



DUNMAN HIGH SCHOOL
Preliminary Examinations
Higher 1

CANDIDATE
NAME

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CLASS

6	C		
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INDEX
NUMBER

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PHYSICS

8866/01

Paper 1 Multiple Choice

September 2014
1 hour

Additional Materials: 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.

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.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any working should be done in this booklet.

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

This document consists of **15** 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,	$s = ut + \frac{1}{2} at^2$
	$v^2 = u^2 + 2as$
work done on/by a gas,	$W = p\Delta V$
hydrostatic pressure,	$p = \rho gh$
resistors in series,	$R = R_1 + R_2 + \dots$
resistors in parallel,	$1/R = 1/R_1 + 1/R_2 + \dots$

1 What is the unit of magnetic flux density, in terms of S. I. base units?

- A $\text{kg s}^{-2} \text{A}^{-1}$
- B $\text{kg}^{-1} \text{s}^2 \text{A}$
- C $\text{kg m}^2 \text{s}^{-2} \text{A}$
- D $\text{kg m s}^{-2} \text{A}^{-1}$

2 The wavelength of photons emitted by a hydrogen atom is given by the formula

$$\frac{1}{\lambda} = R_H \left(1 - \frac{1}{n^2} \right)$$

where R_H is a constant and n is an integer greater than or equal to 2.

A student conducted an experiment to determine the constant R_H . The results are summarized below:

n	wavelength λ (nm)
2	122 ± 2

What is the average value for R_H and its corresponding uncertainty?

- A $(1.093 \pm 0.009) \times 10^7 \text{ m}^{-1}$
- B $(1.09 \pm 0.02) \times 10^7 \text{ m}^{-1}$
- C $(1.09 \pm 0.04) \times 10^7 \text{ m}^{-1}$
- D $(1.1 \pm 0.1) \times 10^7 \text{ m}^{-1}$

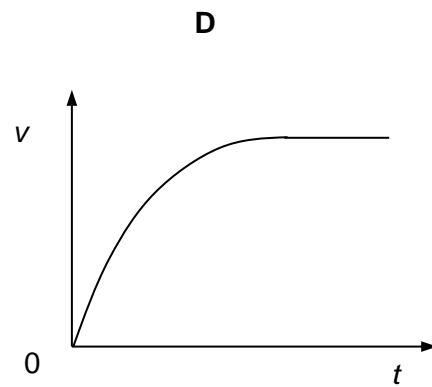
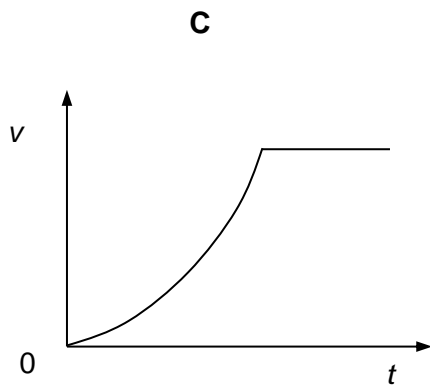
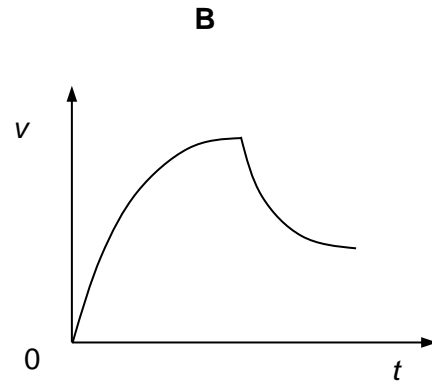
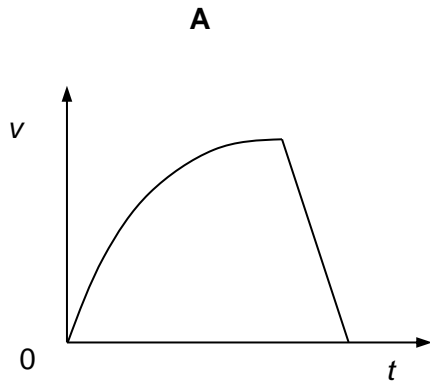
3 A force F is exerted on a freely moving object. At one instant in time, the object has velocity v and acceleration a .

