IB · DP · Physics

30 mins 30 questions

Practice Paper 1

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Total Marks /30

1 In an experiment, a radio-controlled car takes 1.50 ± 0.05 s to travel 30.0 ± 0.1 m.

What is the car's average speed and the uncertainty in this value?

A. 20.0 ± 0.732 m s^{-1}

B. 20.0 ± 0.0366 m s^{-1}

C. 20.0 ± 0.066 m s^{-1}

D. 20.0 ± 9.91 m s^{-1}

(1 mark)

2 Blue light has a wavelength of 450 nm.

Which of the following also represents this wavelength?

A. 4.5 pm

B. 0.45 μm

C. 0.0045 mm

D. 0.45 km

(1 mark)

3 An object of mass 5.6 g is falling vertically at a constant speed in air.

What is the approximate magnitude of the drag force acting on the object?

A. 0 N

B. 0.056 N

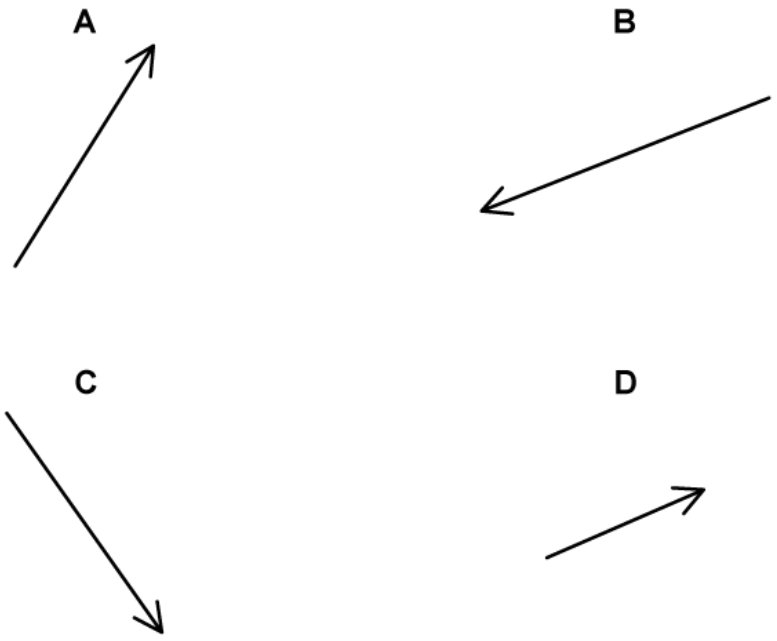
C. 56 N

D. 0.112 N

(1 mark)

4 The diagram shows vector $\boldsymbol{p}$.

In which of the following diagrams is vector $\boldsymbol{p}$ multiplied by a scalar represented?



A. 1 and 4

B. 2 only

C. 2 and 4

D. 1 only

(1 mark)

5 A spring of mass *m* and spring constant *k* rests on top of a vertical spring whose base is attached to the floor.

What is the energy stored by the spring?

A. $\frac{m^2g^2}{2k}$

B. $\frac{m^2g^2}{2k^2}$

C. $\frac{mg}{2k}$

D. $\frac{mg}{2}$

(1 mark)

6 A sled with a child has a combined weight of 400 N and rests on a horizontal surface. The coefficient of static friction between the sled and the surface is 0.50 and the coefficient of dynamic friction is 0.30.

A horizontal force *F* is applied to the sled and its magnitude increases uniformly from zero. Once the sled starts moving, the pulling force no longer increases.

What is the minimum resultant force required on the moving sled?

A. 80 N

B. –80 N

C. 320 N

D. 0 N

(1 mark)

7 Which of the following is the correct definition for elastic potential energy?

A. Elastic potential energy is a measure of how much a material can be stretched or compressed

B. Elastic potential energy is the maximum amount that can be stretched or compressed

C. Elastic potential energy is a measure of the stiffness of a material

D. Elastic potential energy is the energy stored within a material (e.g. in a spring) when it is stretched or compressed

(1 mark)

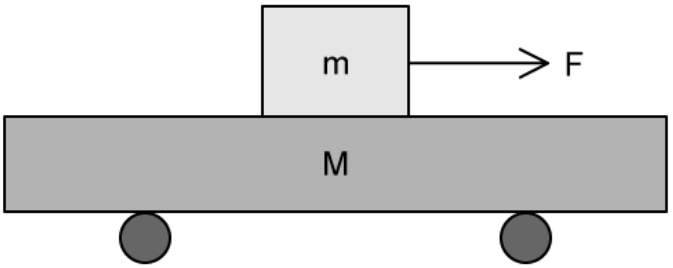
8 A body of mass 3*M* at rest explodes into two pieces of mass 2*M* and *M*.

