ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Advanced Level

PHYSICS   **6032/1**
PAPER 1 Multiple Choice

NOVEMBER 2023 SESSION   1 hour

Additional materials:
   Multiple Choice answer sheet
   Soft clean eraser
   Soft pencil (type B or HB is recommended)
   Electronic calculator

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.
Write your name, centre number and candidate number on the answer sheet in the spaces provided unless this has already been done for you.

There are **forty** questions in 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 very carefully the instructions on the answer sheet.

INFORMATION FOR CANDIDATES

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.

DATA

speed of light in free space	$c = 3.00 \times 10^8$ ms^{-1}
permeability of free space	$\mu_0 = 4\pi \times 10^{-7}$ Hm^{-1}
permittivity of free space	$\varepsilon_0 = 8.85 \times 10^{-12}$ Fm^{-1} ($1/4\pi\varepsilon_0 =$ 8.99 $\times 10^9$ mF^{-1})
elementary charge	$e = 1.60 \times 10^{-19}$ C
the Planck constant	$h = 6.63 \times 10^{-34}$ Js
unified atomic mass unit	$1\,u = 1.66 \times 10^{-27}$ kg
rest mass of electron	$m_e = 9.11 \times 10^{-31}$ kg
rest mass of proton	$m_p = 1.67 \times 10^{-27}$ kg
molar gas constant	$R = 8.31$ JK^{-1}mol^{-1}
the Avogadro constant	$N_A = 6.02 \times 10^{23}$ mol^{-1}
the Boltzmann constant	$k = 1.38 \times 10^{-23}$ JK^{-1}
gravitational constant	$G = 6.67 \times 10^{-11}$ Nm^{2}kg^{-2}
acceleration of free fall	$g = 9.81$ ms^{-2}

FORMULAE

uniformly accelerated motion	$s = ut + \frac{1}{2}at^2$
	$v^2 = u^2 + 2as$
work done on/by a gas	$W = p\,\Delta V$
gravitational potential	$\emptyset = -\,Gm/r$
hydrostatic pressure	$p = \rho gh$
pressure of an ideal gas	$p = \frac{1}{3}\frac{Nm}{V} <c^2>$
simple harmonic motion	$a = -\omega^2 x$
velocity of particle in s.h.m.	$v = v_o \cos \omega t$
	$v = \pm\omega\sqrt{(x_o^2 - x^2)}$
Doppler effect	$f_o = \dfrac{f_s v}{v \pm v_s}$
Attenuation of xrays	$I = I_o e^{-\mu x}$
electric potential	$V = \dfrac{Q}{4\pi\varepsilon_0 r}$
capacitors in series	$1/C = 1/C_1 + 1/C_2 + \ldots$
capacitors in parallel	$C = C_1 + C_2 + \ldots$
energy of charged capacitor	$W = \frac{1}{2}QV$
electric current	$I = Anvq$
resistors in series	$R = R_1 + R_2 + \ldots$
resistors in parallel	$1/R = 1/R_1 + 1/R_2 + \ldots$
Hall voltage	$V_H = \dfrac{BI}{ntq}$
alternating current/voltage	$x = x_o \sin\omega t$
radioactive decay	$x = x_o \exp(-\lambda t)$
decay constant	$\lambda = \dfrac{0.693}{t_{\frac{1}{2}}}$

[Turn over

1   Which one has the greatest in magnitude?

    A   2 pN
    B   2 nN
    C   2 mN →
    D   2 μN —

2   The base unit for the gravitational constant G is

    A $m^3 kg^{-1} s^{-2}$.
    B $kg m^3 s^{-3}$.
    C $N m^{-2} kg^{-2}$.
    D $m^2 kg^{-2}$.

[handwritten: $f = \dfrac{G\,MM}{R^2}$ $\dfrac{4\,kg^2}{m^2} = kg\,m^2 s^{-2}$ $a = \dfrac{kg\,m^3 s^{-2}}{kg^2} = kg^{-1}\,m^3 s^{-2}$]

3   A student uses an analogue voltmeter which does not read zero when the switch is open and has a mirror below the pointer. *[handwritten: PR   SA]*

The results obtained are

    A   precise but not accurate.
    B   precise and accurate.
    C   accurate but not precise.
    D   not accurate and not precise.

