IB · DP · Physics

40 mins 40 questions

Practice Paper 1

Scan here to return to the course
or visit savemyexams.com

Total Marks /40

1 In an experiment investigating the electrolysis of copper, a student sets out to find the electrochemical equivalent, *Z*.

The electrochemical equivalent of a substance is the amount of substance deposited on a cathode per Coulomb of charge.

This can be determined using the equation:

$$Z = \frac{m_1 - m_2}{It}$$

Where:

- Mass of cathode before passing current, m_1 = (54.39 ± 0.01) × 10^{-3} kg
- Mass of cathode after passing current, m_2 = (52.06 ± 0.01) × 10^{-3} kg
- Current, I = 3.00 ± 1 A
- Time, t = 4800 ± 100 s

What is the largest possible value of *Z* from these readings?

A. $\frac{233}{940}$ × 10^{-6} kg C^{-1}

B. $\frac{231}{940}$ × 10^{-6} kg C^{-1}

C. $\frac{235}{940}$ × 10^{-6} kg C^{-1}

D. $\frac{253}{720}$ × 10^{-6} kg C^{-1}

(1 mark)

2 What does the gradient of a displacement-time graph represent?

A. Distance

B. Speed

C. Velocity

D. Acceleration

(1 mark)

3 A student throws a stone with velocity 3 m s^{-1} at an angle θ to the vertical from the surface of a lake. Air resistance can be ignored. The acceleration due to gravity is g.

What is the angle θ if the stone hits the surface of the lake 15 m from the student after 10 s?

You may use the fact that sin 30 = 0.5.

A. 90°

B. 45°

C. 60°

D. 30°

(1 mark)

4 An object is released from a stationary hot air balloon at height *s* above the ground. Air resistance is negligible.

An identical object is released at the same height above the ground from another balloon that is rising at a constant speed.

Which of the following does not increase for the object released from the rising balloon?

A. The time taken for it to reach the ground

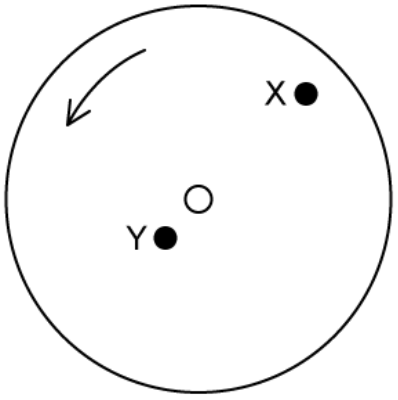
B. The distance through which it falls

C. Its acceleration

D. The speed with which it hits the ground

(1 mark)

5 A horizontal disc rotates uniformly at a constant angular velocity about a central axis normal to the plane of the disc.



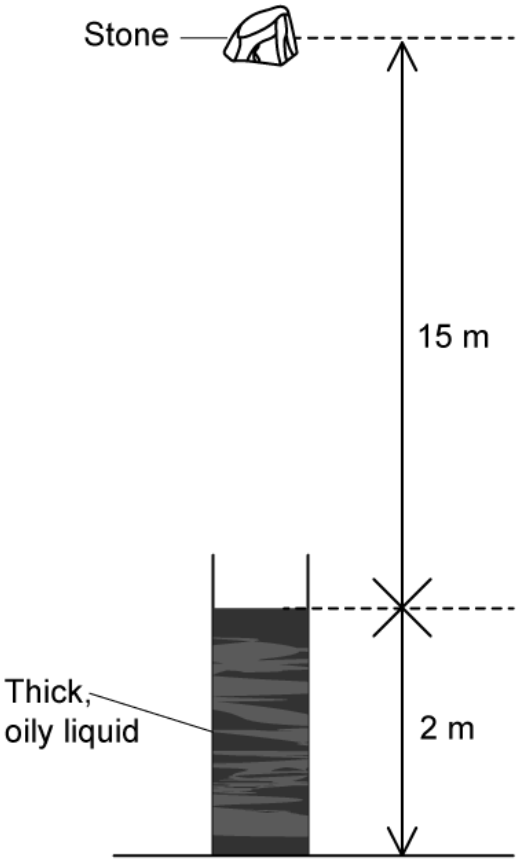
Point X is on a distance *3L* from the centre of the disc. Point *Y* is a distance *L* from the centre of the disc. Point Y has a linear speed *v* and a centripetal acceleration *a*.

What is the linear speed and centripetal acceleration of point X?

	Linear Speed of X	Acceleration of X
A.	3*v*	*a*
B.	*v*	*a*
C.	3*v*	3*a*
D.	2*v*	2*a*

(1 mark)

6 A stone of mass *m* kg is dropped from a height of 15 m above the surface of a thick, oily liquid. The surface of the liquid is 2 m above the ground.



The resistive force acting on the stone as it falls through the liquid is equivalent to 3*mg* N. Assume the acceleration due to free fall g = 10 m s^{-2} and air resistance is negligible.

What is the speed of the stone when it has travelled x m through the liquid?

A. $2\sqrt{5(15 - 2x)}$ m s^{-1}

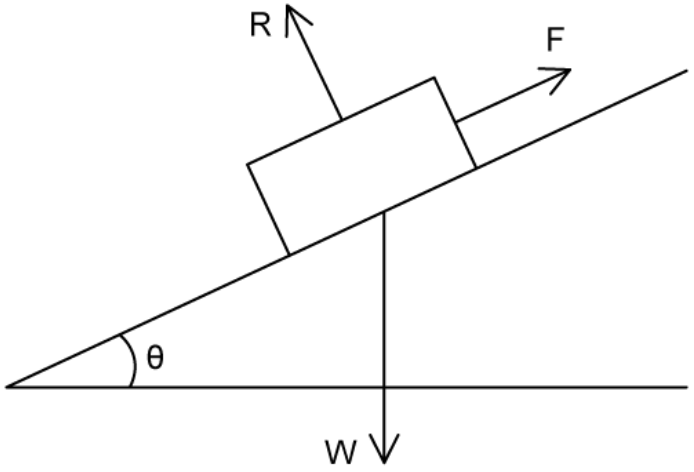
B. $10m(15 - 2x)$ m s^{-1}

C. $2\sqrt{5(15 - x)}$ m s^{-1}

D. $2\sqrt{15(5 - x)}$ m s^{-1}

(1 mark)

7 A rectangular object sits at rest on a plane inclined at angle to the horizontal.



R is the normal force, W is the weight and F is friction.

