PIONEER JUNIOR COLLEGE
JC2 Preliminary Examination

PHYSICS 8866/01
Higher 1

Paper 1   Multiple Choice

23 September 2016

1 hour

Additional Material: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and index number on the Answer Sheet in the spaces provided.

There are **thirty** 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 in this booklet.

This document consists of **16** printed pages.

Data

speed of light in free space,	$c = 3.00 \times 10^8 \text{ m s}^{-1}$
elementary charge,	$e = 1.60 \times 10^{-19} \text{ C}$
the Planck constant,	$h = 6.63 \times 10^{-34} \text{ J s}$
unified atomic mass constant,	$u = 1.66 \times 10^{-27} \text{ kg}$
rest mass of electron,	$m_e = 9.11 \times 10^{-31} \text{ kg}$
rest mass of proton,	$m_p = 1.67 \times 10^{-27} \text{ kg}$
acceleration of free fall,	$g = 9.81 \text{ m s}^{-2}$

Formulae

uniformly accelerated motion,	$s = ut + \dfrac{1}{2}at^2$
	$v^2 = u^2 + 2as$
work done on/by a gas,	$W = p\Delta V$
hydrostatic pressure,	$p = \rho g h$
resistors in series,	$R = R_1 + R_2 + ...$
resistors in parallel,	$1/R = 1/R_1 + 1/R_2 + ...$

1 An experiment was conducted to measure the diameter of a needle using a travelling microscope. The travelling microscope is marked every 0.01 mm but has a zero error of 0.08 mm. The student is not aware of this zero error and records the reading as 2.16 mm.

Is the reading accurate and is it precise?

	accurate	precise
A	no	no
B	no	yes
C	yes	no
D	yes	yes

2 Which of the following kinetic energies could be that of a student walking briskly?

A 7.5 J **B** 30 J **C** 500 J **D** 1200 J

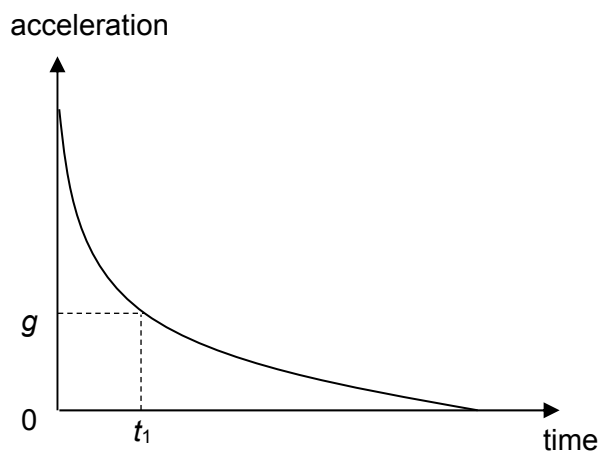3 Which quantity and unit is a base quantity and unit in the SI system of units?

	base quantity	base unit
A	pressure	Pa
B	charge	C
C	current	A
D	power	W

4 A fighter-bomber flies towards a target at a speed of 750 km h^{-1}. At a height of 500 m above the ground, it releases a 150 kg bomb while diving at an angle of 20° below the horizontal.

How far ahead of the target horizontally must the bomb be released?

A 170 m

B 1000 m

C 3000 m

D 3800 m

5 A light plastic ball is thrown vertically up into the air. The graph below shows the variation of acceleration with time of the ball. At time t_1, the acceleration of the ball is equal to the acceleration of free fall, g.

Which of the following statements about the motion of the ball is correct?

A t_1 is the time taken for the ball to reach its maximum height.

B t_1 is the time taken for the ball to fall back to its original height.

C The time taken for the ball to reach its maximum height is shorter than t_1.

D The time taken for the ball to fall back to its original height is shorter than t_1.

6 Car A is at rest when car B passes it with a speed of 20 m s^{-1}. At that instant, car A speeds up in the same direction as B with an acceleration of 5.0 m s^{-2}, while car B slows down with a deceleration of 3.0 m s^{-2}.

What is the distance between them after 6.0 s?

A 24 m

B 66 m

C 84 m

D 90 m

7 An object of mass 2.0 kg is moving on a smooth horizontal surface with a speed of 1.41 m s⁻¹ in a north-easterly direction. A constant force of 0.20 N acts on the object in a easterly direction for 10 s.

