Name:		Index Number:		Class:	

DUNMAN HIGH SCHOOL
Preliminary Examination
Year 6

H2 PHYSICS

9749/01

Paper 1 Multiple Choice Questions

26 September 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name at the top of this page.
Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.

There are **30** 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 on this booklet.

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

This document consists of **17** printed pages and **3** blank pages.

Data

speed of light in free space,	c =	3.00×10^{8} m s^{-1}
permeability of free space,	μ_o =	$4\pi \times 10^{-7}$ H m^{-1}
permittivity of free space,	ε_o =	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	=	ρgh
gravitational potential,	ϕ	=	$-Gm/r$
temperature,	T/K	=	T/°C + 273.15
pressure of an ideal gas,	p	=	$\frac{1}{3}\frac{Nm}{V}\langle c^2 \rangle$
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	=	$v_0 \cos \omega t$
		=	$\pm\omega\sqrt{x_o^2 - x^2}$
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	=	$\frac{Q}{4\pi\varepsilon_o r}$
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 denxity 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,	λ	=	$\frac{\ln 2}{t_{\frac{1}{2}}}$

1 Two students A and B carry out a series of experiments to determine the density of water. The results are tabulated below. The true value for the density of water is 1000 kg m^{-3}.

density of water, ρ / kg m^{-3}	
Student A	**Student B**
1002	998
998	998
997	998
1001	997
999	997

Which of the following statements below correctly compares the two sets of experimental results?

A Results of Student A is more accurate and more precise than those of Student B.

B Results of Student A is more accurate and less precise than those of Student B.

C Results of Student A is less accurate and more precise than those of Student B.

D Results of Student A is less accurate and less precise than those of Student B.

2 An object of mass 3.0 kg is falling vertically from rest. Air resistance R, in newtons, is given by the empirical equation

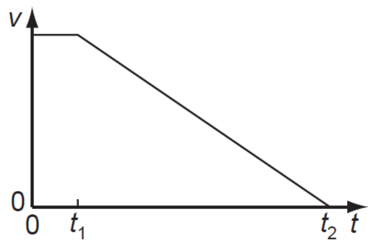
$$R = 0.60\,v$$

where v is the velocity in metres per second.

What is the maximum velocity of the object and what is the acceleration of the object when its velocity is 12 m s^{-1}?

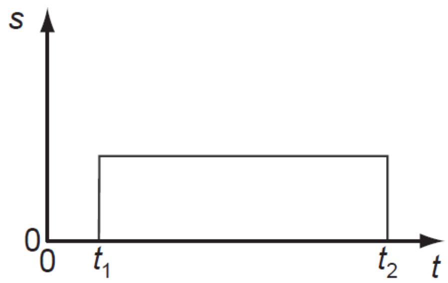
	maximum velocity / m s^{-1}	acceleration when v = 12 m s^{-1} / m s^{-2}
A	16	2.4
B	16	7.4
C	49	2.4
D	49	7.4

3 When a car driver sees a hazard ahead, she applies the brakes as soon as she can and brings the car to rest. The graph shows how the speed v of the car varies with time t after the hazard is seen.

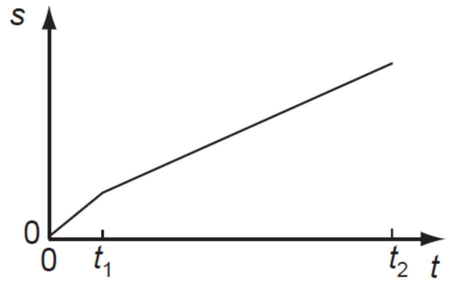


Which graph represents the variation with time t of the distance s travelled by the car after the hazard has been seen?