Which row correctly labels R and F in terms of mass m and acceleration due to gravity g.

	R	F
A.	mg	mg
B.	$mg \cos \theta$	0
C.	$mg \sin \theta$	$mg \cos \theta$
D.	$mg \cos \theta$	$mg \sin \theta$

(1 mark)

8 The strength of intermolecular forces varies between in the different states of matter.

What is the order from highest to lowest strength of intermolecular forces?

A. solid > liquid > gas

B. solid > gas > liquid

C. liquid > gas > solid

D. gas > liquid > solid

(1 mark)

9 Under what conditions of temperature and pressure will the behaviour of a real gas approximate to the behaviour of an ideal gas?

A. Low temperature and low pressure

B. Low temperature and high pressure

C. High temperature and low pressure

D. High temperature and high pressure

(1 mark)

10 Air consists of 0.9% argon molecules and 0.002% neon molecules. Argon has a relative molecular mass of 40 and neon a relative molecular mass of 20.

What is the ratio of the root mean square speed of argon to that of neon molecules in the air?

A. $\sqrt{\frac{1}{2}}$

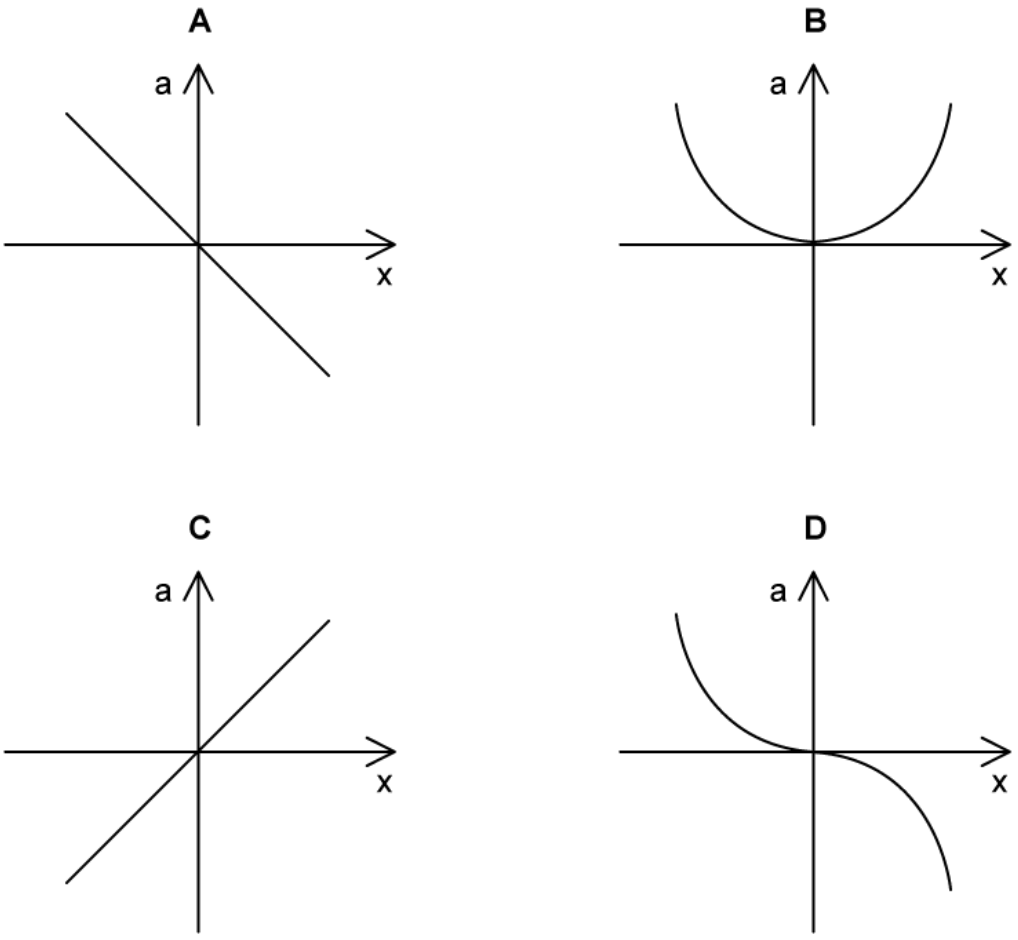
B. $\sqrt{\frac{1}{4}}$

C. $\sqrt{\frac{1}{8}}$

D. $\sqrt{\frac{2}{9}}$

(1 mark)

11 Which graph correctly represents the relationship between acceleration, *a*, and displacement, *x*, in simple harmonic motion?



(1 mark)

12 Which line identifies quantities which always have opposite directions during simple harmonic motion?

A. Acceleration and displacement

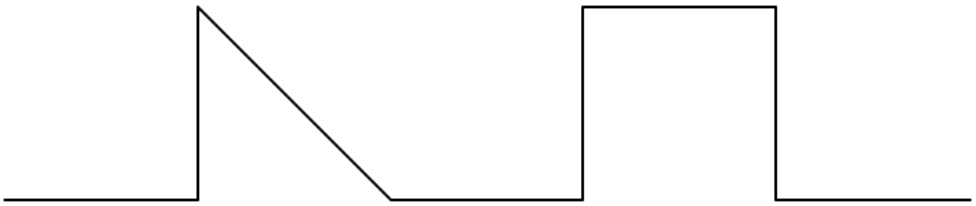
B. Acceleration and velocity

C. Velocity and restoring force

D. Acceleration and restoring force

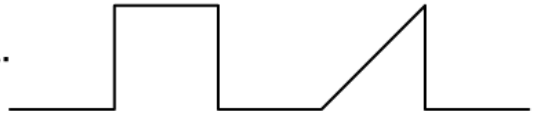
(1 mark)

13 Two pulses are travelling towards each other.

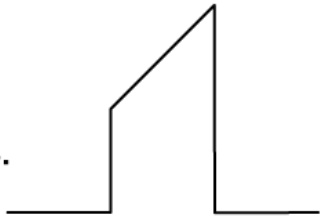


What is a possible shape observed when the pulses undergo superposition?

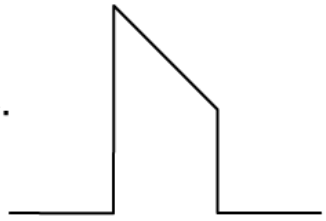
A.