4   The graph represents the motion of a falling object.
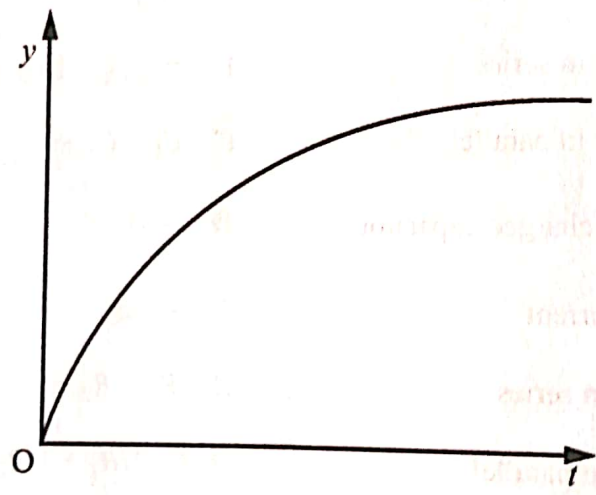
What does y represent?

    A   distance when air resistance is not negligible
    B   acceleration when air resistance is negligible
    C   speed when air resistance is not negligible ✗
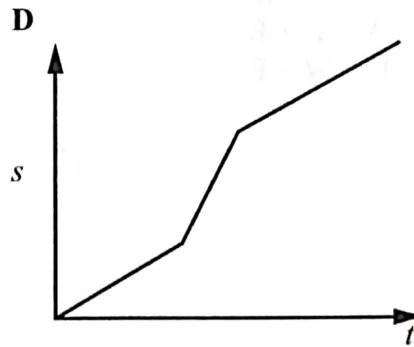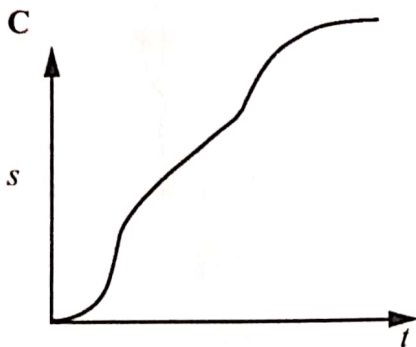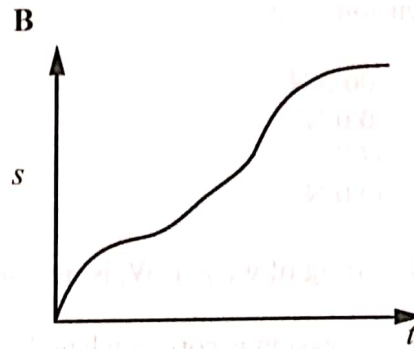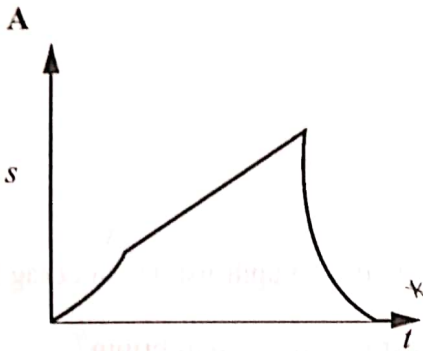   D   displacement when air resistance is negligible

5 The diagram shows a velocity time graph for a moving object.
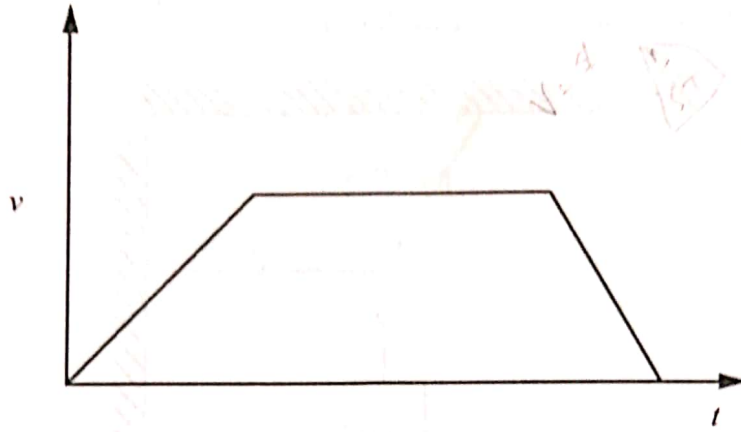
Which one is the corresponding graph of displacement, *s*, against time, *t*?