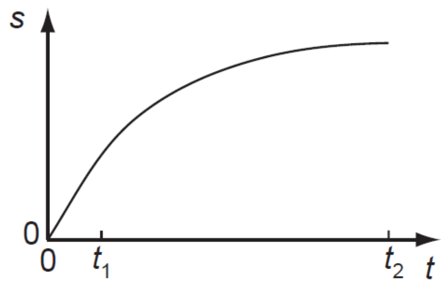
A



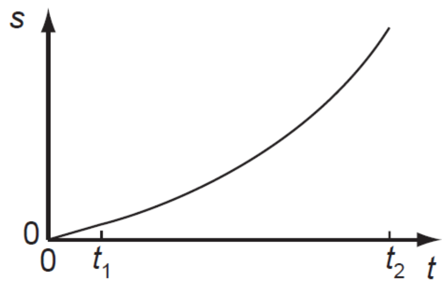
B



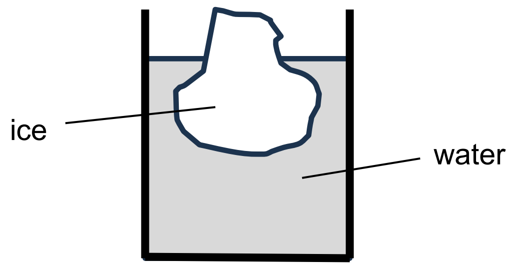
C



D



4 A lump of ice floats in water as shown.



Which statement is correct?

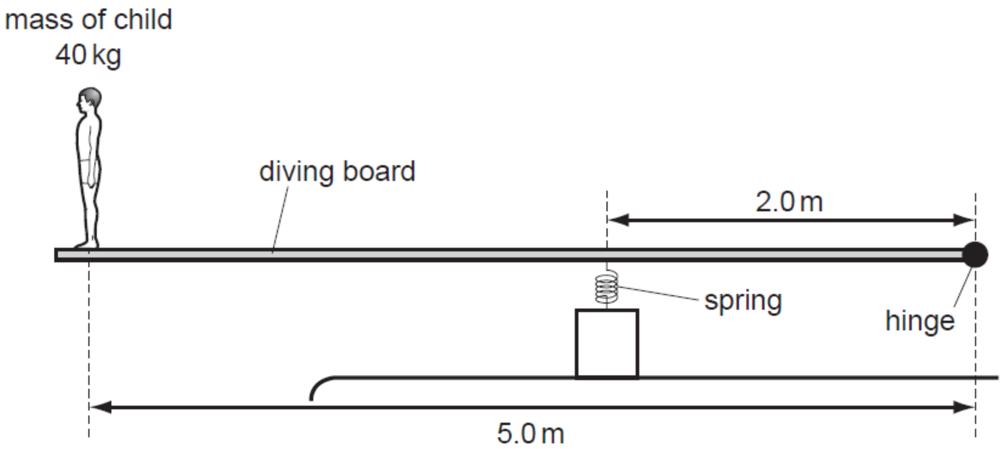
A The lump of ice floats because the area of its lower surface is larger than the area of its upper surface.

B The pressure difference between the lower and upper surface of the lump of ice gives rise to an upthrust equal to its weight.

C The ice has a greater density than the water.

D The mass of water displaced by the ice is equal to the upthrust.

5 A uniform diving board of length 5.0 m and mass 50 kg is hinged at one end and supported 2.0 m from this end by a spring of spring constant 10 kN m^{-1}. A child of mass 40 kg stands at the far end of the board.