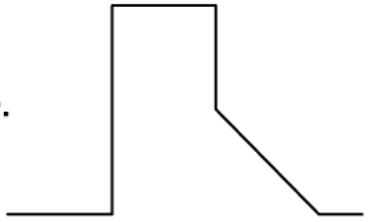
B.



C.



D.



(1 mark)

14 Which of the following options will alter the frequency of a wave?

A. Reflection

B. Refraction

C. Diffraction

D. None of the above

(1 mark)

15 Two waves from individual point sources meet at a point X. Which of the following conditions is necessary for interference to be observed at point X?

A. Waves of equal amplitude

B. Waves of equal wavelength

C. A constant phase difference between the waves

D. The waves must be electromagnetic

(1 mark)

16 A strain gauge is a device which measure force. An applied tension on a thin wire of known resistance changes the length and cross-sectional area so that the value of the resistance is changed in a predictable way (assuming that volume remains constant).

When the length of the wire is increased by 5 % what will be the effect on the resistance?

A. − 5 %

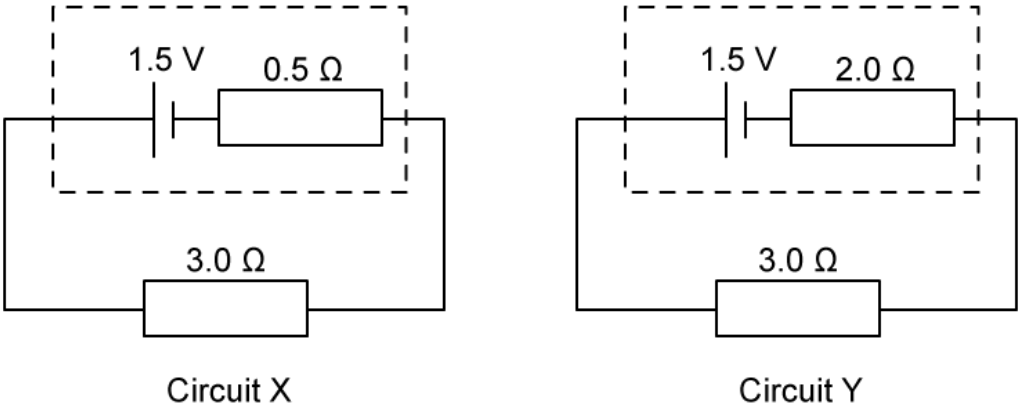
B. + 5 %

C. − 10 %

D. + 10 %

(1 mark)

17 In the two circuits shown, only the internal resistances differ.

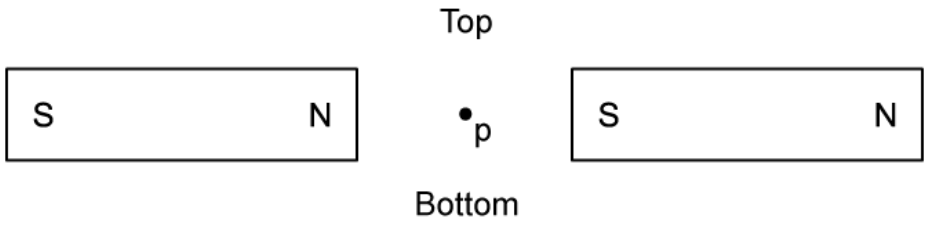


Which row in the table below correctly describes the potential difference across and power dissipated by the 3 Ω resistor?

	potential difference across the 3 Ω resistor (V)	**power dissipated in the 3 Ω resistor (W)**
A.	Greater in X than in Y	Lesser in X than in Y
B.	Greater in X than in Y	Greater in X than in Y
C.	Lesser in X than in Y	Lesser in X than in Y
D.	Lesser in X than in Y	Greater in X than in Y

(1 mark)

18 A proton *p* is at downwards from top to bottom between the poles of two horizontal magnets.



The magnetic force on the proton is:

A. From top to bottom

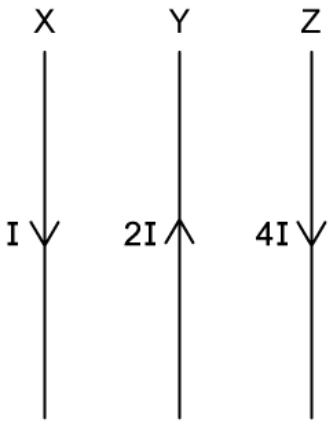
B. From left to right

C. zero

D. Out of the page

(1 mark)

19 Three long parallel straight wires, X, Y and Z, are equally separated and placed in the same plane in a vacuum. They carry a current of *I*, 2*I* and 4*I* respectively, as shown:



It is known that the magnetic flux density *B* at a distance *r* due to a long straight wire carrying current *I* is given by:

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

where μ_0 is the permeability of free space.

What is the force per unit length acting on wire X?

A. 0

B. $\frac{\mu_0 I^2}{\pi r}$ N m^{-1}

C. $\frac{\mu_0 I^2}{2\pi r}$ N m^{-1}

D. $\frac{\mu_0 I^2}{3\pi r}$ N m^{-1}

(1 mark)

20 Two samples P and Q of different radioactive isotopes have the same initial activity. Sample P has a third of the number of atoms as sample Q. The half-life of P is T seconds.

What is the half-life of sample Q?