A

B

C

D

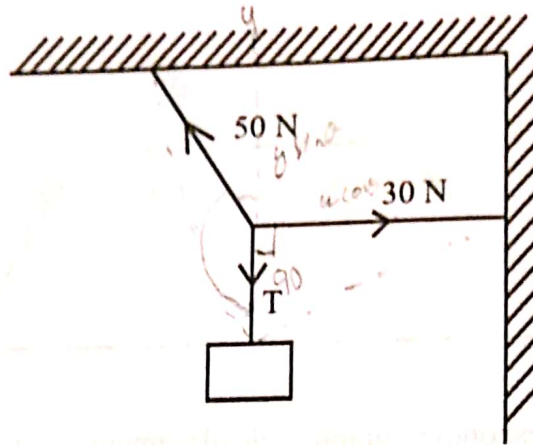**[Turn over**

6   An information board in a supermarket is suspended in equilibrium by two light strings attached to the wall and the ceiling as shown.
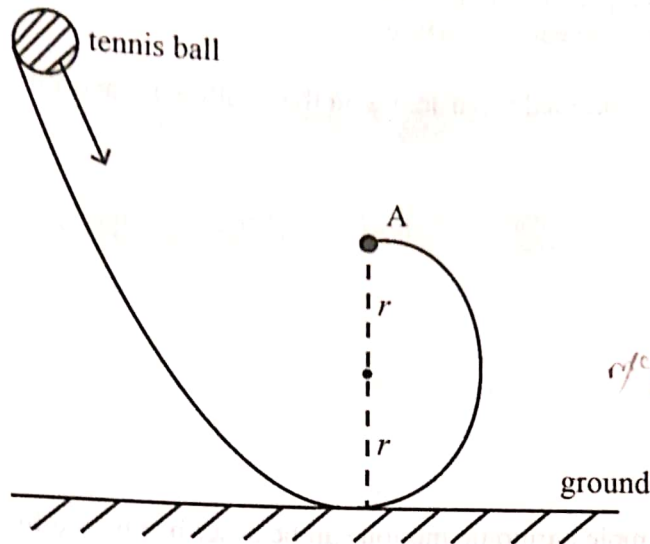

The tension, T, is

A   100.0 N.
B   60.0 N.
C   57.7 N.
D   40.0 N.

7   A ball bearing of weight, W, is moving in a fluid with upthrust, U, and drag force, F.

Which expression is correct when the ball bearing attains equilibrium?

A $W + F + U = 0$
B $F = U + W x$
C $W = U + F$
D $U = W + F$

8 The diagram shows a tennis ball rolling with velocity, v, in a curved path of radius, r.

tennis ball

A

r

r

ground

The minimum velocity at A is given by

A $\sqrt{2gr}$.

B $\sqrt{gr}$.

C $2\sqrt{gr}$.

D $\dfrac{\sqrt{2gr}}{2}$.

9 Neglecting air resistance, which statement is correct for a mass projected vertically upwards?

A The kinetic energy of the mass is maximum at the maximum height.
B The total energy of the mass is constant throughout the motion.
C The potential energy of the mass increases uniformly with time during ascent.
D The momentum of the mass is constant throughout the motion.

10 The minute hand of a clock is 3.0 cm long.

What is the mean angular speed of the minute hand?

A 2.9×10^{-5} rads^{-1}
B 7.0×10^{-3} rads^{-1}
C 1.7×10^{-3} rads^{-1}
D 3.0×10^{-1} rads^{-1}

[Turn over

11   A satellite of weight, W, on the earth's surface of radius, R, is placed in a circular orbit at a height $4R$ above the earth's surface.