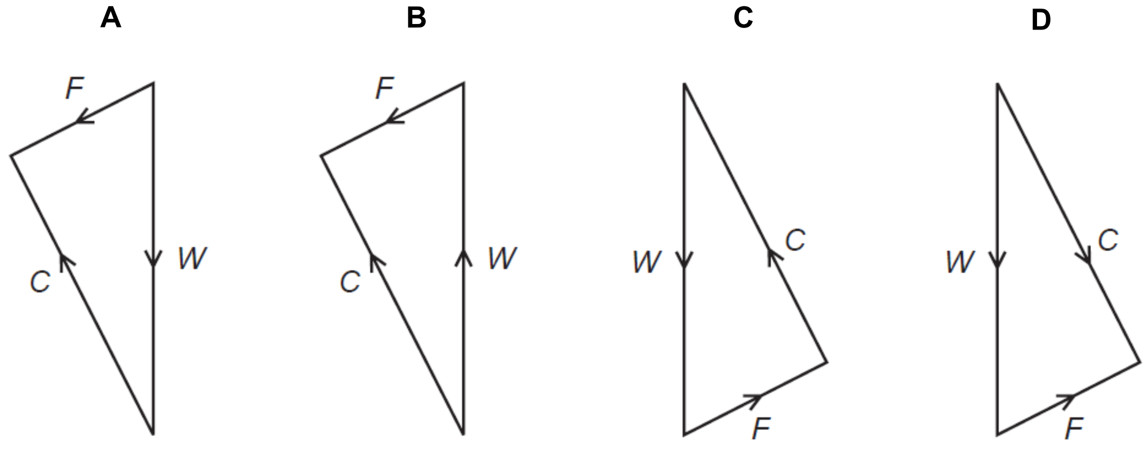


What is the extra compression of the spring caused by the child standing on the end of the board? (Assume the diving board remains horizontal with and without the child standing on it.)

A 1.0 cm **B** 6.1 cm **C** 9.8 cm **D** 16 cm

6 A sledge slides down a slope at a constant velocity. The three forces that act on the sledge are the normal contact force *C*, the weight *W* and a constant frictional force *F*.

Which diagram represents these forces acting on the sledge?



7 A piston in a gas supply pump has an area of 600 cm^2 and it moves a distance of 40 cm during one stroke. The pump moves the gas against a fixed pressure of 5000 Pa.

How much work is done by the piston during one stroke?

A 1.2×10^2 J **B** 1.2×10^4 J **C** 1.2×10^6 J **D** 1.2×10^8 J

8 An area of land is at a distance of 2.0 m below sea level. To prevent flooding, pumps are used to lift rainwater up to sea level.

What is the minimum pump output power required to lift 1.3×10^9 kg of rainwater per day?

A 15 kW **B** 30 kW **C** 150 kW **D** 300 kW

9 The minute hand of a large clock is 3.0 m long.

What is the speed at the tip of the minute hand?

A 1.7×10^{-3} m s^{-1} **B** 5.2×10^{-3} m s^{-1} **C** 0.10 m s^{-1} **D** 0.31 m s^{-1}

10 Two stars of masses M and $2M$ move in circular motion about their common centre of mass.

Which of the following statements is true?

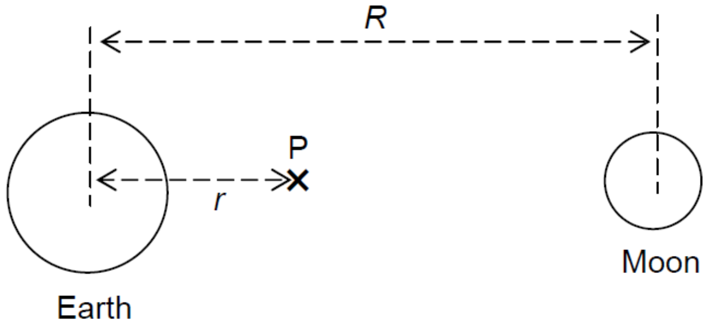
A Such a motion is not possible.

B Both stars move with the same speed.

C Both stars move with the same radius.

D Both stars move with the same angular velocity.

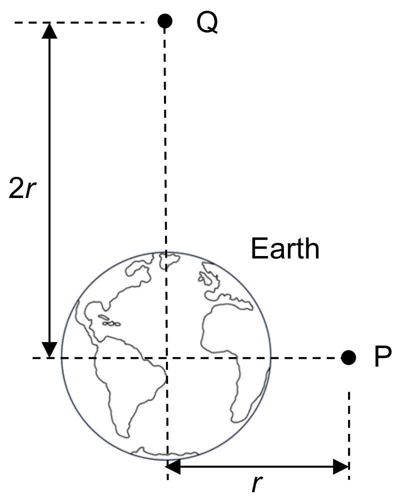
11 A spacecraft is launched from the surface of the Earth towards the Moon. In order to reach the Moon with the least effort possible, the spacecraft needs to reach a point P, beyond which it will move towards the Moon without any further input of energy. R is the distance between the Earth and the Moon, M_E is the mass of the Earth and M_M is the mass of the Moon.