A. $\frac{T}{3}$

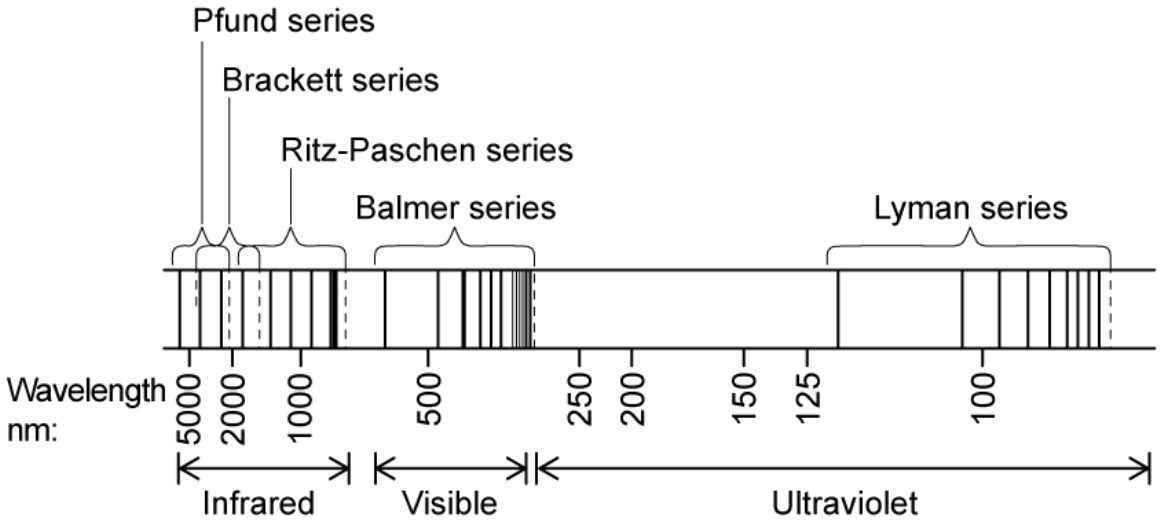
B. $\frac{T}{3\sqrt{2}}$

C. $3T$

D. $3\sqrt{2}T$

(1 mark)

21 A larger version of the hydrogen emission spectrum from the infrared to the ultraviolet region looks as follows:



Using information in the diagram, which hydrogen series corresponds to the highest energy photons being emitted?

A. Lyman series

B. Balmer series

C. Brackett series

D. Pfund series

(1 mark)

22 Which of the following statements correctly describes why quarks were first hypothesised?

A. To account for patterns in properties of elementary particles

B. To describe nuclear emission and absorption spectra

C. To account for the missing energy and momentum in beta decay

D. To explain the existence of isotopes

(1 mark)

23 Energy density is a property of a substance which is calculated by multiplying its specific energy with which quantity?

A. Volume

B. Mass

C. Volume × mass

D. $\frac{\text{Mass}}{\text{Volume}}$

(1 mark)

24 Diesel fuel has a specific energy of about 4.5×10^{7} J kg^{-1} and an energy density of close to 3.5×10^{10} J m^{-3}. Which value is closest to the density of diesel?

A. 1.2×10^{-3} kg m^{-3}

B. 800 kg m^{-3}

C. 3.7×10^{10} kg m^{-3}

D. 1.7×10^{18} kg m^{-3}

(1 mark)

25 The black body temperature of Venus is 90% of the black body temperature of Earth.

Which of the following correctly shows the ratio:

$$\frac{\textit{energy radiated per second per unit area on Venus}}{\textit{energy radiated per second per unit area on Earth}}$$

A. 0.7

B. 0.9

C. 1.0

D. 1.5

(1 mark)

26 A simple pendulum oscillates with a time period T near the surface of the Earth. The same pendulum is moved to the surface of the moon where the acceleration of free fall is 0.2 g. What is the best estimate for the value of T for the pendulum near the surface of the moon?

A. 0.2 T

B. 0.4 T

C. 1.4 T

D. 2.2 T

(1 mark)

27 A single slit diffraction pattern is performed several times using light of different colours, slits of different widths and different distances to the screen. Which change will decrease the width of the central peak?

A. Change the light source from red to blue

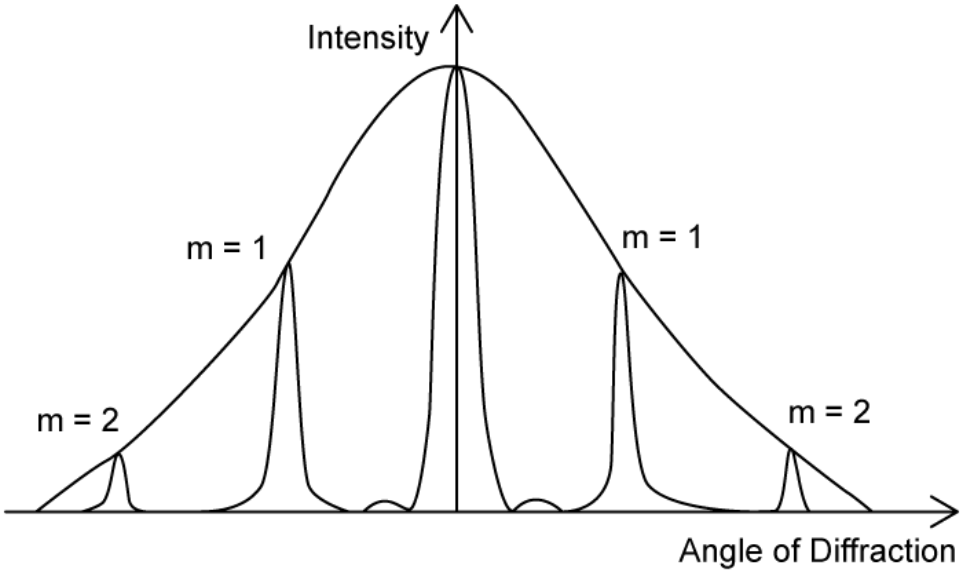
B. Change the light source from blue to red

C. Make the slit width narrower

D. Move the screen further away

(1 mark)

28 The graph shows the variation with diffraction angle of the intensity of light when monochromatic light is incident on a diffraction grating.



The number of slits is reduced to less than 20. The width and the separation of the slits remain the same.

Three possible changes to the pattern are:

I. The intensity of the primary maxima increases

II. The width of the primary maxima increases

III. Secondary maxima are seen between the primary maxima

Which of the possible changes are correct?

A. I and II only

B. I and III only

C. II and III only

D. I, II and III only

(1 mark)

29 A boat sits on a lake, and is hit by 4 waves every 10 s. As the boat starts to move in the same direction as the waves, exactly 2 waves from behind hit the boat every 10 s. The speed of the boat is 1.5 m s^{-1}.

What is the speed of the waves?