Which of the three quantities must be directed in the same direction?

- A a and v only
- B a and F only
- C v and F only
- D v , F and a

- 4 A ball falls from rest through a great height before hitting the ground.

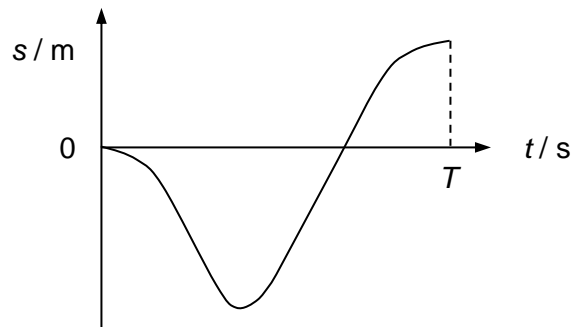
Which of the graphs below best represents the variation with time t of the speed v of the ball? Consider the motion of the ball from the moment it is released to the time just before it hits the ground.



- 5 A man sitting in a train carriage observes that a stationary pendulum hanging from the ceiling makes an angle of 30° with the vertical. What is the acceleration of the train?

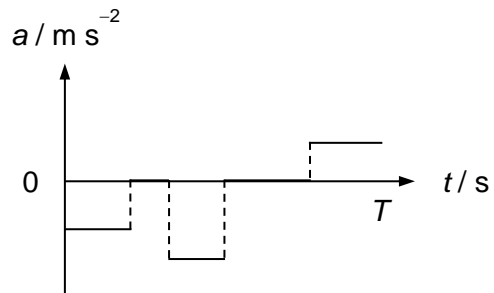
A 4.9 m s^{-2} **B** 5.7 m s^{-2} **C** 8.5 m s^{-2} **D** 17 m s^{-2}

- 6 The graph below shows the variation of the displacement of an object over a period of time T .

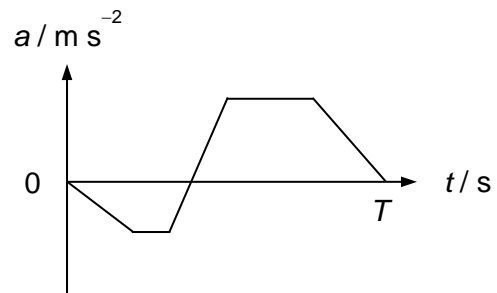


Which of the following graphs best represents the corresponding acceleration experienced by the object over the same time interval?