What is the gravitational force acting on the satellite in the orbit?

A $\frac{W}{4}$

B $\frac{W}{5}$

C $\frac{W}{16}$

D $\frac{W}{25}$

12   A particle in simple harmonic motion can be described by the following physical quantities:

1.   velocity of the particle.
2.   restoring force on the particle.
3.   acceleration of the particle

Which of these quantities are in phase for a particle in simple harmonic motion?

A   1 and 2.
B   1 and 3.
C   1, 2 and 3.
D   2 and 3.

13   The attenuation of X-rays in matter is represented by the expression $I = I_o e^{-\mu x}$.

Which statement is correct?

A   The linear absorption coefficient μ is constant for all media.
B   The linear absorption coefficient μ is unique to the medium.
C   The linear absorption coefficient μ depends on photon energy.
D   The equation represents an exponential decrease in the intensity of the transmitted beam.

14   What is the frequency of a sound wave travelling with velocity 2.0 kms^{-1} in a liquid such that the shortest distance between a compression and a rarefaction is 0.5 mm?
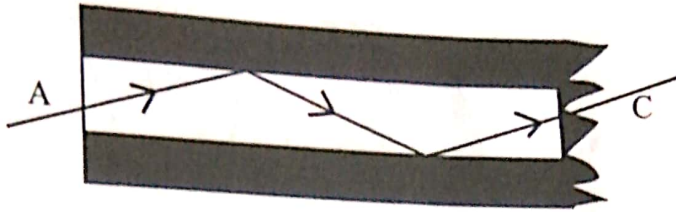
A   0.2 MHz
B   2.0 MHz
C   4.0 MHz
D   8.0 MHz

15 The diagram shows a piece of an optical fibre.

Which statement is correct?

A Cladding has a larger refraction index than the core.
B The core has a larger refractive index than cladding.
C The refractive indices are the same.
D Cladding reflects light more than the core.

**16** Which statement is **not** correct about a stationary wave?

A No energy is transferred along the direction of propagation.
B Points between two successive nodes have different amplitude.
C Particles at nodes have the largest amplitude.
D All points between two successive nodes vibrate in phase.

17 The potential difference between two points on a current carrying conductor is the

A force required by a unit positive charge between the points.
B ratio of the energy dissipated between the points to the current.
C the ratio of the power dissipated between the points to the charge moved.
D ratio of the power dissipated between the points to the current.