A. 1.5 m s^{-1}

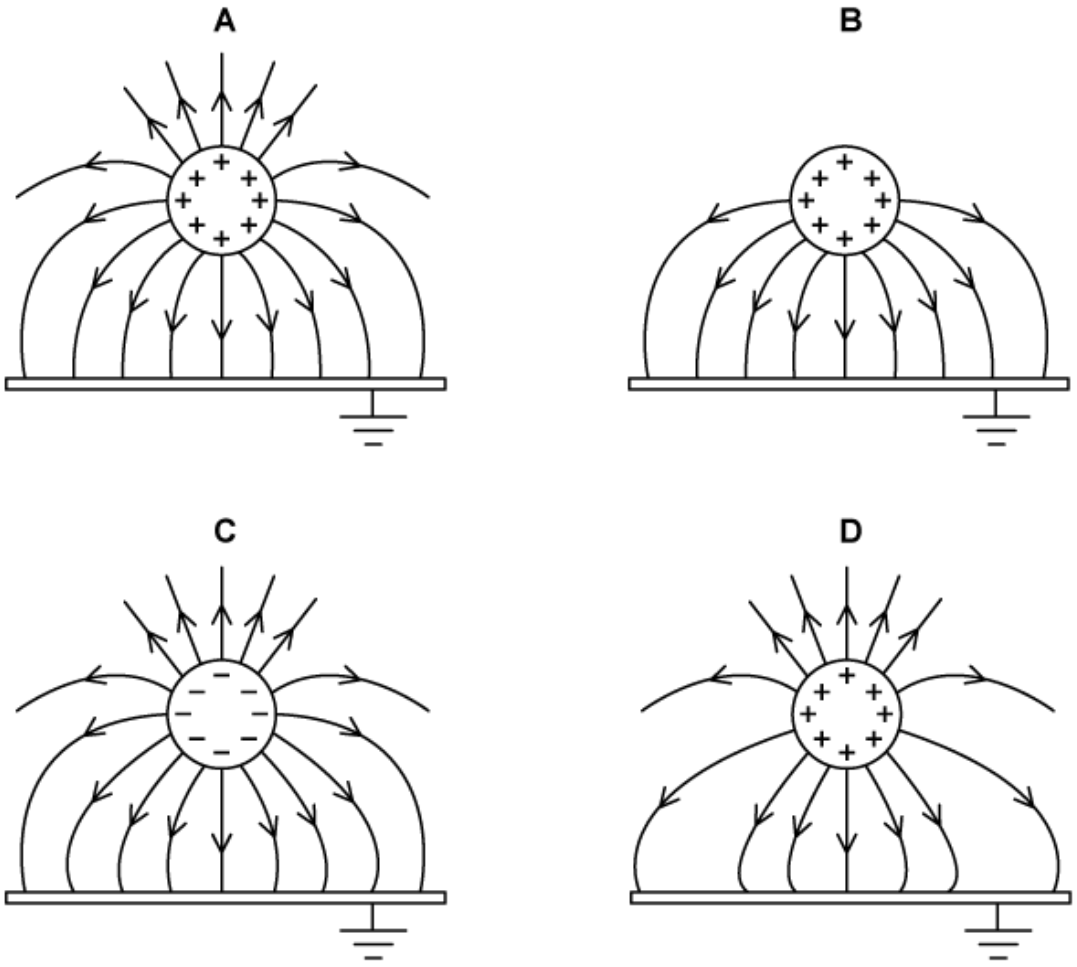
B. 3 m s^{-1}

C. 1500 m s^{-1}

D. 340 m s^{-1}

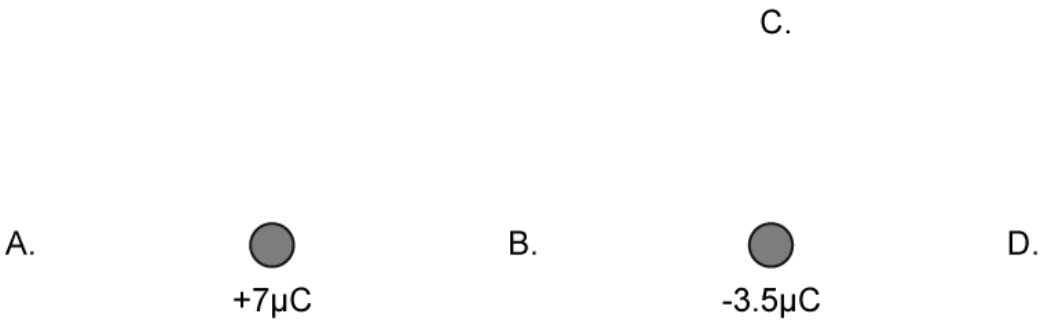
(1 mark)

30 What is the electric field pattern between a conducting sphere and an earthed metal plate?



(1 mark)

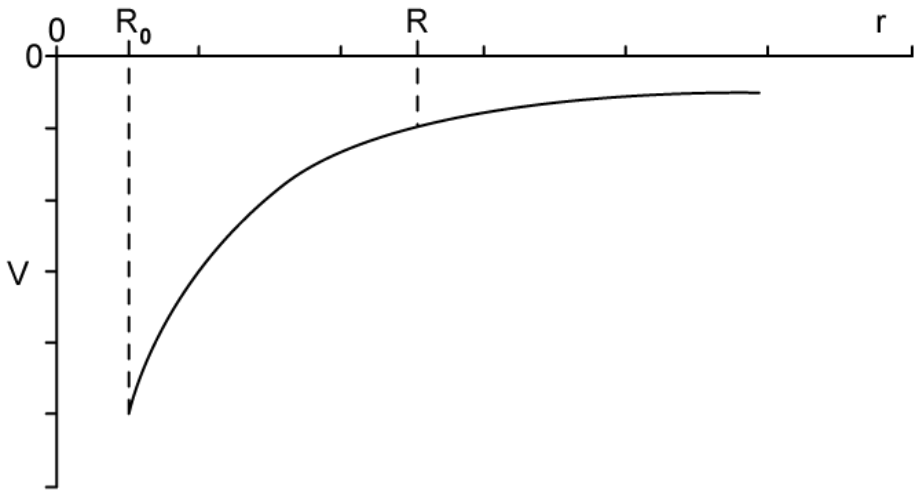
31 Two point charges are at rest as shown. Four positions, each of distance *r* from the nearest point charge, are marked in the image.



At which position is the electric field strength greatest?

(1 mark)

32 The graph shows the variation of gravitational potential V with distance r from the centre of a spherical planet of mass M and radius R_0.



Which statement best describes how to determine the gravitational field strength at a distance $r = R$ from the planet?