What is the ratio $\frac{kinetic\ energy\ of\ 2M}{kinetic\ energy\ of\ M}$ and $\frac{momentum\ of\ 2M}{momentum\ of\ M}$?

	$\frac{kinetic\ energy\ of\ 2M}{kinetic\ energy\ of\ M}$	$\frac{momentum\ of\ 2M}{momentum\ of\ M}$
A.	$\frac{1}{2}$	-1
B.	1	-1
C.	$\frac{1}{4}$	2
D.	$\frac{1}{2}$	-2

(1 mark)

9 A block of mass *m* rests on a trolley of mass *M*. The coefficient of dynamic friction between the block and the trolley is *μ*.



A horizontal force *F* acts on the block causing it to slide over the trolley. What is the acceleration of the trolley?

A. $\frac{F-\mu mg}{M}$

B. $\frac{\mu mg}{(M+m)}$

C. $\frac{F-\mu Mg}{m}$

D. $\frac{\mu mg}{M}$

(1 mark)

10 Aluminium melts at 660 °C. A mass m of solid aluminium is initially at a temperature of 645 °C. The aluminium is heated and melts into liquid aluminium and continues to be heated up to a final temperature of 720 °C.

- Specific latent heat of fusion of aluminium = L_f
- Specific heat capacity of solid aluminium = c_S
- Specific heat capacity of liquid aluminium = c_L

Which expression gives the energy needed for this change to occur?

A. $m(15c_S + L_f + 60c_L)$

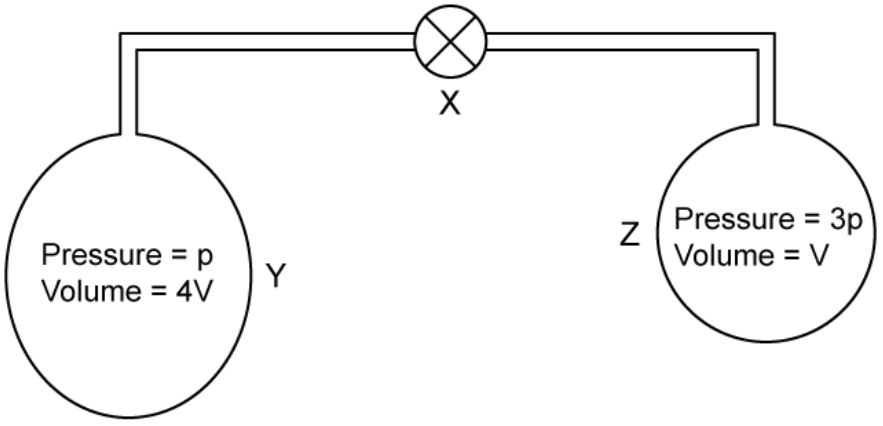
B. $m(c_S + 15L_f + 75c_L)$

C. $m(15c_S + 60L_f + c_L)$

D. $m(15c_S + L_f + 75c_L)$

(1 mark)

11 A mass of 5×10^{-3} kg of Hydrogen is split between two gas bottles Y and Z. Y and Z are connected by a tube that has a negligible volume compared with the volume of each bottle.



Initially the valve X is closed and gas bottle Y has a volume $4V$ and contains Hydrogen at a pressure p. Gas bottle Z has a volume V and contains Hydrogen at a pressure of $3p$. Y and Z are initially at the same temperature.

X is now opened.

What is the new gas pressure assuming there is no change in temperature?