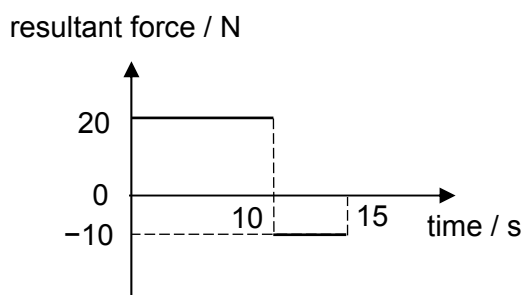What is the final velocity of the object?

A 0.71 m s⁻¹ in a northerly direction

B 1.00 m s⁻¹ in a northerly direction

C 1.58 m s⁻¹ in a direction 71.6° East of North

D 2.23 m s⁻¹ in a direction 63.5° East of North

8 A helicopter of mass 1000 kg accelerates vertically upwards due to the vertical lift force generated by its rotating blades. It starts from rest and travels a vertical distance of 50 m in 4.0 s.

To enable the helicopter to fly forward in a horizontal straight line, the helicopter is now tilted such that its lift force is at an angle of 52° to the vertical. The magnitude of the lift force remains constant.

Ignoring air resistance, what is the forward horizontal acceleration of the helicopter?
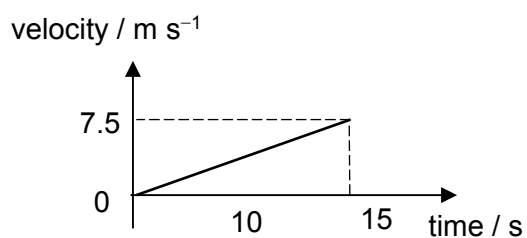
A 3.4 m s⁻²

B 8.6 m s⁻²

C 13 m s⁻²

D 16 m s⁻²

9 The graph below shows the variation with time of the resultant force on a mass of 20 kg.
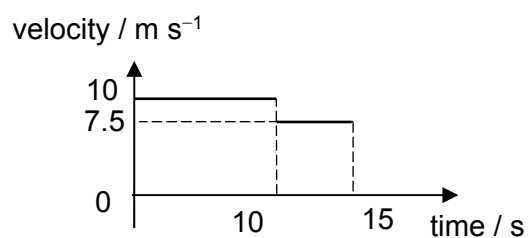
resultant force / N

Which of the following graphs show the possible variation of the velocity with time of the mass?

A

velocity / m s^{-1}

B

velocity / m s^{-1}
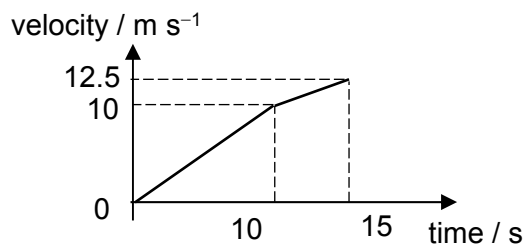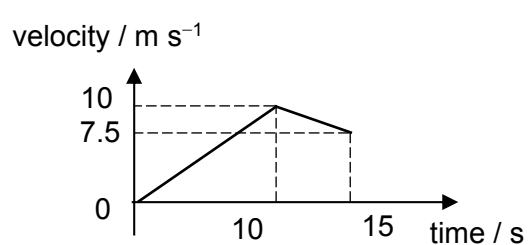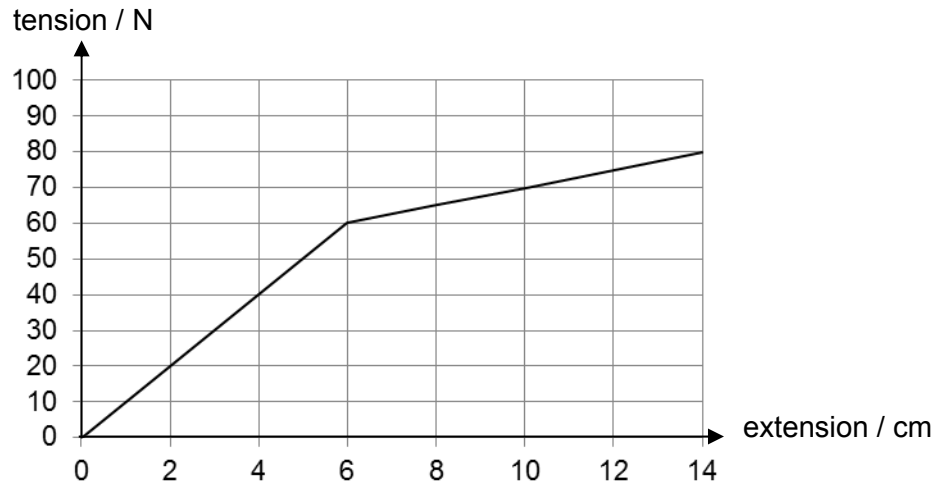