A. The area enclosed by the horizontal axis, the line $r = R_0$, the line $r = R$, and the curve

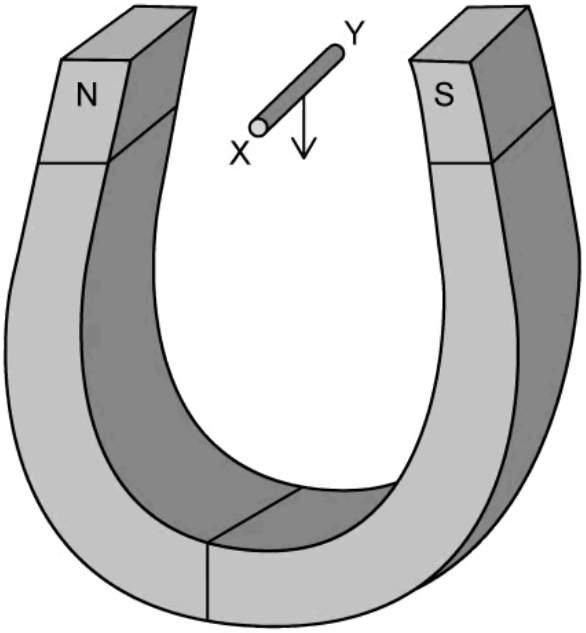
B. The gradient at the point $r = R$

C. The inverse of the gradient at the point $r = R$

D. The negative of the gradient at the point $r = R$

(1 mark)

33 A length of conducting wire XY is moved downwards through the poles of a horseshoe magnet.



This will change the ends of the wire so that compared to end Y of the wire, end X will have

A. More electrons

B. Fewer electrons

C. More protons

D. Fewer protons

(1 mark)

34 What is the maximum instantaneous power delivered by a sinusoidal ac power supply with rms voltage V supplying rms current $2I$?

A. IV

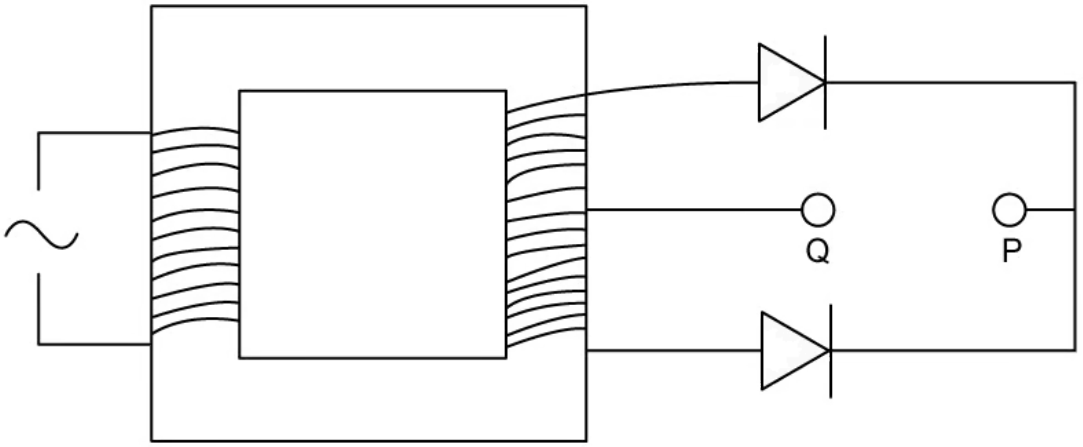
B. $2IV$

C. $4IV$

D. $\frac{2}{\sqrt{2}}IV$

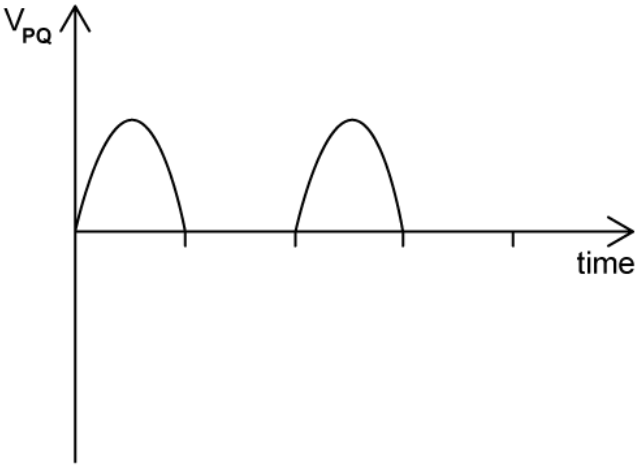
(1 mark)

35 The secondary coil of an ac transformer is connected to two diodes as shown.

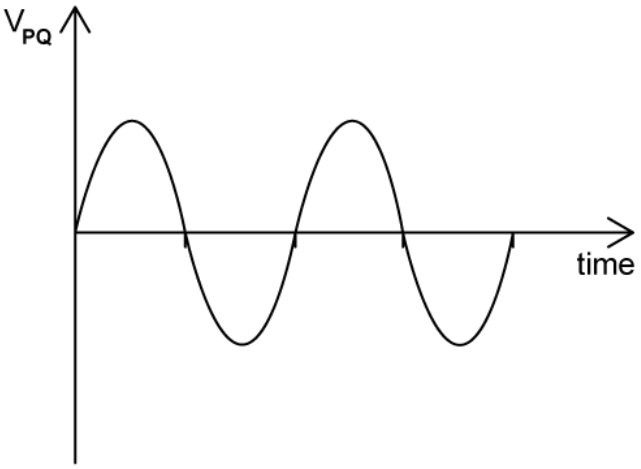


Which graph correctly shows the variation with time of the potential difference V_{PQ} between P and Q?

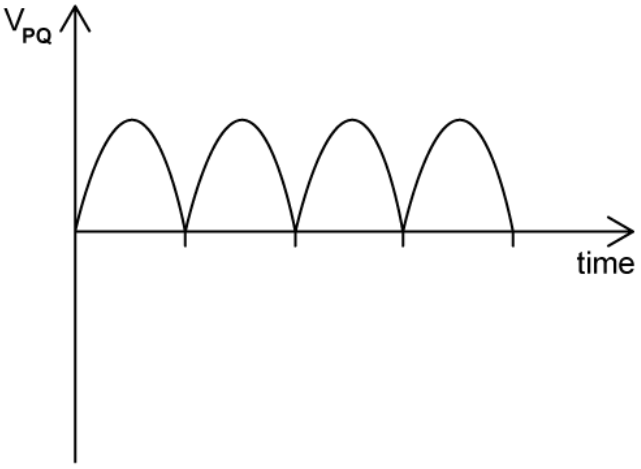
A.



