emission into a daughter product which in turn decays by a β^- emission into a granddaughter product.

Which letter in the diagram represents the granddaughter product?



30 Radiation from a radioactive source enters an evacuated region in which there is a uniform magnetic field perpendicular to the plane of the diagram. This region is divided into two by a sheet of aluminium about 1 mm thick. The curved horizontal path followed by the radiation is shown in the diagram below.



Which of the following correctly describes the type of radiation and its point of entry?

	type of radiation	point of entry
A	alpha	X
B	alpha	Y
C	beta	X
D	beta	Y

END OF PAPER

2024 J2 Prelim P1

Q1	D	Q6	C	Q11	C	Q16	B	Q21	A	Q26	D
Q2	B	Q7	B	Q12	D	Q17	A	Q22	A	Q27	C
Q3	D	Q8	B	Q13	C	Q18	A	Q23	A	Q28	D
Q4	B	Q9	D	Q14	D	Q19	B	Q24	C	Q29	B
Q5	C	Q10	C	Q15	C	Q20	A	Q25	A	Q30	D

1. Ans: D

Option A is wrong. $F = ma \Rightarrow N \equiv \frac{kg}{ms^{-2}} = kg\ m\ s^{-2}$

Option B is wrong. $f = \frac{1}{T} \Rightarrow Hz \equiv s^{-1}$

Option C is wrong. $W = Fd \Rightarrow J \equiv N\ m$

Option D is correct. $F = BIL\sin\theta \Rightarrow B = \frac{F}{IL\sin\theta} \Rightarrow T \equiv \frac{kg\ m\ s^{-2}}{A\ m} = kg\ A^{-1}\ s^{-2}$

2. Ans: B

$$\frac{\text{distance travelled between 0 to 20 s}}{\text{distance travelled between 5 to 15 s}} = \frac{\text{distance travelled between 0 to 10 s}}{\text{distance travelled between 5 to 10 s}} = \frac{\text{area under v-t graph from 0 to 10 s}}{\text{area under v-t graph from 5 to 10 s}} = \frac{1}{0.75} = 1.3$$

3. Ans: D

Since the acceleration on the way up will be larger (air resistance and weight acting in the same direction) than the acceleration of the way down (air resistance and weight acting in opposite directions), the time taken on way up will be less.

4. Ans: B

$impulse = \frac{1}{2}(62)(0.21) = 6.51\ kg\ m\ s^{-1}$

$v = \frac{p}{m} = \frac{6.51}{0.150} = 43.4\ m\ s^{-1}$

5. Ans: C

$acceleration = \frac{(10)(9.81)}{10+12} = 4.459\ m\ s^{-2}$

By considering the 12 kg block, tension = resultant force
Hence,
$tension = (12)(4.459) = 53.5N$

6. Ans: C

$\tan(3.8^\circ) = \frac{centripetal\ acceleration}{9.81}$

$centripetal\ acceleration = 0.65158\ m\ s^{-2}$

$\frac{v^2}{r} = 0.65158\ m\ s^{-2}$

$r = \frac{\left(\frac{57.8}{3.6}\right)^2}{0.65158} = 396\ m$

7. Ans: B

For satellite in geostationary orbit, period = 24 hours = 86400 s

$\omega = \frac{2\pi}{86400}$

gravitational force provides for centripetal force

$\frac{GMm}{r^2} = mr\omega^2$

$r = \left(\frac{GM}{\omega^2}\right)^{\frac{1}{3}} = \left(\frac{(6.67\times10^{-11})(5.97\times10^{24})}{\left(\frac{2\pi}{86400}\right)^2}\right)^{\frac{1}{3}} = 4.2227\times10^7\ m$

$\omega = \frac{v}{r}$

$v = \omega r = \left(\frac{2\pi}{86400}\right)(4.2227\times10^7) = 3071\ m\ s^{-1}$

Alternatively, a shorter method would skip calculating the radius r.