C

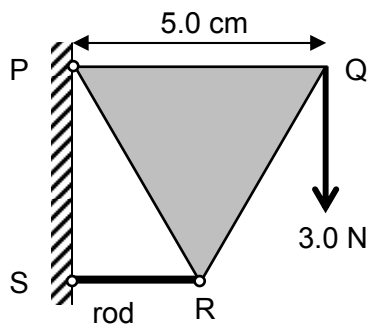velocity / m s^{-1}

D

velocity / m s^{-1}

10 A sample is placed in a tensile testing machine. The graph below shows the variation of the tension applied on the sample with its extension.

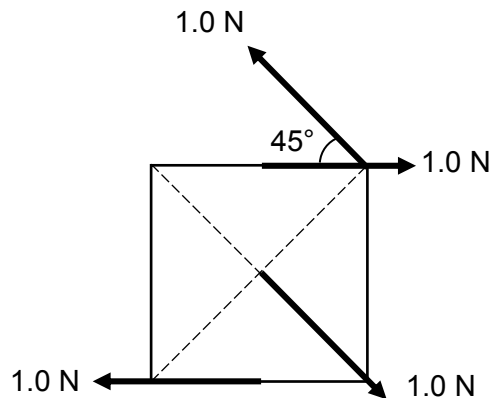What is the extension in the sample when the work done on it is 4.4 J?

A 7.0 cm

B 9.4 cm

C 10 cm

D 12 cm

11 An equilateral triangle PQR of mass 100 g is mounted on a smooth wall using a hinge at P as shown in the figure below. PQ has a length of 5.0 cm, and is horizontal. A rod is hinged to R and S, such that the rod is horizontal. A downward force of 3.0 N is applied at Q, and the system is in equilibrium.

What is the magnitude of the horizontal force exerted by the wall on the rod at S?

A 2.5 N   **B** 3.5 N   **C** 4.0 N   **D** 4.6 N

[Turn over

12 The figure below shows forces acting on a piece of square cardboard of negligible mass in a single plane. The cardboard has a length of 5.0 cm on each side.
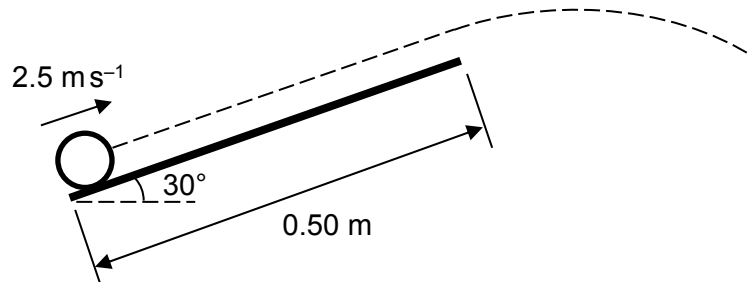

Which of the following statements is true?

A The cardboard is not in equilibrium.

B The cardboard is in rotational equilibrium.

C The cardboard is not in translational equilibrium.

D The cardboard will rotate in an anticlockwise direction.

13 An electric motor is required to haul a cage of mass 400 kg up a mine shaft at constant speed through a vertical height of 1200 m in 2.0 minutes.

Given that the overall efficiency of the motor is 80%, what is the total power wasted?