What is the distance r, from the centre of the Earth to point P, in terms of R, M_E and M_M?

A $\dfrac{R}{\sqrt{\dfrac{M_E}{M_M}}}+1$ **B** $\dfrac{R}{\sqrt{\dfrac{M_M}{M_E}}+1}$ **C** $\left(\sqrt{\dfrac{M_M}{M_E}}\right)R$ **D** $\dfrac{M_M}{M_E}R$

12 P and Q are two points above Earth's surface at distances r and $2r$ respectively from the centre of the Earth.



The gravitational potential at P is –800 kJ kg^{-1}. When a 1.00 kg mass is taken from Q to P, what is the work done on the mass?

A –400 kJ **B** –200 kJ **C** 400 kJ **D** 800 kJ

13 When a graph of temperature in Kelvin against temperature in degrees Celsius is plotted, a linear graph is obtained.

What is the vertical intercept and gradient of the line?

	vertical intercept	gradient
A	−273.15	1
B	0	1 / 273.15
C	0	273.15
D	273.15	1

14 When a frictionless and well-insulated bicycle pump is used to pump up a basketball, the air in the ball becomes hotter than the surrounding air.

Which of the following statements best describes this observation?

A Thermal energy is supplied to the air during the pumping action, but the internal energy remains unchanged.

B Work is done on the air and since little thermal energy escapes, the internal energy increases.

C The internal energy of the air increases because thermal energy is supplied and work is done on the air.

D After compression, the internal energy decreases as thermal energy is lost to the surroundings.

15 Which of the following statements is true for an object undergoing very lightly damped oscillations?

A The period of oscillation increases over time.

B The total energy of the object decreases exponentially with time.

C The amplitude of the oscillation is proportional to the frequency.

D The damping force is always pointing towards the equilibrium point.

16 A speaker of a public address system operates at 2000 W and radiates sound uniformly in all directions.

If a typical adult ear has a surface area of 2.1×10^{-3} m^2 and assuming that the sound from the speaker strikes the surface of the ear perpendicularly, how much power is intercepted by the ear of an adult standing 78 m away from the speaker?

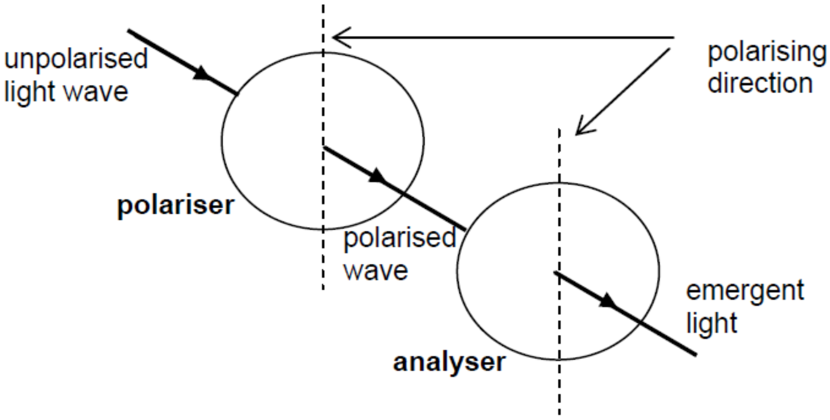
A 5.49×10^{-5} W

B 2.20×10^{-4} W

C 4.28×10^{-3} W

D 2.61×10^{-2} W

17 An unpolarised light wave is passed through two polaroids. Their polarising axes are aligned as shown.



The analyser could be rotated such that its polarising axis could be at different angles with respect to the polariser. Which of the following order of angles gives the correct order of increasing intensity of the emergent light?