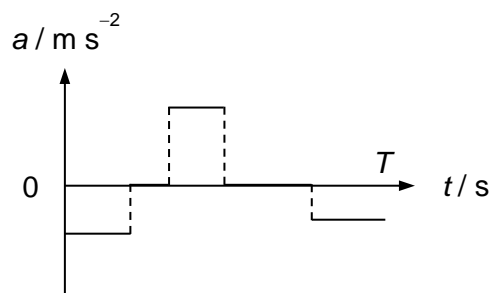
A



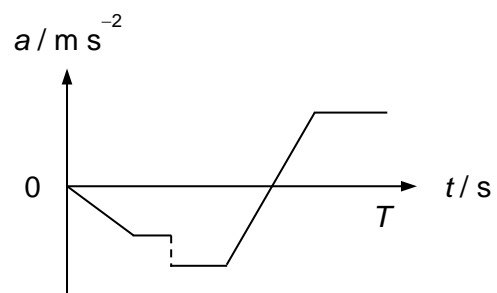
B



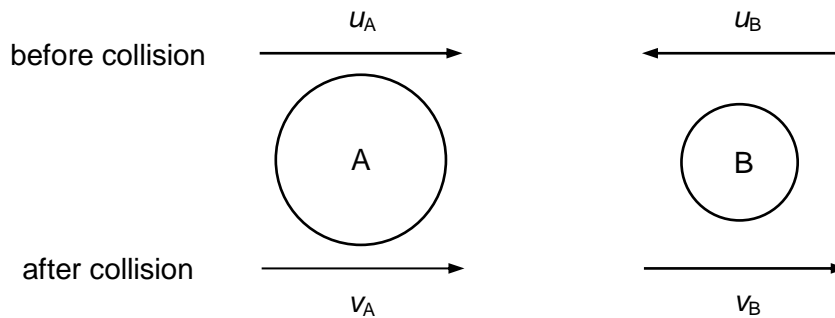
C



D

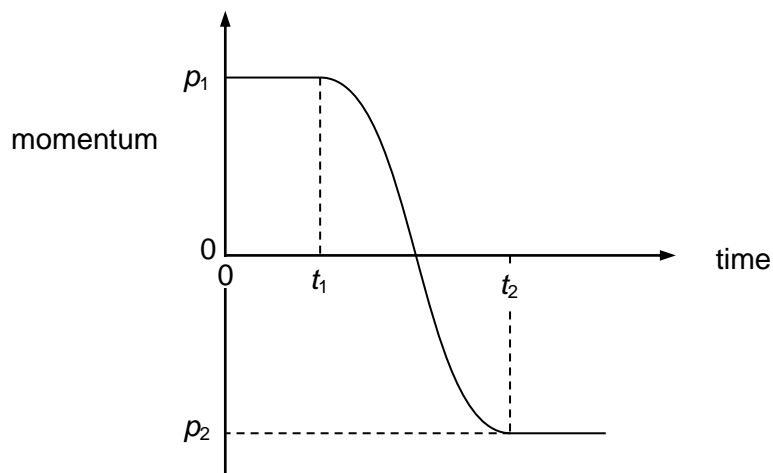


- 7 Two spheres A and B approach each other with speeds u_A and u_B respectively. The spheres have a head-on elastic collision and move off with speeds v_A and v_B in the same direction.



Which of the equations below apply to this collision?

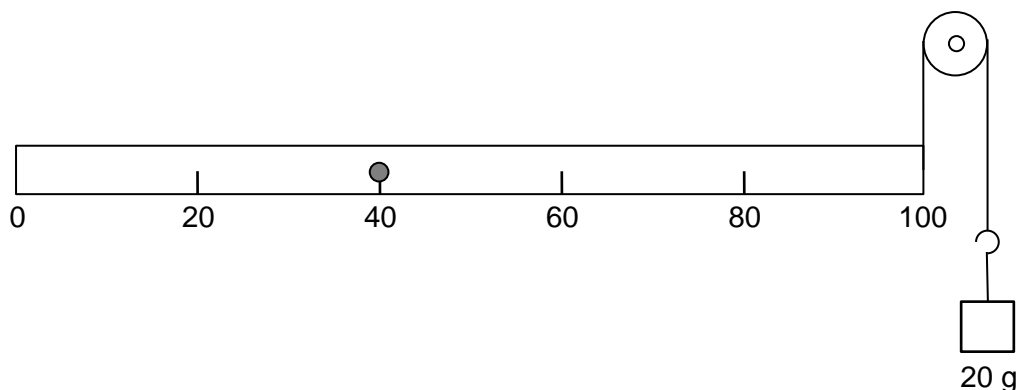
- A** $u_A + u_B = v_B - v_A$
B $u_A - u_B = v_B - v_A$
C $u_A - u_B = v_B + v_A$
D $u_A + u_B = v_B + v_A$
- 8 The graph below shows the variation with time of the momentum of a ball as it moves along a straight line.



What is the magnitude of the average force acting on the ball between times t_1 and t_2 ?

- A** $\frac{p_1 - p_2}{t_2}$ **B** $\frac{p_1 - p_2}{t_2 - t_1}$ **C** $\frac{p_1 + p_2}{t_2}$ **D** $\frac{p_1 + p_2}{t_2 - t_1}$

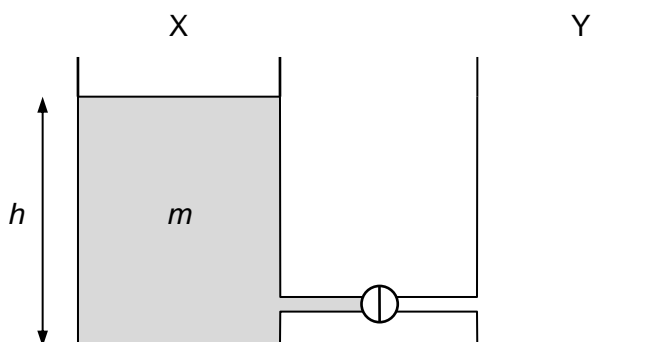
- 9 A uniform metre rule of mass 100 g freely rotates about a pivot at the 40 cm mark. At the 100 cm mark, a string is tied to the metre rule and passed round a frictionless pulley. The string is tied to a 20 g mass on the other end.