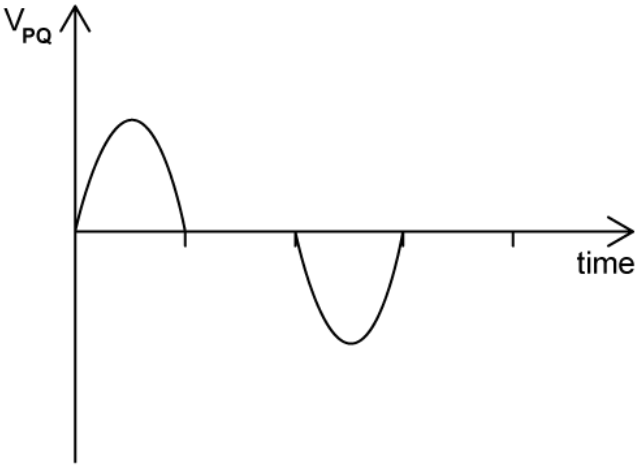
B.



C.



D.



(1 mark)

36 Which statement about the effect of dielectric materials on capacitance is incorrect?

A. The larger the opposing electric field from the polar molecules in the dielectric, the larger the permittivity

B. When the polar molecules in a dielectric align with the applied electric field from the plates they each produce their own electric field

C. The electric field from the polar molecules opposes the electric field from the plates, reducing the overall electric field

D. The dielectric material is an electrical conductor

(1 mark)

37 Consider the following statements regarding the Bohr model of the hydrogen atom:

I. The momentum of an electron is equal to the Planck constant divided by its de Broglie wavelength
II. The angular momentum of the atom is quantised
III. The energy levels are quantised

Which statements originate from the idea that the circumference of the orbit must be an integer number of the de Broglie wavelength?

A. I and II only

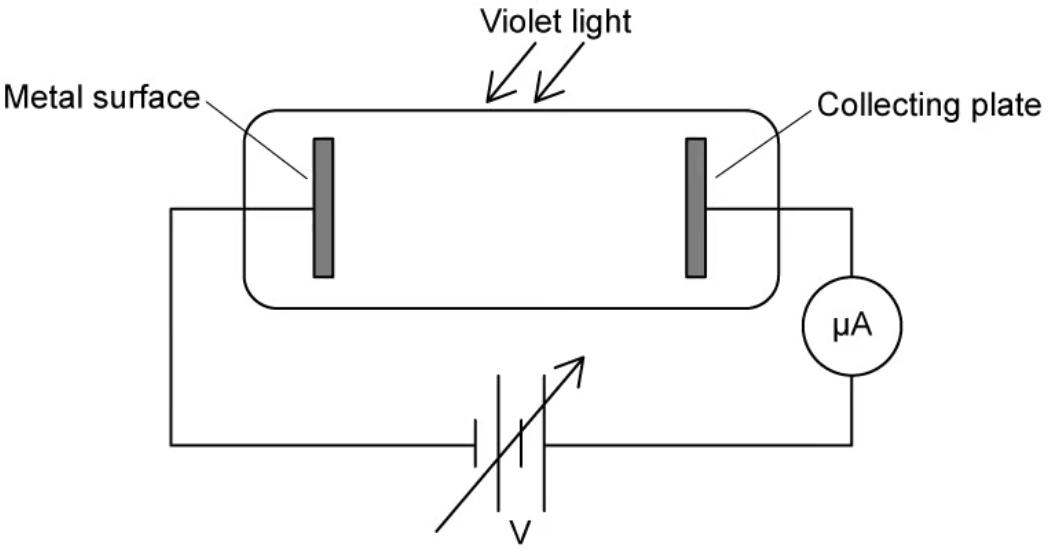
B. I and III only

C. II and III only

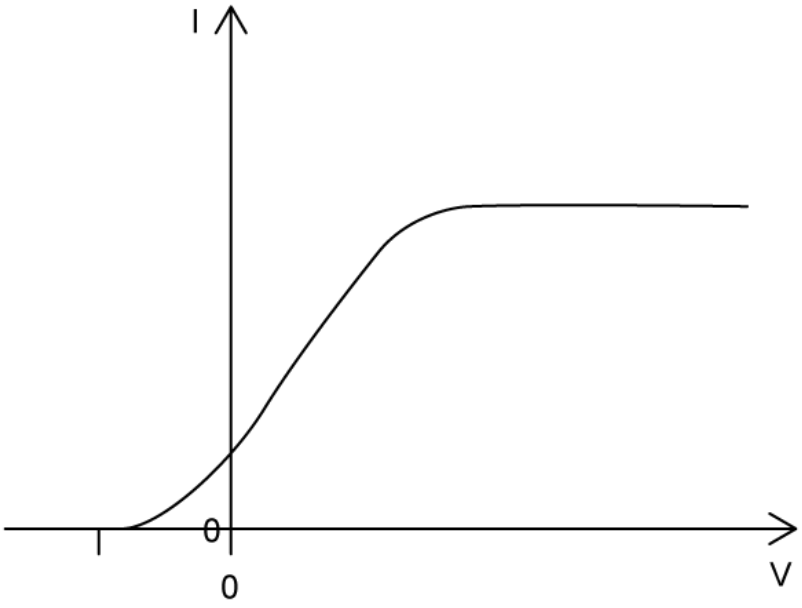
D. I, II and III

(1 mark)

38 Violet light is incident on a metal surface, producing photoelectrons.

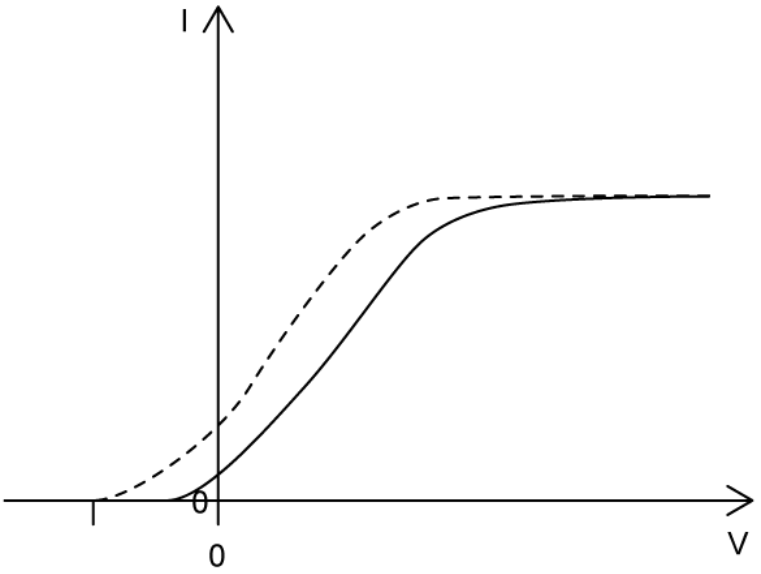


The variation of photocurrent *I* with potential difference *V* is shown.