A 7.8 kW
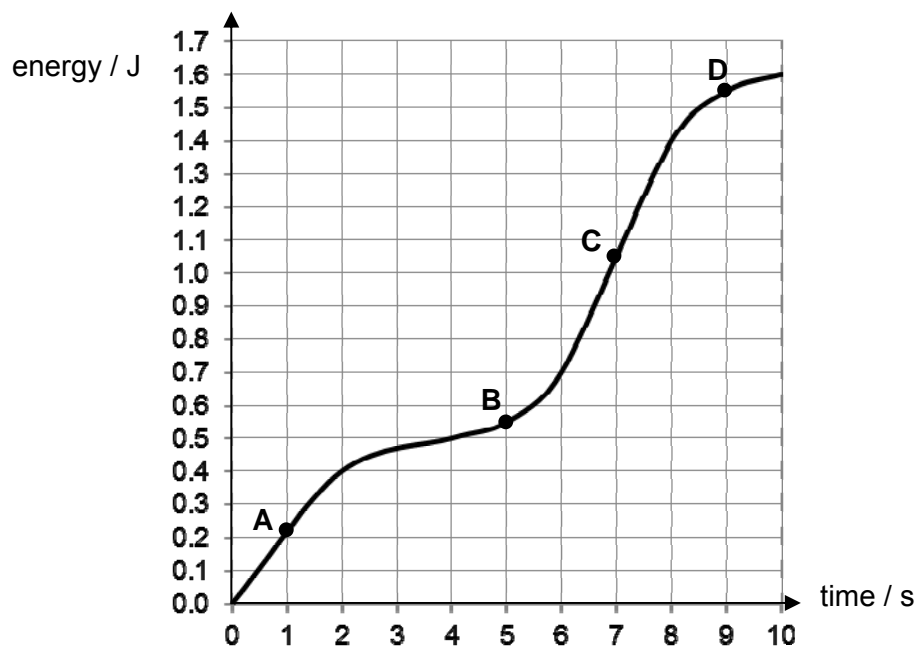
B 9.8 kW

C 39 kW

D 49 kW

14 A ball of mass 200 g is projected up a smooth inclined plane of length 0.50 m, at an angle of 30° above the horizontal, with an initial speed of 2.5 m s⁻¹. The ball leaves the plane and then moves in a projectile motion.
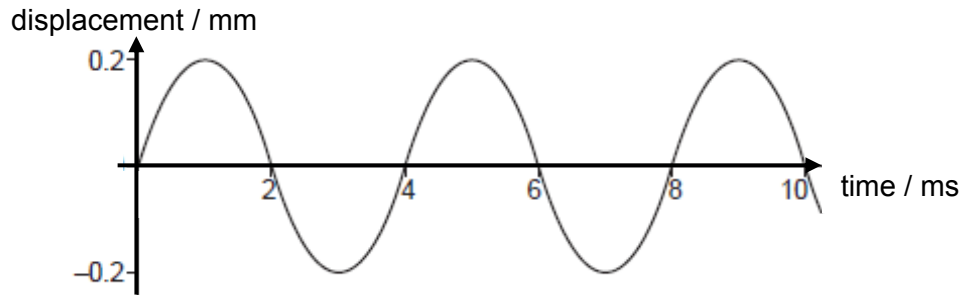

Assuming that the air resistance is negligible, what is the minimum kinetic energy of the ball during its flight?

A 0 J

B 0.10 J

C 0.13 J

D 0.47 J

15 The diagram below is a graph representing the amount of energy generated by an engine over time.

At which of the following instances did the engine generate the most power?

[Turn over

16 A sound wave moves with a speed of 320 ms^{-1} through air. The variation with time of the displacement of an air particle due to this wave is shown in the graph.

displacement / mm

0.2

2   4   6   8   10   time / ms

−0.2

Which statement about the sound wave is correct?

A The frequency of the wave is 500 Hz.

B The wavelength of the sound wave is 1.28 m.

C The graph shows that sound is a transverse wave.

D The intensity of the wave will be doubled if its amplitude is increased to 0.4 mm.

17 The order of magnitude of the frequency of the longest wavelength ultraviolet waves can be expressed as 10^x Hz.

What is the value of x?

A 12   **B** 14   **C** 16   **D** 18

18 Which of the following is not an essential condition for an observable interference pattern to occur between the waves from two sources?

A The sources must be coherent.

B The waves from the two sources must overlap.

C The sources must emit waves of equal amplitude.

D The frequencies of the two sources must be equal.

19 In a double-slit experiment, the distance between the fringes on a screen was too small to measure.

What would increase the distance between the fringes?