A 0°, 90°, 135°

B 0°, 135°, 90°

C 90°, 0°, 135°

D 90°, 135°, 0°

18 A guitar string of length L stretched between two ends is plucked. It is known that the speed of transverse waves on the string is v and the speed of sound waves is c.

Which of the following expressions, in which n has integer values 1, 2, 3, … etc., will give the frequencies of all stationary waves which can be formed on the wire?

A $\dfrac{nv}{L}$ **B** $\dfrac{nv}{2L}$ **C** $\dfrac{2nc}{L}$ **D** $\dfrac{nc}{L}$

19 Monochromatic light is incident normally on a diffraction grating and first order diffraction is observed at an angle of 28.6°.

Which of the following statements is true?

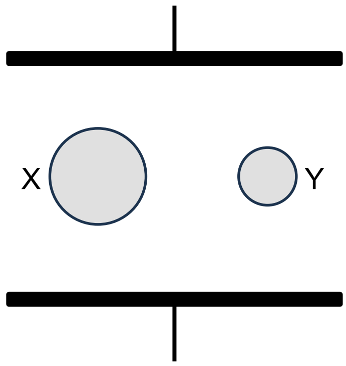
A The second order image is observed at an angle of 57.2° and there are only 6 intensity maxima formed.

B The second order image is observed at an angle of 57.2° and there are only 7 intensity maxima formed.

C The second order image is observed at an angle of 73.2° and there are only 4 intensity maxima formed.

D The second order image is observed at an angle of 73.2° and there are only 5 intensity maxima formed.

20 The diagram shows two unequally charged spheres X and Y of masses 2m and m respectively. They are kept stationary by the application of a potential difference between two parallel plates.



If the plates are moved closer together, what is the subsequent motion of the two charges?

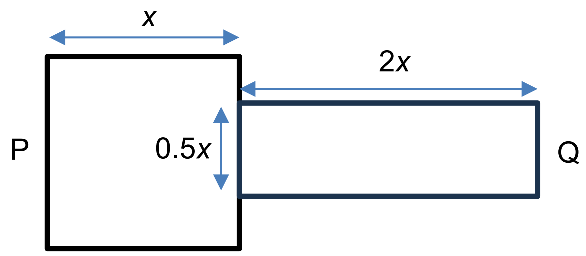
A Both X and Y will move upward with the same acceleration.

B Both X and Y will move upward but X will have a larger acceleration than Y.

C Both X and Y will move downward with the same acceleration.

D Both X and Y will move downward but X will have a larger acceleration than Y.

21 A thin square sheet of metal of uniform thickness and of side x has a resistance of 4.0 Ω measured between opposite edges. It is connected to another sheet of the same metal of the same thickness but of length $2x$ and width $0.5x$.