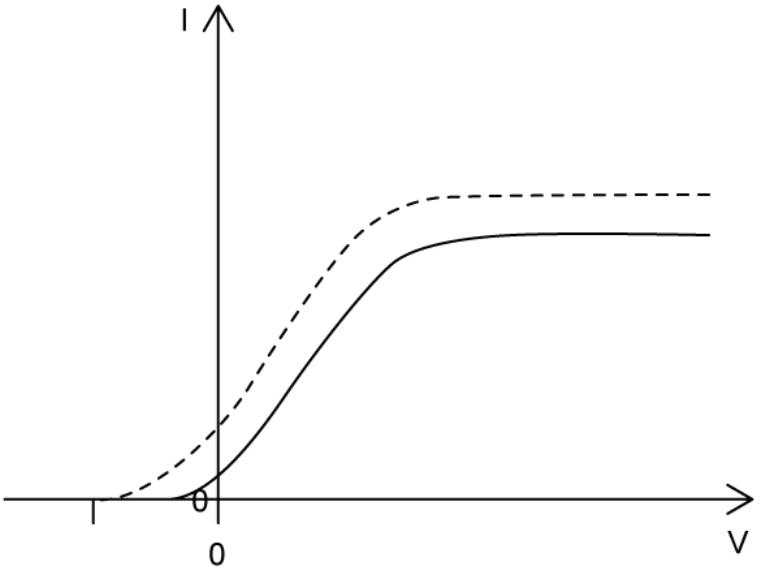


The light source is changed to red light of the same intensity as the violet light. Which graph shows the variation of photocurrent *I* with potential difference *V* for the red light? The results for the violet light are shown as a dashed line.

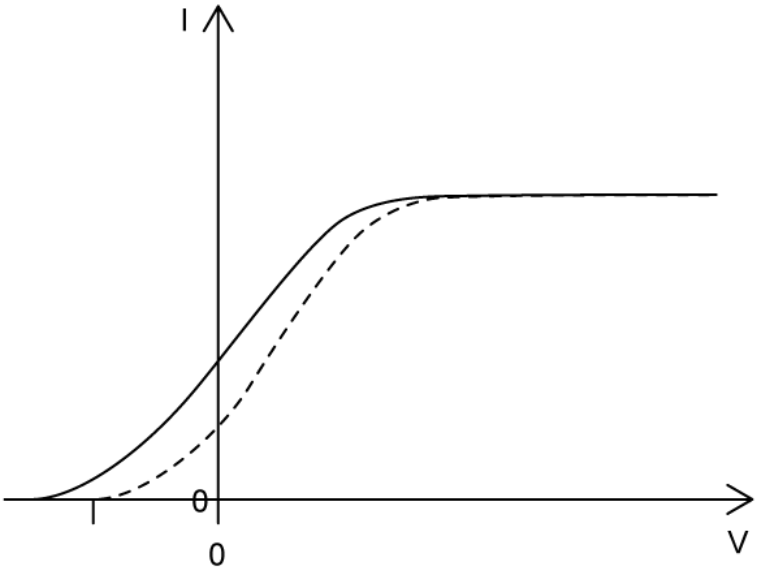
A.



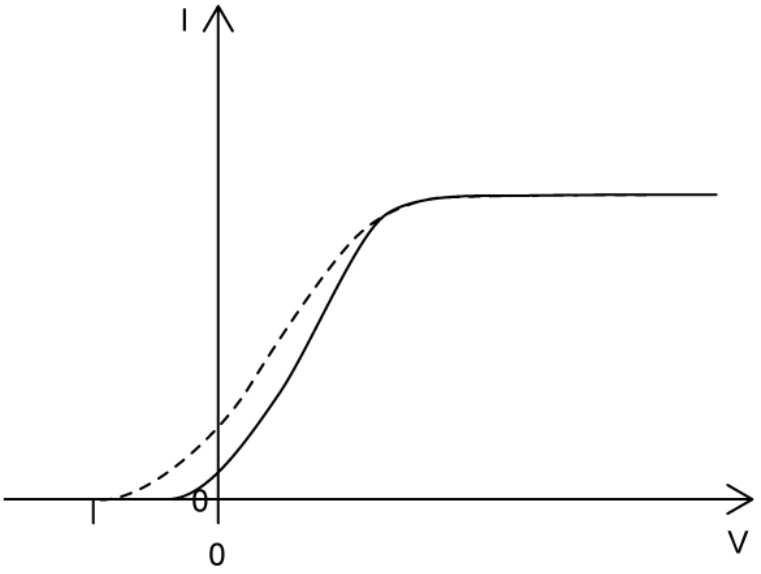
B.



C.



D.



(1 mark)

39 A pure sample of a radioactive nuclide has mass m, half-life $T_{1/2}$ and initial activity A_0.

Identify the half-life and initial activity of another sample which is otherwise identical but has mass 3m.

	Half-life	Initial activity
A.	$T_{1/2}$	A_0
B.	$3T_{1/2}$	$\frac{1}{3}A_0$
C.	$T_{1/2}$	$3A_0$
D.	$3T_{1/2}$	$3A_0$

(1 mark)

40 The diameter of Iridium-192 ($^{192}_{77}Ir$) nucleus is approximately four times that of the diameter of a nucleus of which other isotope?

A. $^{3}_{1}H$

B. $^{48}_{22}Ti$

C. $^{11}_{5}B$

D. $^{7}_{3}Li$

(1 mark)