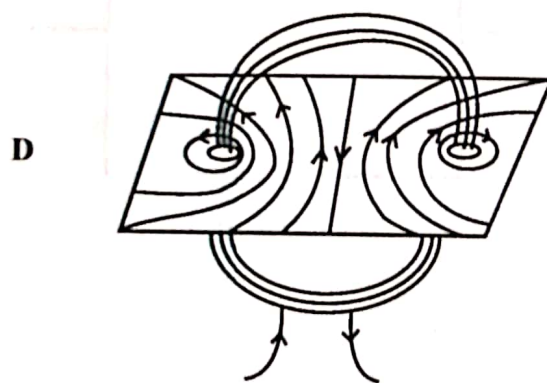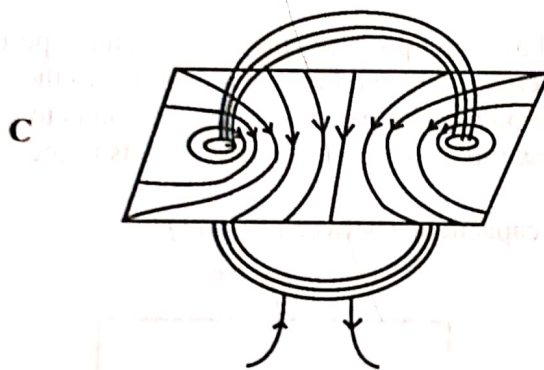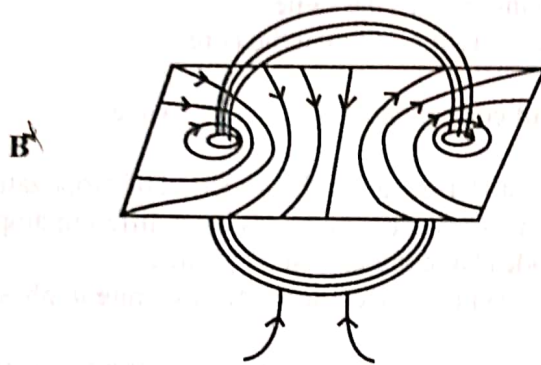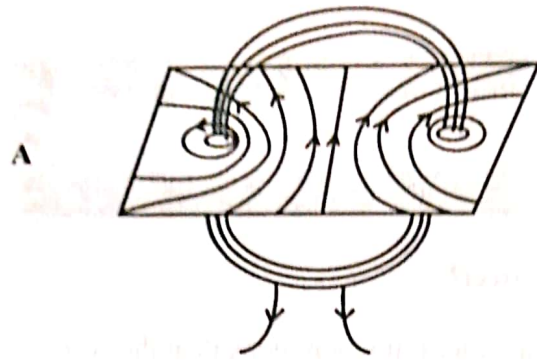**18** What is the effective capacitance between P and Q?
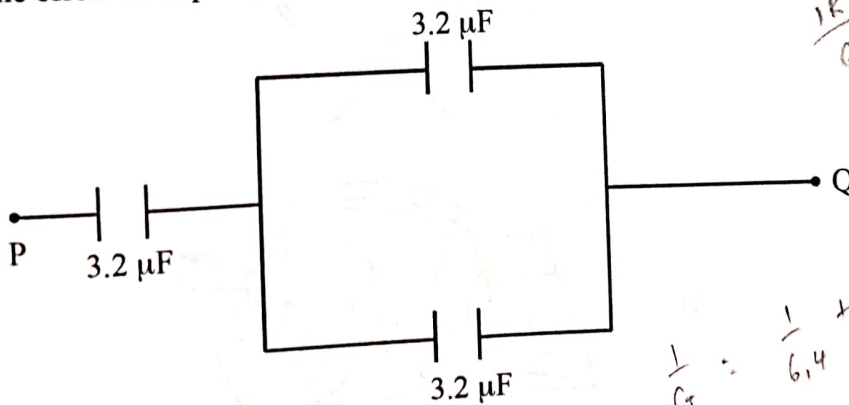
A 1.6 μF
B 2.1 μF
C 3.4 μF
D 4.8 μF

[Turn over

19   Which diagram correctly describes the flux patterns due to a current carrying circular coil?

A

B


C

D

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20 The purpose of laminating the core of a transformer is to

    A   improve the flux linkage between the primary and secondary coils.
    B   reduce the effects of eddy currents.
    C   produce a uniform radial field in the two coils.
    D   dissipate the heat generated by the two coils.