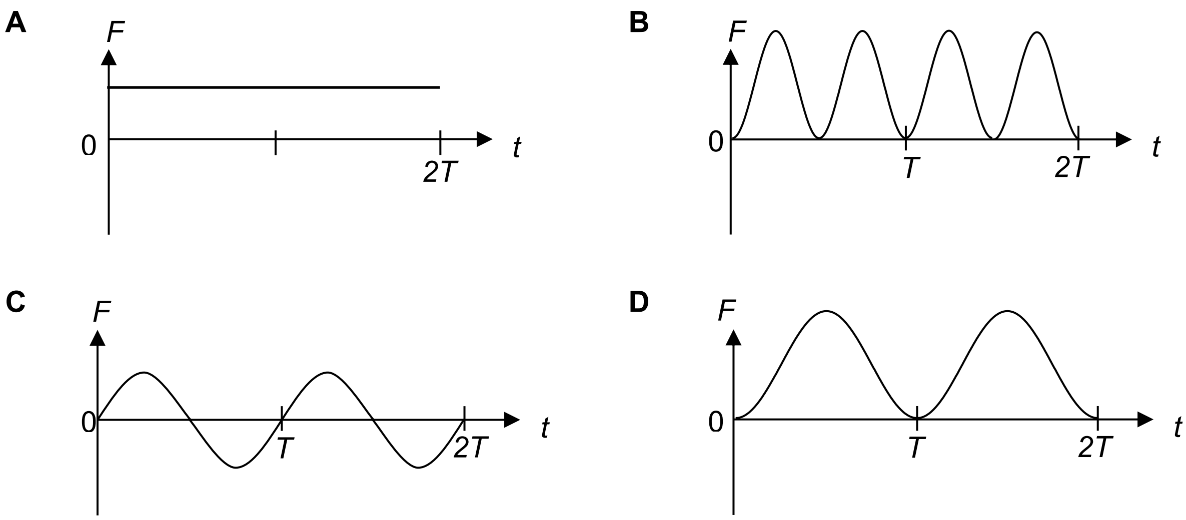


What is the resistance between edges P and Q?

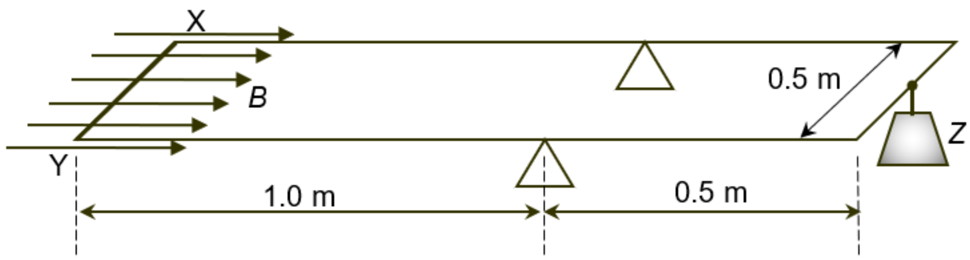
A 8 Ω **B** 12 Ω **C** 16 Ω **D** 20 Ω

22 Two parallel conductors carry equal sinusoidal alternating currents which are in phase. The periods of the alternating currents are T.

Which of the following graphs shows how F, the mutual force of attraction varies with time t?



23 A 1.5 m by 0.5 m light and rigid rectangular conducting frame is pivoted along its longer sides with a weight *Z* hung on one shorter side as shown. A uniform horizontal magnetic field *B* of flux density 0.050 T is applied at right-angles to the section XY of the frame.

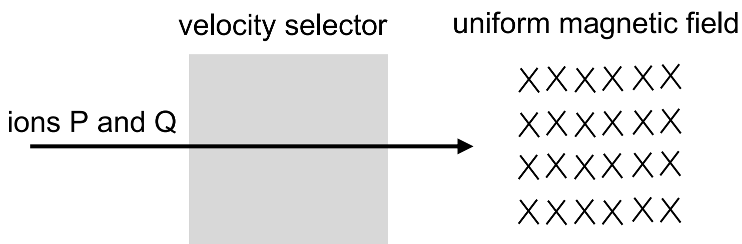


When a current passes through the section XY of the frame, which combination of the magnitude and direction of current flowing in section XY, and the weight *Z* makes the frame horizontal?

	magnitude of current in section XY	direction of current in section XY	*Z* / N
A	1.96 A	from X to Y	0.049
B	1.96 A	from Y to X	0.098
C	3.92 A	from X to Y	0.196
D	3.92 A	from Y to X	0.098

24 Two ions P and Q pass through a velocity selector un-deviated. Ion P has 2 times the charge and 1.5 times the mass of ion Q.

They then enter a region of uniform magnetic field where P travels in a circular arc of radius 3.7 cm.



What is the radius of the circular arc travelled by ion Q?