A. $\frac{3}{8}p$

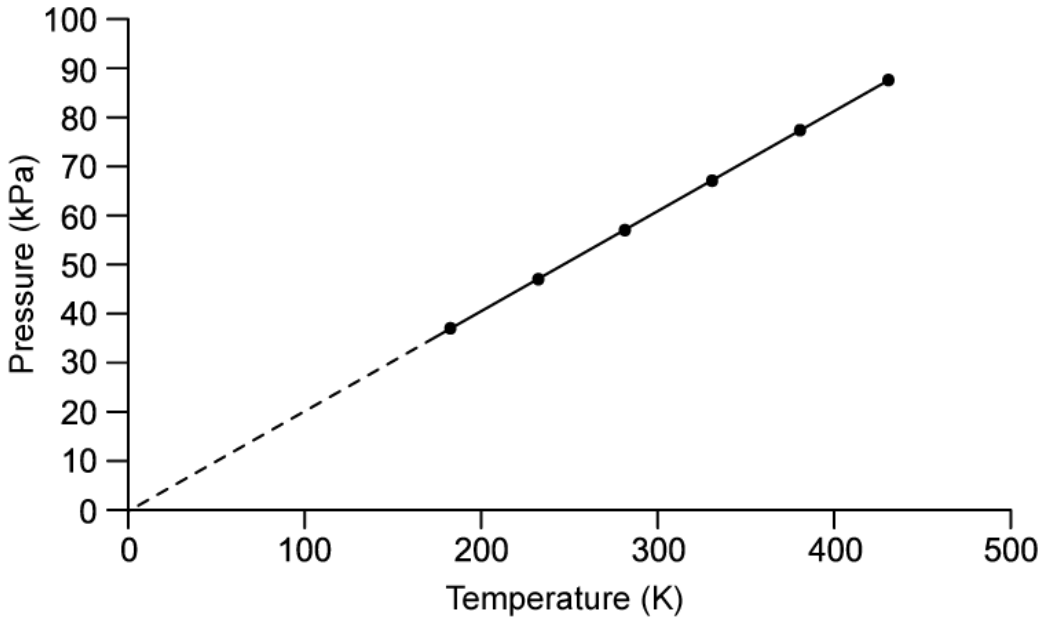
B. $\frac{1}{6}p$

C. $\frac{8}{5}p$

D. $\frac{7}{5}p$

(1 mark)

12 The variation of pressure *p* with temperature *T* is shown on the graph for a fixed mass of an ideal gas at constant volume.



What is the ratio of pressure and temperature of the ideal gas?

A. 200 Pa K^{-1}

B. 300 Pa K^{-1}

C. 400 Pa K^{-1}

D. 500 Pa K^{-1}

(1 mark)

13 A sound wave has a wavelength of 0.40 m. What is the phase difference between two points along the wave which are 1.7 m apart?