21 The diagram shows a bar magnet passing through a solenoid with a uniform velocity as shown.
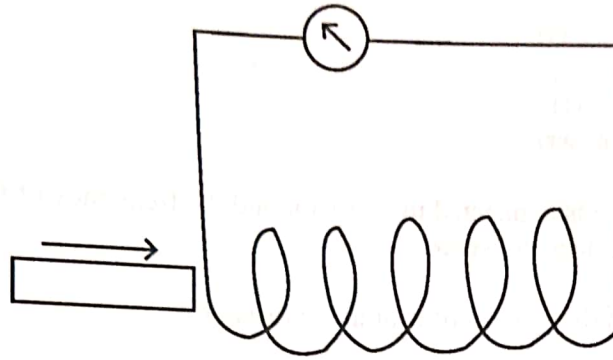
Which graph represents the variation of current, I, in a solenoid with time, t?
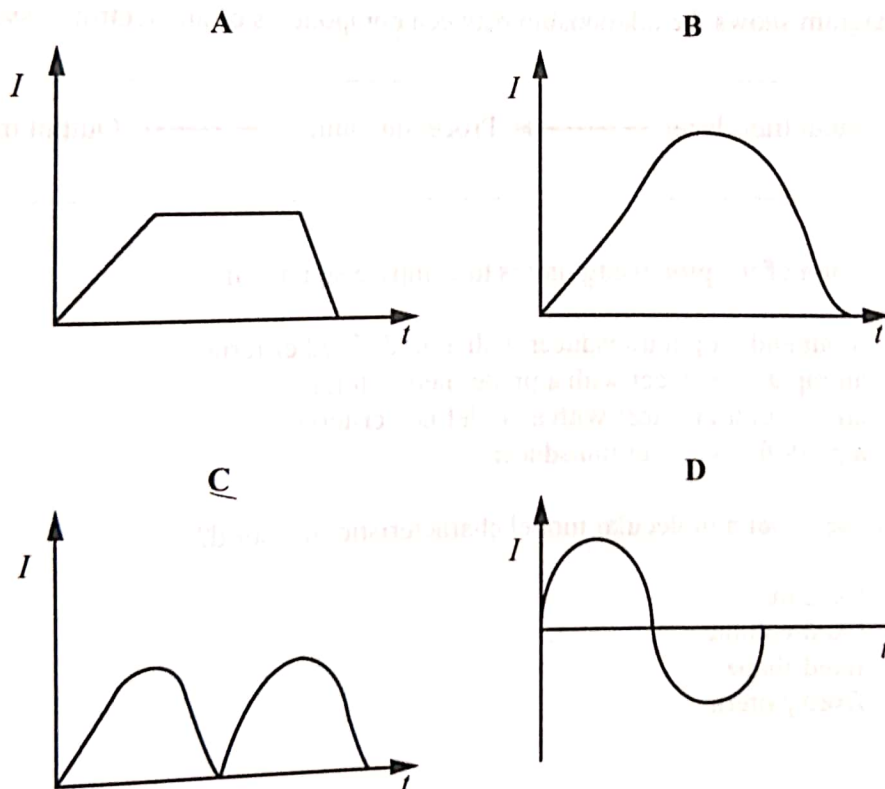
[Turn over

22   What is the effect on the current in the secondary coil of doubling the number of turns in the primary coil?

   A   halved
   B   doubled
   C   squared
   D   remains the same

23   Which equation represents a sinosodial current $I = I_o Sin(wt)$ with double the frequency only?

   A $2I = I_o Sin(2wt)$
   B $I = 2I_o Sin(wt)$
   C $I = I_o Sin(2wt)$
   D $I = 2I_o Sin(2wt)$

24   An alternating p.d is connected to a resistor and the frequency of the supply is varied, keeping r.m.s. voltage constant.

   The mean rate of dissipation of heat in the resistor is

   A   proportional to frequency.
   B   independent of frequency.
   C   proportional to (frequency)^2.
   D   inversely proportional to frequency.

25   The diagram shows the relationship between components of an electronic system.

Input transducer	→	Processing unit	→	Output transducer
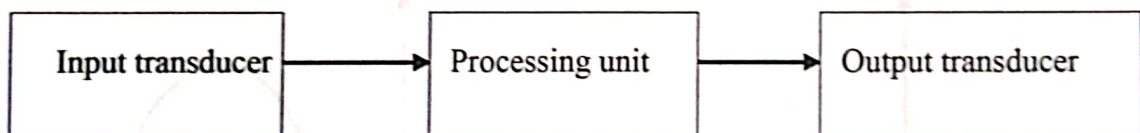
   The function of the processing unit is to compare signals of

   A   input and output transducer with a predefined criteria.
   B   an input transducer with a predefined criteria.
   C   an output transducer with a predefined criteria.
   D   a predefined output transducer.

26   Which one is **not** a molecular model characteristic of a solid?

   A   fixed mass
   B   fixed volume
   C   fixed shape
   D   fixed pattern

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27 Which graph shows the variation of pressure, P, with height, h, when an inflated balloon falls freely, where P_o is atmospheric pressure?