A 1.2 cm　　**B** 2.8 cm　　**C** 4.9 cm　　**D** 11 cm

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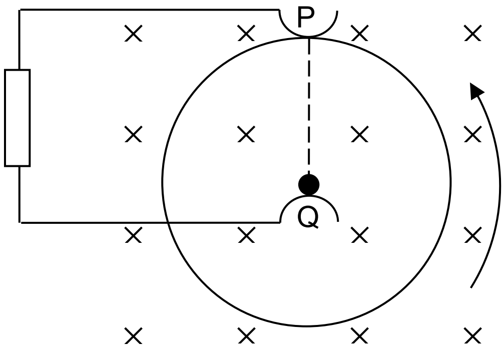
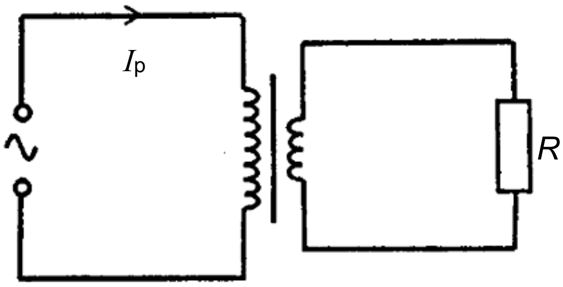
25 The diagram shows a metal disc rotating anticlockwise in a uniform magnetic field.



Which of the following describes the direction of current along radius PQ and the potential of P with respect to Q?

	direction of current along radius PQ	potential of P with respect to Q
A	P to Q	lower
B	Q to P	lower
C	Q to P	higher
D	P to Q	higher

26 An ideal transformer is used to step down the a.c. voltage supply to a resistive load *R*. If the number of turns in the primary coil is doubled, what is the new current in the primary coil?



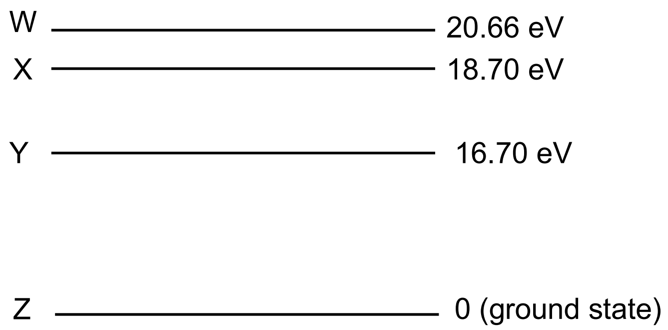
A Twice the original current in the primary coil.

B Same as the original current in the primary coil.

C Half the original current in the primary coil.

D One quarter of the original current in the primary coil.

27 Some of the electron energy levels for neon in a helium-neon laser are shown.



Which energy change for electrons results in laser light of wavelength 633 nm?

A W → X **B** W → Y **C** W → Z **D** X → Y

28 A proton has a kinetic energy of 1.00 MeV.

If its momentum is measured with an uncertainty of 1.00%, what is the minimum uncertainty in its position?

A 5.64×10^{-14} m
B 9.08×10^{-14} m
C 2.87×10^{-12} m
D 9.77×10^{-10} m

29 In order to detect a leak in a water-pipe buried 0.4 m below a soccer field, which of the following radioactive isotope should be added to the water?

	emitter	half-life
A	β	a few hours
B	α	a few hours
C	β	several years
D	α	several years

30 Two deuterium nuclei fuse together to form a Helium-3 nucleus, with the release of a neutron. The reaction is represented by

$$ {}^{2}_{1}\mathrm{H} + {}^{2}_{1}\mathrm{H} \rightarrow {}^{3}_{2}\mathrm{He} + {}^{1}_{0}\mathrm{n} + \text{energy} $$

The binding energies per nucleon are:

for ${}^{2}_{1}\mathrm{H}$ 1.09 MeV,
for ${}^{3}_{2}\mathrm{He}$ 2.54 MeV.

How much energy is released in this reaction?

A 0.36 MeV **B** 1.45 MeV **C** 3.26 MeV **D** 5.44 MeV

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