$mr\omega^2 = \frac{GMm}{r^2}$

$r^3\omega^2 = GM$

$\times\omega^3$ *to both sides*

$(r^3\omega^3)(\omega^2) = GM\omega^3$

$v^3\omega^2 = GM\omega^3$

$v = \sqrt[3]{GM\omega} = \sqrt[3]{(6.67\times10^{-11})(5.97\times10^{24})\left(\frac{2\pi}{24\times3600}\right)} = 3071\ m\ s^{-1}$

8.	**Ans: B** increase in GPE of space probe = $GPE_{final} - GPE_{initial}$ $= -\frac{GMm}{r_{final}} - \left(-\frac{GMm}{r_{initial}}\right) = (6.67\times10^{-11})(1.30\times10^{22})(5500)\left(\frac{1}{1.19\times10^{7}} - \frac{1}{(1.19+0.24)\times10^{7}}\right)$ $= 6.73\times10^{8}\ J$
9.	**Ans: D** Statement D is not an essential assumption of kinetic theory of gas and can be derived from pressure of a gas
10.	**Ans: C** heat gained by ice in melting + heat gained by 20 g of water (total mass of water) = heat lost by 130 g of water $0.020 \times 3.3 \times 10^5 + [0.020 \times 4.2 \times 10^3 \times (T - 0)] = 0.130 \times 4.2 \times 10^3 \times (50 - T)$ $6.6 \times 10^3 + 84\ T = 27.3 \times 10^3 - 546\ T$ $630\ T = 20700$ $T = 33\ °C$ distractor: T = 38 °C (heat gained by melted ice water omitted)
11.	**Ans: C** Resonance occurs when the natural frequency of water molecules matches the frequency of the incident microwave. By changing its frequency, resonance will not occur, resulting in smaller amplitude of vibration of water molecules and therefore, lesser amount of energy absorbed by the food for it to be cooked. To warm up the food faster, the water molecules need to vibrate more to transfer more energy to the food. This can be achieved by increasing the amplitude of the incident microwave which will result in more energy being transferred from the microwave to the water molecules.
12.	**Ans: D** $I \propto 1/x^2$ $I_Q/I_P = (1/2)^2 = ¼$ $I_Q/I_P = (A_Q/A_P)^2 = (6/A_P^2) = 1/4$ $A_P = 12.0\ \mu m$
13.	**Ans: C** At P, acceleration is maximum, OS represents two periods, Kinetic energies at Q and R are the same
14.	**Ans: D** To obtain a steady interference with minimum intensity at point P, both the sources must be coherent and be out of phase by π radians. Both sources can be of the same amplitude. The next minimum produced at Q corresponds to a path difference of 1 m and this should be equal to one wavelength. Thus, the wavelength of the waves must be 1 m and not 2 m.

15.	**Ans: C** Separation between the horizontal threads is determined by the vertical bright fringes. $\tan\theta = \frac{0.0548/2}{2.00} = 0.0137$ $\theta = 0.7849^{o}$ $d\sin\theta = m\lambda$ $d\sin 0.7849^{o} = 2(685\times10^{-9})$ **d = 1.00 x 10^{-4} m = 0.100 mm.** For comparison, the spacing of the vertical threads is determined by the horizontal bright fringes: $d\sin 0.7849^{o} = 1(685\times10^{-9})$ d = 5.00 x 10^{-6} m = 0.0500 mm.
16.	**Ans: B** Initially, since the oil droplet drops with a reduced acceleration, it means the electric force due to the two metal plates is acting in the opposite direction. $$W - F_E = ma$$ Subsequently, when the polarity is reversed, we have $$W + F_E = 7ma$$ Thus by subtracting the first expression from the second $$2F_E = 6ma$$ $$2\frac{qV}{x} = 6ma$$ $$q = \frac{3max}{V}$$
17.	**Ans: A** The electric field is directed upwards in order to produce an upward electric force to balance the downwards weight. Therefore, the lower plate will be at higher potential and upper plate at lower potential. Since the particle is positively charged, when it moves towards the upper plate (lower potential), its electric potential energy will decrease.
18.	**Ans: A** For NTC thermistor, as current increases, the amount of heat generated increases and the equilibrium temperature T increases. As T increases, bonded electrons break free from bonds, increasing the number of 'mobile charge carriers', hence decreasing resistance. Since resistance is the ratio of V to I, the graph should show an increasing ratio of I to V.