A. zero

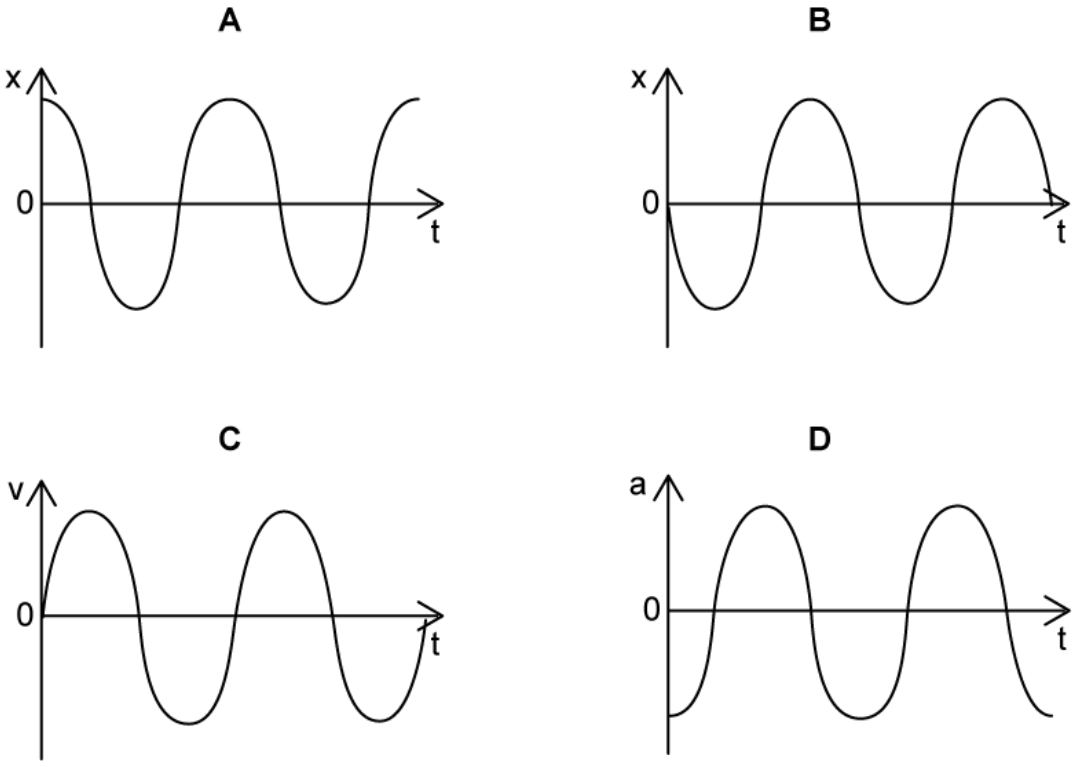
B. 45°

C. 90°

D. 180°

(1 mark)

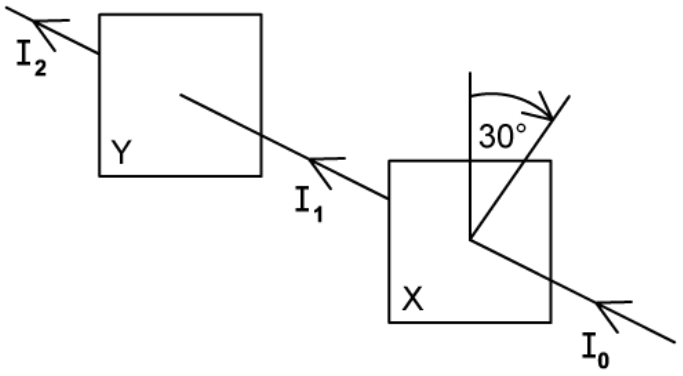
14 Choose the graph that shows an oscillation beginning at equilibrium.



(1 mark)

15 A beam of unpolarised light, I_0, is incident on a polarising filter X. The filter has been set up so that its transmission axis is parallel to that of a second filter Y.

Filter X is rotated by an angle which is approximately 30°.



Which line correctly describes beam I_2 being emitted from filter Y?

	polarisation	**intensity**
A.	no change	different
B.	different	different
C.	no change	no change
D.	different	no change

(1 mark)

16 When moving from material A to material B, the direction of a ray of light moves away from the normal. If n_A and n_B are the refractive indices of materials A and B respectively, then which of the following statements is true in this situation?

A. The ratio of $\frac{n_A}{n_B}$ is larger than one

B. The ratio of $\frac{n_A}{n_B}$ is less than one

C. The ratio of $\frac{n_A}{n_B}$ is exactly than one

D. The ratio of $\frac{n_A}{n_B}$ cannot be known without more information

(1 mark)

17 A standing wave is set up on a string with both ends fixed. The frequency of the first harmonic is 150 Hz.

Determine the approximate length of the string, *L* and for the second harmonic, the approximate distances between two successive nodes, *N* and two successive antinodes, *A*.

The speed of sound is air = 340 m s^{-1} and the speed of sound on the string = 250 m s^{-1}.

	***L* / m**	***N* / m**	***A* / m**
A.	1.10	0.55	0.55
B.	1.10	0.24	0.55
C.	0.84	0.42	0.42
D.	0.84	0.42	0.56

(1 mark)

18 Which of the following statements about electric fields and potential differences is incorrect?

A. The presence of a potential difference requires an electric field

B. Work on or by an electron across a potential difference *V* is *eV*

C. Work on or by an electron across a potential difference is path dependent

D. The electric field is a vector field

(1 mark)

19 Which of the following statements about discharging cells is incorrect?

A. The capacity of a cell is proportional to the amount of charge delivered to an external circuit over a cell's lifetime