A increasing the distance between the light source and the slits

B increasing the distance between the slits and the screen

C increasing the frequency of the light source
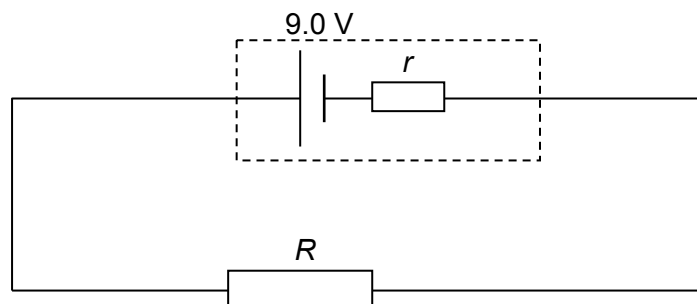
D increasing the distance between the slits

20 The charge that an electric battery can deliver is specified in ampere-hours.

For example, a battery of capacity 50 ampere-hours could supply, when fully charged, 0.25 A for 200 hours.

What is the maximum energy that a fully charged 12 V, 50 ampere-hour battery could supply?

A 600 J

B 36000 J

C 120000 J

D 2160000 J

21 A circuit is formed by connecting a resistor of resistance R between the terminals of a battery of electromotive force (e.m.f.) 9.0 V and internal resistance r.
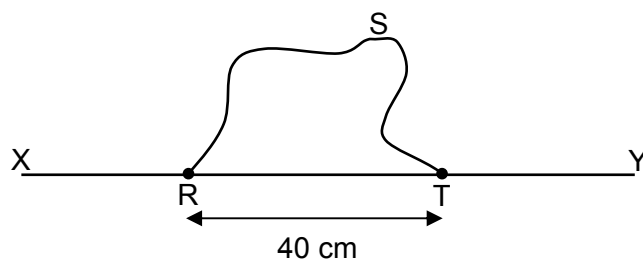

A charge of 6.0 C flows through the resistor in a time of 2.0 minutes causing it to dissipate 48 J of thermal energy.

What is the internal resistance r of the battery?

A 1.3 Ω   **B** 20 Ω   **C** 160 Ω   **D** 180 Ω
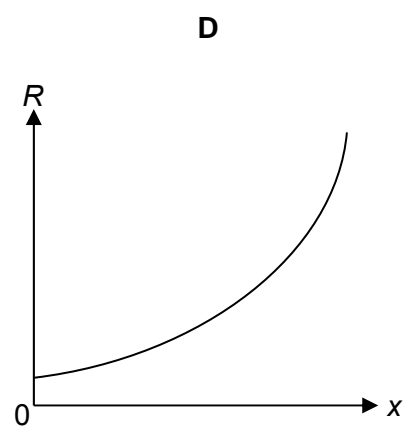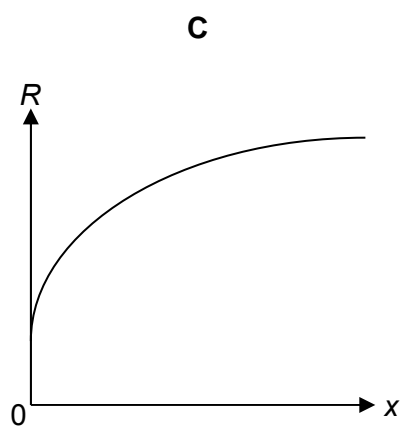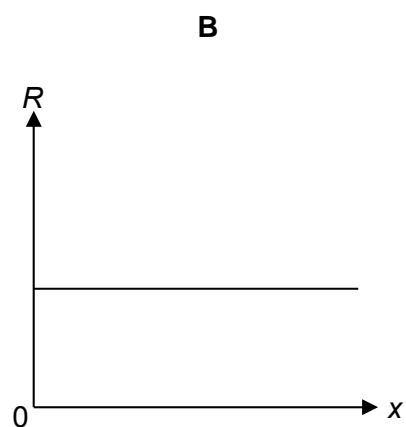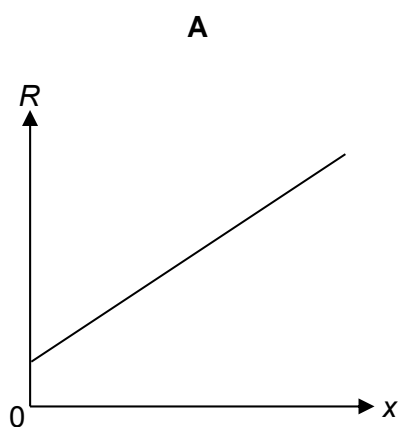
22 A wire RST is connected to another wire XY as shown.