19. **Ans: B**

effective resistance of the outer most loop $= R\left(\frac{3\times1}{3+1}\right) = 0.75R$

effective resistance across XY $= R(0.75+1+1) = 2.75R$

20. **Ans: A**

magnetic flux density at centre of coil Q, $B_Q = \frac{\mu_0 N I_Q}{2r} = \frac{\mu_0 I_Q}{2r}$

magnetic flux density at a distance $2r$ from wire P at centre of coil Q, $B_P = \frac{\mu_0 I_P}{2\pi d} = \frac{\mu_0 I_P}{2\pi(2r)}$

For the resultant magnetic field to be zero at the centre of coil Q,
B_Q and B_P a the centre must be equal in magnitude and opposite in direction.

$$B_Q = B_P$$

$$\frac{\mu_0 I_Q}{2r} = \frac{\mu_0 I_P}{2\pi(2r)}$$

$$I_Q = \frac{I_P}{2\pi}$$

$$I_P = 2\pi I_Q$$

Since B_Q is out of the page at the centre of coil Q, B_P must be into the page at the centre. Hence direction of current in wire P flows to the right.

21. **Ans: A**

Since the reading on the balance increased, there must be a downward force acting on the horseshoe magnet and an upward force on the wire according to Newton's 3rd law.

Using Fleming's left hand rule, since magnetic force on wire is upwards and current is from Y to X, the magnetic field must be from A (North) to the opposite face (South)

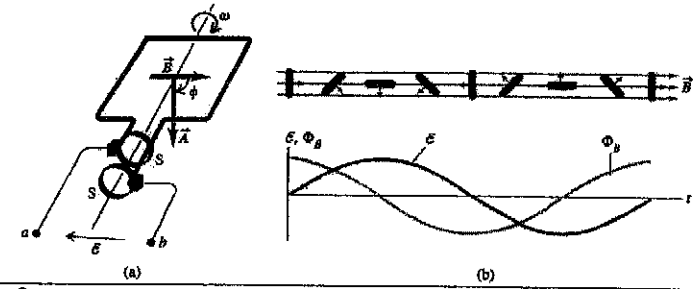
22. **Ans: A**

As solenoid X moves away from Y, Y will experience a decreasing magnetic flux through it, therefore, the direction of the induced e.m.f. will be so as to create a magnetic field in the same direction to oppose the decrease. By right hand grip rule, the current will flow from N to M.

Since the magnetic North pole for Y is facing the magnetic South pole for X, the force will be attractive in nature. This can also be explained by Lenz's law as the solenoid Y will need to be attracted so that the motion of solenoid X away from it can be opposed.

Lastly, the rate of change of magnetic flux linkage will be decreasing as the magnetic flux density will not be dropping at a linear rate but follows an inverse cube relationship. Therefore current is diminishing.

23. **Ans: A**



24. **Ans: C**

$current = \frac{P}{V} = \frac{120000}{6000} = 20\,A$

power dissipated in wire $= (20)^2(3.0) = 1200\,W$

25. **Ans: A**

$x = x_0 \sin(\omega t)$, *where* $\omega = \frac{2\pi}{T} = \frac{2\pi}{12.6}$ *and* $x_0 = 1.5$

26. **Ans: D**

Option A is incorrect:
Low intensity high frequency can result in photoelectric effect.

Option B is incorrect:

$$hf - \Phi = eV_s$$

$$h(2f) - \Phi \neq e(2V_s)$$

Option C is incorrect:
This option is correct for **min frequency** so should have been *max* wavelength.

Option D is **CORRECT**:
Increasing intensity for a monochromatic light will increase the number of photons incident.

27. **Ans: C**

Using $\Delta x \Delta p \geq h$,

$$\frac{\Delta v}{v} \times 100 = 0.005$$

$$\Delta v = \frac{0.005}{100} \times 2.0\times10^6 = 100 \text{ m s}^{-1}$$

$$\Delta x \geq \frac{h}{\Delta(mv)} = \frac{h}{m\Delta v} = \frac{6.63\times10^{-34}}{9.11\times10^{-31}\times100}$$

$$= 7.278\times10^{-6}$$

$$= 7.3\times10^{-6} \text{ m}$$

28.	**Ans: D**
29.	**Ans: B** A a β^- emission will only cause proton number to increase by 1 but nucleon number to stay the same.
30.	**Ans: D** Since the radiation can penetrate aluminium, it cannot be alpha radiation which is least penetrative of all the radiation can be stopped by a sheet of paper. Since there is a magnetic field perpendicular to the diagram, the path is curved due to the magnetic force. The radius of the path is smaller on the left of the aluminium sheet, this can be attributed due to the particle losing speed after passing through it. Hence, it must have entered from Y and exits from X.