A

B

C

D
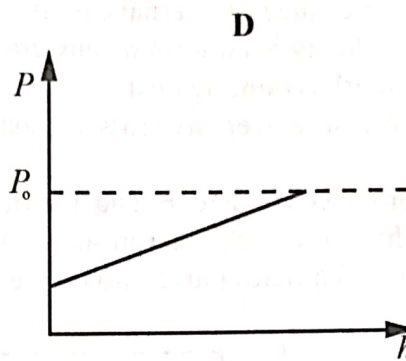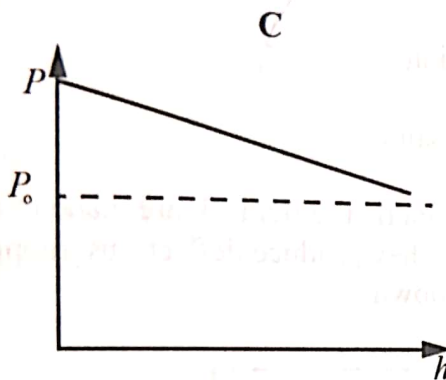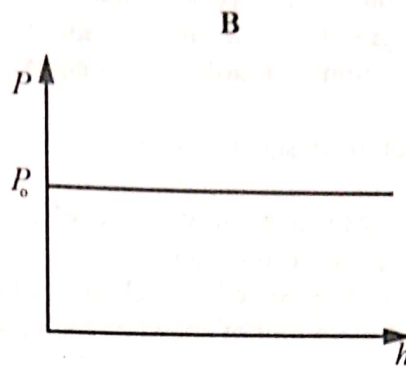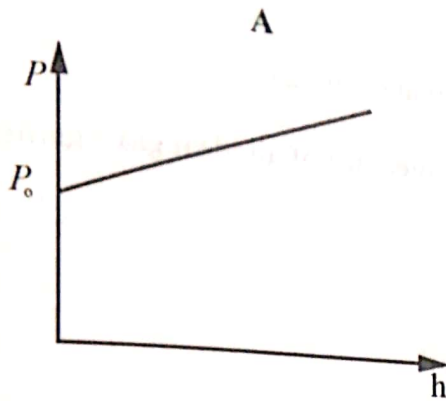
28 During plastic deformation of a ductile material

A   Hooke's law is obeyed.
B   elastic limit is at breaking point.
C   shape and size are retained.
D   failure is after yielding point.

29 Area under a stress-strain graph gives energy stored per unit

A   area.
B   volume.
C   density.
D   length.

30 What thermodynamic temperature is equivalent to 50.85 °C?

A   222.15 K
B   222.30 K
C   323.85 K
D   324.00 K

[Turn over

31 Internal energy of an ideal gas is entirely kinetic because

    A   Newton's laws are invalid during collisions.
    B   there are intermolecular forces.
    C   gravity effects are negligible.
    D   volume of molecules is equivalent to that of the gas.

32 The root mean square value of the speed of molecules of an ideal gas signifies

    A   mean speed of the molecules.
    B   speed of molecules.
    C   average speed of each molecule.
    D   square root of speed of each molecule.

33 Which characteristic is **not** correct for a non viscous fluid flow?

    A   No change of internal energy.
    B   Velocity is uniform on any cross-section.
    C   Work is done against viscous forces.
    D   Pressure over any cross section is the same.

34 A uniform electric field, E, and a uniform magnetic the field, B, are made to be perpendicular to each other in such a way that they produce deflections in opposite directions. Particles move into the fields as shown.
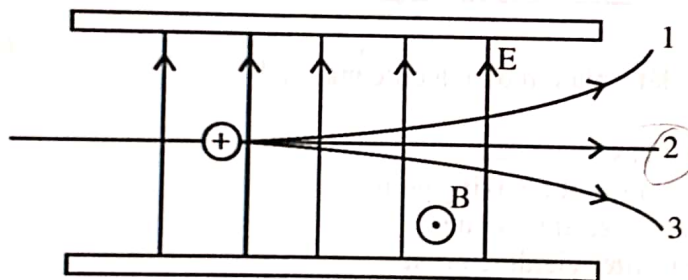

Which path(s) have particles with a velocity $v = \frac{E}{B}$?

    A   1
    B   2
    C   3
    D   1, 2 and 3

35 A thin gold leaf was bombarded with alpha particles in an experiment to determine the nature of an atom.

    Which one was **not** observed during the experiment?

    A   Most of the alpha particles were deflected through large angles.
    B   Most of the alpha particles were deflected through small angles.
    C   Few of the alpha particles were deflected through angles of more than 90°.
    D   Some alpha particles were not deflected.