Each wire is 120 cm long with a resistance per unit length of 8.0 $\Omega\,m^{-1}$.

What is the total resistance between X and Y?

A 2.7 Ω
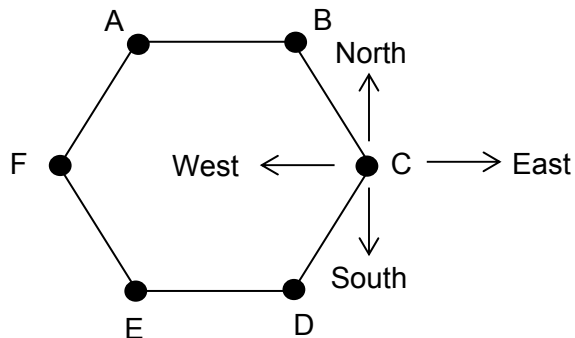
B 4.8 Ω

C 8.8 Ω

D 13.6 Ω

23 When a metal wire is stretched, it becomes longer.

Assuming that the volume of the wire remains constant, which graph best represents the variation with extension x of the resistance R of the wire?
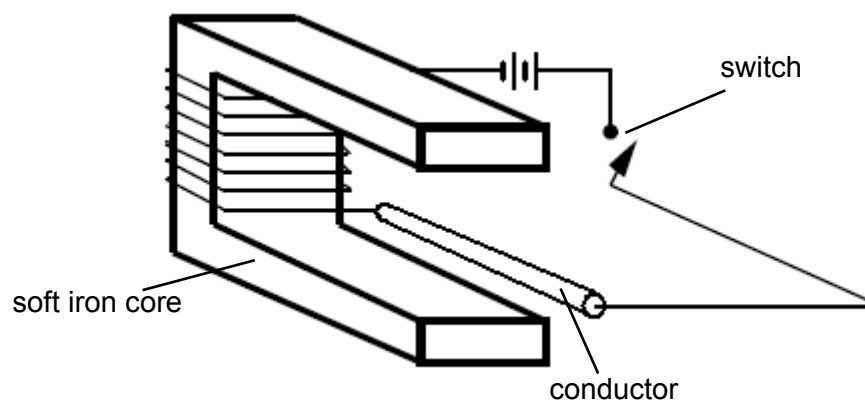
A

B

C

D

24 Six vertical conductors are placed at the corners of a regular hexagon ABCDEF as shown below. Each conductor at A, B, C, D and E carries equal currents in the same direction perpendicular to the plane of the paper. The conductor at F carries current of the same magnitude but in the opposite direction.

Ignoring the Earth's magnetic field, in which direction is the net force on the conductor at C due to the other conductors?
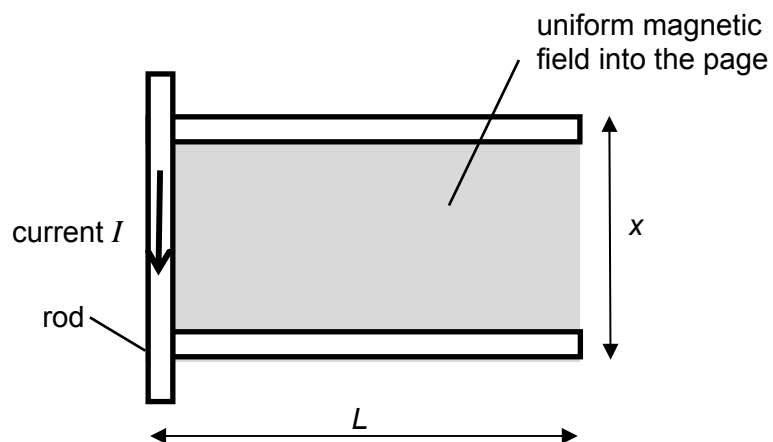
A North

B South

C East

D West

25 A straight conductor rests in the space between two arms of a soft iron core.

After the switch has been closed for a while, in which direction is the magnetic force acting on the conductor?