At which mark on the ruler must a 50 g mass be suspended so that the ruler remains stationary in the horizontal position shown?

- A** 4 cm **B** 36 cm **C** 44 cm **D** 96 cm

- 10 The diagram shows two identical vessels X and Y connected to a short pipe with a tap.



Initially, X is filled with water of mass m to a depth h , and Y is empty. When the tap is opened, water flows from X to Y until the depths of water in both vessels are equal. How much potential energy is lost by the water during this process? Let the acceleration of free fall be g .

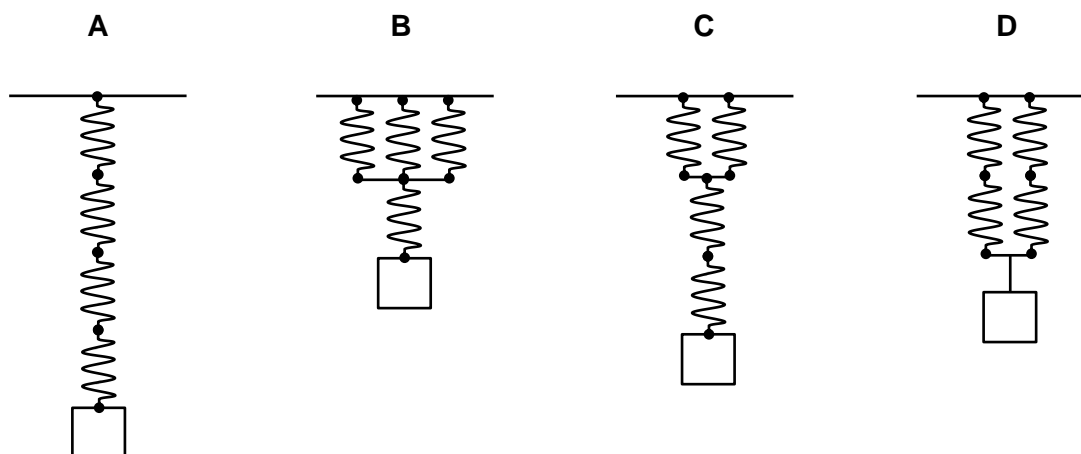
- A** 0 **B** $\frac{mgh}{4}$ **C** $\frac{mgh}{2}$ **D** mgh

- 11 For a car to move with constant acceleration, the power output of the car's engine must

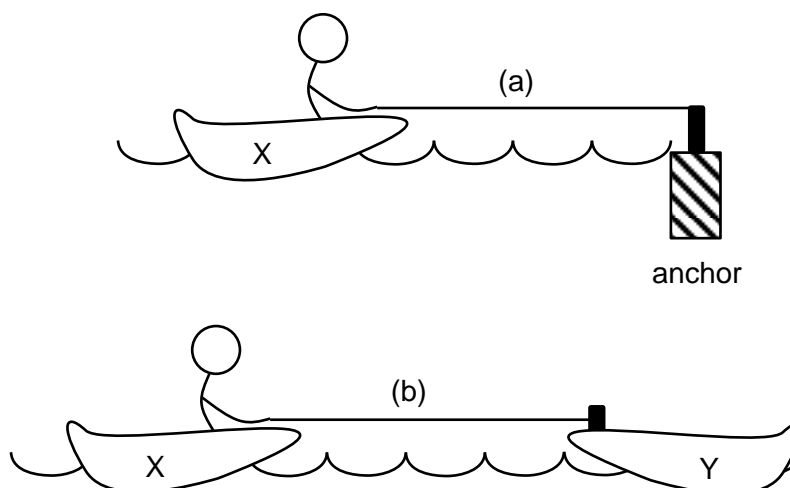
- A** decrease with time.
B remain constant.
C increase with time.
D decrease, then increase with time.

- 12 Four identical springs are arranged in different ways.

Which arrangement will result in the highest effective spring constant?