36 Which graph shows the variation of the de Broglie's wavelength, λ, with momentum p?

A

B

C

D
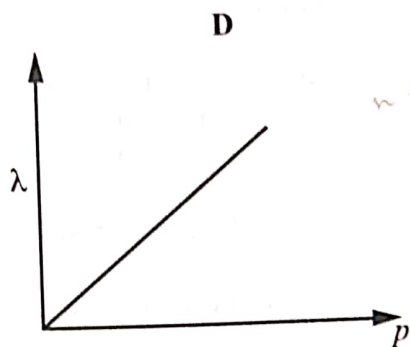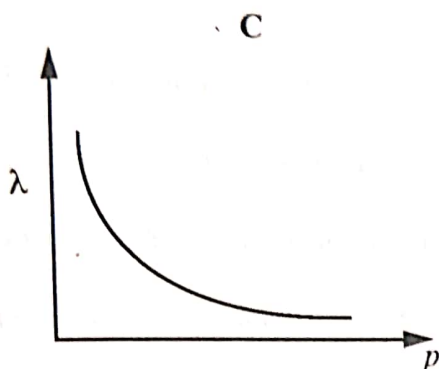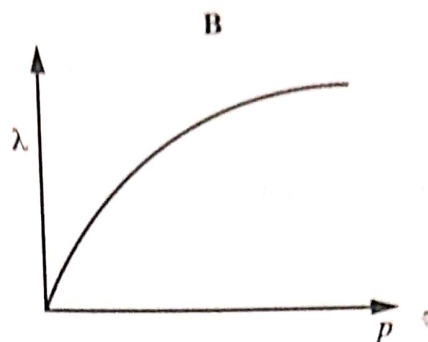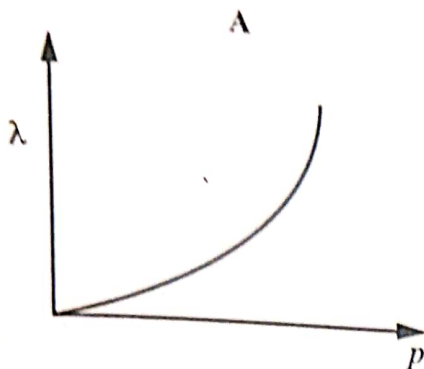
37 Radium-226 has a half life of 1 600 years and a decay constant of $1.37 \times 10^{-11} \text{s}^{-1}$.

What is the activity of 1 gram of a sample of Radium containing 2.66×10^{21} particles?

A 5.15×10^{-33} Bq

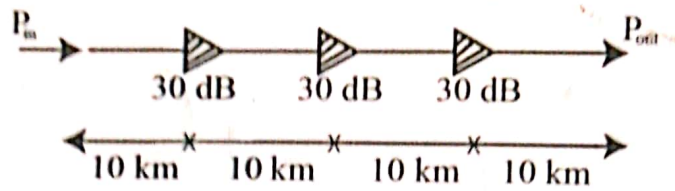B 2.10×10^{-8} Bq

C 1.94×10^{10} Bq

D 3.60×10^{10} Bq

38 What is input power to a cable of length of 20 km with an attenuation per unit length of 2dB km^{-1} and 5×10^{-6} W output power?

A 5×10^{-2} W

B 5×10^{-4} W

C 8×10^{-6} W

D 2.5×10^{-6} W

[Turn over

39 The diagram shows a cable of length 40 km which has an attenuation of 2 dB km^{-1}. Repeater amplifiers with a gain of 30 dB are placed every 10 km along its length.

What is the overall gain or loss in the system?

A   +120 dB
B   +80 dB
C   +40 dB
D   +10 dB

40 Which statement correctly describes frequency modulation?

A   Frequency of the carrier wave is made to vary in synchrone with the displacement of the information signal.

B   Frequency of the carrier wave is made to vary in synchrone with the displacement and amplitude.

C   Frequency of the carrier wave varies proportionally with displacement and amplitude.

D   Frequency of carrier wave varies inversely with displacement and amplitude.