A up

B down

C left

D right

[Turn over

26 A rod of mass m and length $1.5x$ rests on two parallel rails placed a distance x apart. Each rail has length L, resistivity ρ and cross sectional area A. A potential difference of V is applied across the two ends of the rod and a current of I flows in the direction shown.
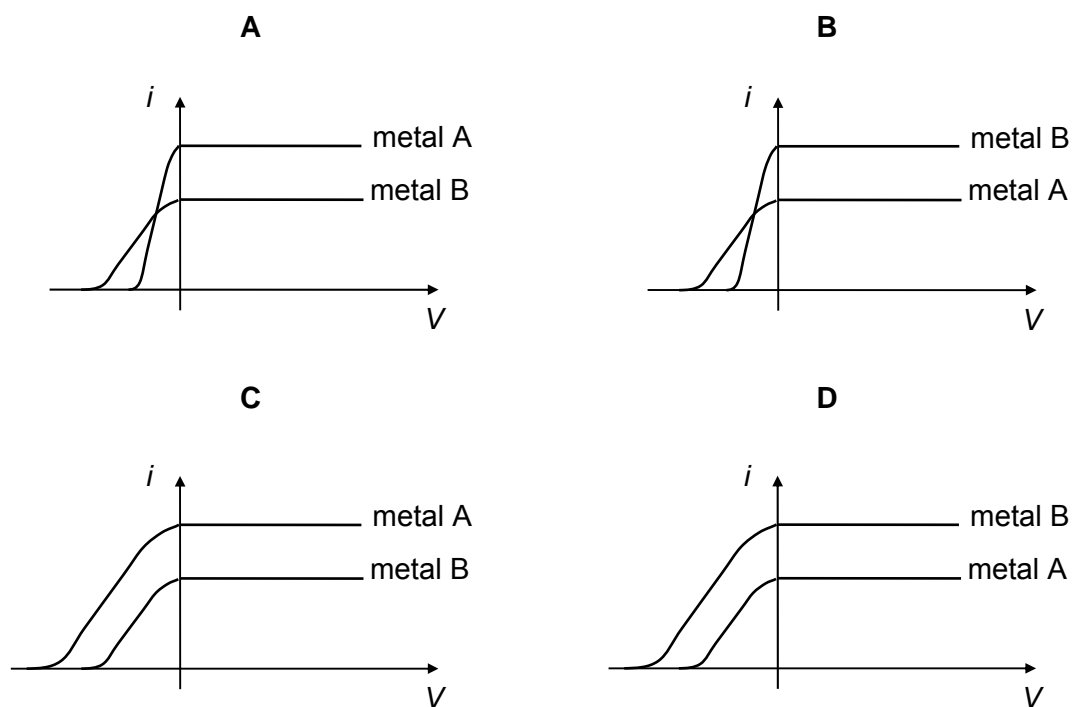

What is the initial acceleration of the rod if there is a uniform magnetic field B directed into the page?

A $\dfrac{BVAx}{2m\rho L}$

B $\dfrac{3BVAx}{4m\rho L}$

C $\dfrac{BIx}{m}$

D $\dfrac{3BIx}{2m}$

27 Metal A has a higher work function energy as compared to metal B. Using a source of constant frequency, the intensity of the radiation incident on metal B is higher than that on metal A.

Which of the following graphs shows the variation of photoelectric current i with potential difference V across the collector and emitter?

A

i

metal A

metal B

V

B

i

metal B

metal A

V

C

i

metal A

metal B

V

D

i

metal B

metal A

V

28 A source of violet light of intensity 500 W m^{-2} and wavelength 380 nm is incident on a zinc plate of area 1.0×10^{-4} m^2.

How many photons strike the zinc plate per second?

A 2.5×10^{18}

B 9.6×10^{16}

C 8.2×10^{15}

D 4.5×10^{14}

　　　　　　　　　　[Turn over

29 A simple model of the energy levels in an atom has only three levels, E_x, E_y, and E_z. A transition from level E_x to level E_z produces radiation of wavelength 380 nm while a transition from level E_y to level E_z produces a radiation of wavelength 300 nm.

Which of the following statements about the energy levels is correct?

A The wavelength of radiation absorbed in a transition between levels E_x and E_y is 80 nm.

B The wavelength of radiation emitted in a transition between levels E_x and E_y is 80 nm.

C Level E_y has a greater energy than levels E_x and E_z.

D Level E_x has a greater energy than levels E_y or E_z.

30 White light from a tungsten filament lamp is passed through sodium vapour and viewed through a spectrometer.

Which of the following best describes the spectrum that would be seen?

A coloured lines on a black background

B dark lines on a coloured background

C white lines on a black background

D dark lines on a white background

End of paper