- 13 A boy on boat X pulls on a rope with a constant force F over a duration of time t . The other end of the rope is either tied to an anchor on (a) the pier or (b) a freely floating boat Y of equal mass as shown below.



W_a and W_b are the total work done by the boy during the time t while P_a and P_b are the average power output of the boy for cases (a) and (b) respectively.

Which of the following is correct?

- | | |
|--------------------------------------|--------------------------------------|
| A $W_a > W_b$ and $P_a > P_b$ | B $W_a = W_b$ and $P_a = P_b$ |
| C $W_a < W_b$ and $P_a < P_b$ | D $W_a > W_b$ and $P_a = P_b$ |

- 14 A source of sound radiates energy equally in all directions. The intensity of sound at a distance of 3.0 m away from the source is 1.8 W m^{-2} . If the power of the source is tripled, the intensity of sound at a distance of 4.5 m from the source is

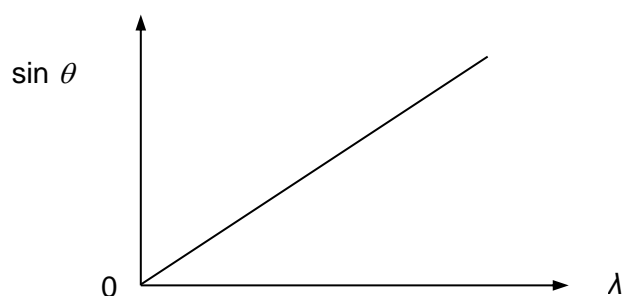
A 0.80 W m^{-2} B 1.4 W m^{-2} C 2.4 W m^{-2} D 4.1 W m^{-2}

- 15 A progressive wave is one which

A has vibrations that are perpendicular to the direction of wave travel.
 B has vibrations that are parallel to the direction of wave travel.
 C transfers energy in the direction of wave travel.
 D transfers energy and particles in the direction of wave travel.

- 16 Two slits with slit separation a are used to deflect light of various wavelengths λ .

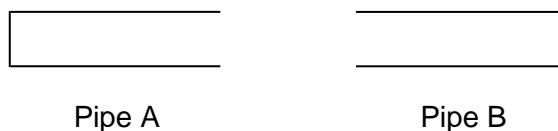
The figure shows a relation between the deflection angles θ for different values of λ in the n^{th} order interference pattern.



What is the gradient of the graph?

A an B $\frac{a}{n}$ C $\frac{n}{a}$ D $\frac{1}{an}$

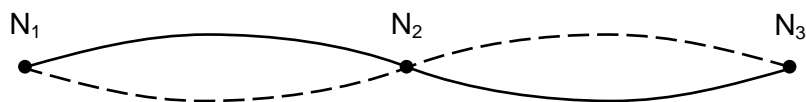
- 17 Pipes A and B shown in the figure below are of equal length.



The fundamental frequencies of pipes A and B are f_A and f_B respectively. What is the ratio $f_A : f_B$?

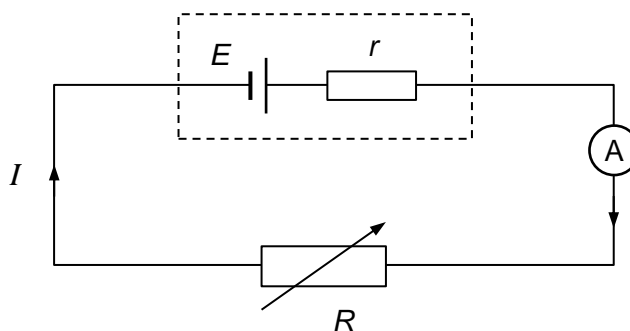
A 4 : 1 B 2 : 1 C 1 : 2 D 1 : 4

- 18 The figure below shows a stationary wave on a string. The stationary wave has three nodes N_1 , N_2 and N_3 .



Which of the statements below is correct?

- A All points on the string vibrate in phase.
 - B All points on the string vibrate with the same amplitude.
 - C Points equidistant from N_2 vibrate with the same frequency and are in phase with each other.
 - D Points equidistant from N_2 vibrate with the same frequency and amplitude.
- 19 A battery of e.m.f. E and internal resistance r delivers a current I through a variable resistance R .



The resistance R is varied and the corresponding currents flowing through an ideal ammeter are recorded.