B. The lifetime of a cell depends on its capacity

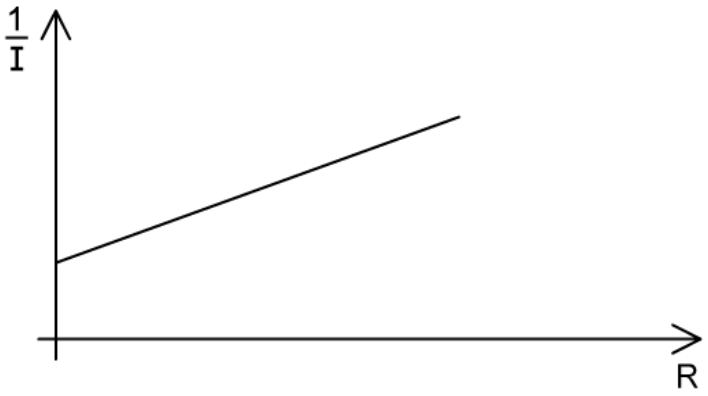
C. The lifetime of a cell depends on the current it produces

D. The internal resistance of a cell gradually increases over its lifetime

(1 mark)

20 An electrical circuit is designed to measure the current *I* through a variable resistor *R*. The cell used in the circuit has an emf ϵ and an internal resistance *r*.

A graph shows the variation of $\frac{1}{I}$ with *R*.



What is the magnitude of the gradient?

A. $\frac{1}{\varepsilon}$

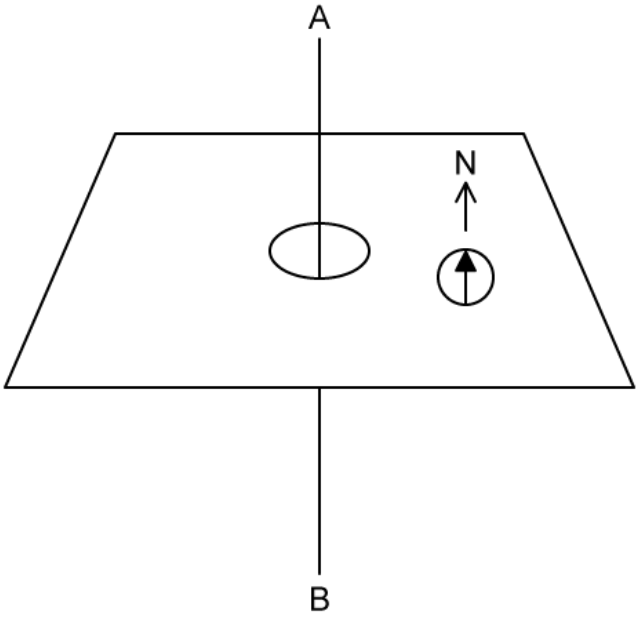
B. $\frac{1}{R}$

C. $\frac{1}{r}$

D. r

(1 mark)

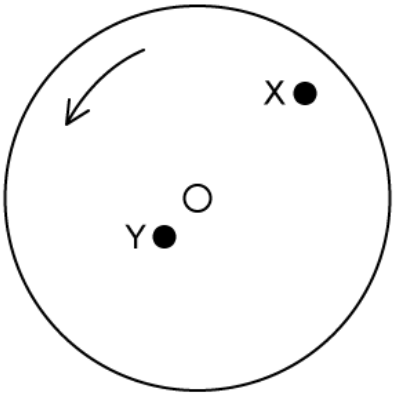
21 A plotting compass is placed next to a vertical wire AB. When there is no current in the wire, the compass points North due to an external magnetic field.



Which diagram shows a possible direction for the compass to point when a current passes from A to B?

(1 mark)

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



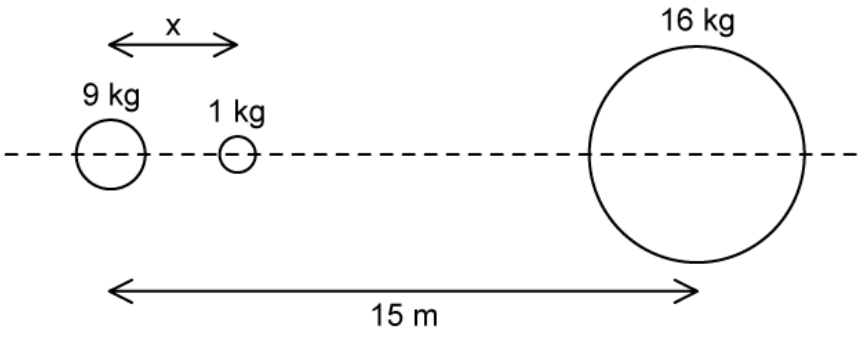
Point X is on a distance *3L* from the centre of the disc. Point *Y* is a distance *L* from the centre of the disc. Point Y has a linear speed *v* and a centripetal acceleration *a*.

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)

23 The diagram below shows three uniform masses in a straight line.



The resultant gravitational force on the 1 kg mass is zero if the distance *x* is:

A. $\frac{45}{7}$ m

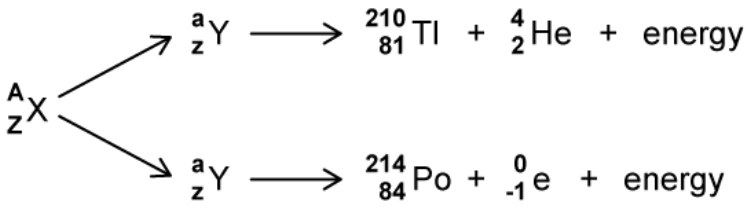
B. 45 m

C. $\frac{27}{5}$ m

D. 35 m

(1 mark)

24 A particular nucleus, ${}^{A}_{Z}X$ decays to form ${}^{a}_{z}Y$, which then has two possible decay paths, resulting in either an isotope of Thallium (Tl) or Polonium (Po), as shown.



Which isotope could **not** be ${}^{A}_{Z}X$?

A. ${}^{215}_{82}Pb$

B. ${}^{214}_{84}Po$

C. ${}^{218}_{85}At$

D. ${}^{214}_{82}Pb$

(1 mark)

25 A sample of californium−239 has an activity of 4000 Bq. The half−life of californium−239 is 1 minute.

What will the activity be after 4 minutes?

A. 4000 Bq

B. 1000 Bq

C. 500 Bq

D. 250 Bq

(1 mark)

26 The Σ^0 baryon has strangeness of −1 and is produced through the strong interaction between a π^+ meson and a neutron.

$$\pi^+ + n \rightarrow \Sigma^0 + X$$

What is the quark composition of particle X?

A. $u\bar{s}$

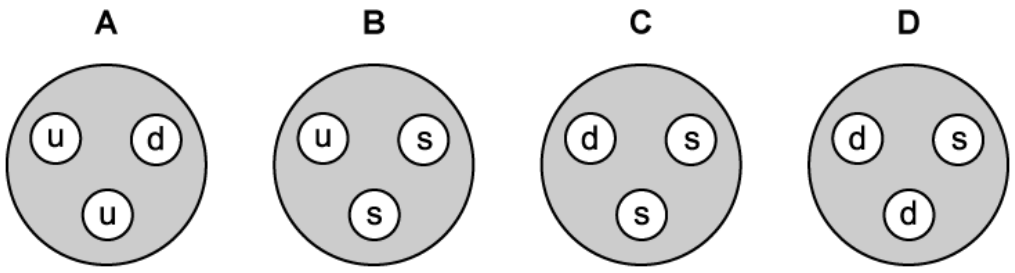
B. uud

C. $u\bar{d}$

D. uus

(1 mark)

27 Which of the four hadrons shown could be Ξ^0?



A.

B.

(1 mark)

28 Which line in the table correctly shows a renewable and a non-renewable energy, and a major direct use for both energy sources?

	Renewable	**Non-renewable**	**Direct use of both**
A.	geothermal	natural gas	heating homes
B.	nuclear fuel	oil	generating electricity
C.	geothermal	natural gas	transport
D.	solar energy	nuclear fuel	heating homes

(1 mark)

29 What is an advantage of pumped storage systems?

A. They can be sited in most areas where energy is needed

B. They are carbon neutral

C. Electricity can be generated rapidly at times of peak demand

D. Efficiency is greater than one since energy is being used to run them which would otherwise go to waste

(1 mark)

30 A black body has a total power radiated *P* and a surface area *A*. The surface area is reduced to one-quarter of *A* and the total power is increased to four times *P*.

What is the value of the peak wavelength?

A. $(1.5 \times 10^{-3}) \times \sqrt[4]{\frac{A}{p}}$

B. $(1.5 \times 10^{-3}) \times \sqrt{\frac{P}{A}}$

C. $2 \times \sqrt[4]{\frac{P}{A}}$

D. $(1.5 \times 10^{-3}) \times \left(\frac{P}{A}\right)^{-\frac{1}{4}}$

(1 mark)