R / Ω	I / A
1.0	3.0
2.0	2.0

What are the internal resistance r and e.m.f. E of the battery?

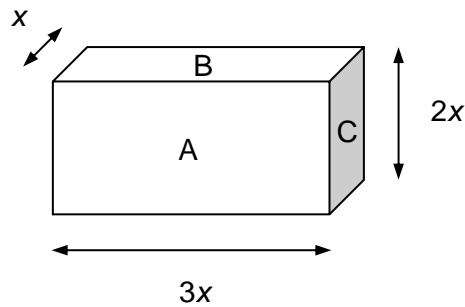
	E / V	r / Ω
A	3.0	1.0
B	3.0	2.0
C	6.0	1.0
D	6.0	2.0

- 20** An electron beam current of $40\ \mu\text{A}$ hits the screen of a cathode-ray oscilloscope and forms a trace on the screen. The time-base of the oscilloscope is set to $20\ \text{ms cm}^{-1}$.

What is the number of electrons arriving at the screen in a two centimetre length of a horizontal trace?

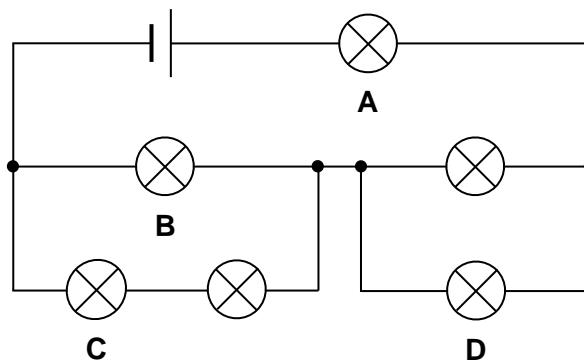
- A** 10^{10} **B** 10^{13} **C** 10^{16} **D** 10^{19}

- 21** A rectangular block has dimensions x , $2x$ and $3x$ as shown in the figure below.

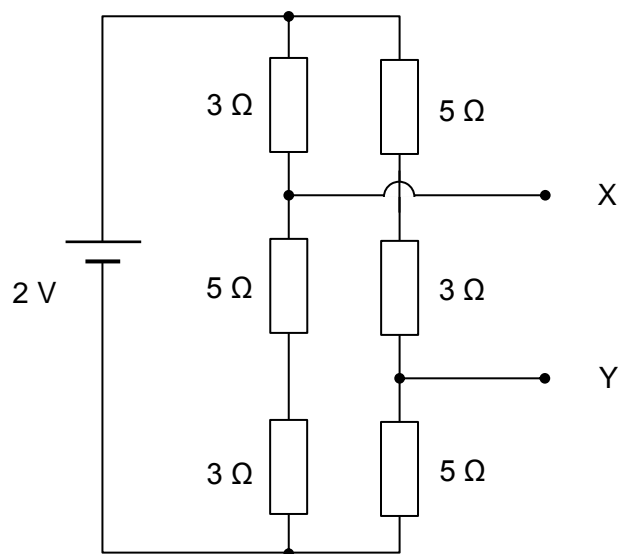


Electrical contact can be made to opposite sides of the block. Between which two sides of the block should electrical contact be made, so that the resistance of the block is a maximum?

- A** Side A and its opposite side
B Side B and its opposite side
C Side C and its opposite side
D Any two sides, as resistance is the same for all pairs of sides
- 22** Six identical light bulbs are connected as shown in the figure below. Which bulb is the dimmest?

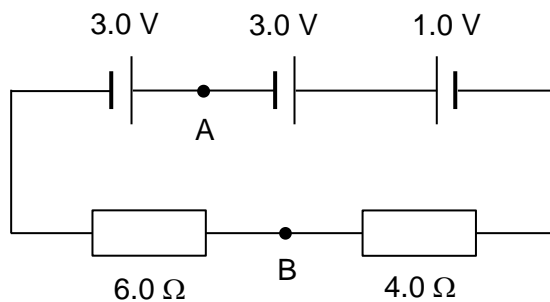


- 23** Six resistors are connected to a 2 V cell of negligible internal resistance.



What is the potential difference across points X and Y?

- A** $\frac{2}{3}$ V **B** $\frac{32}{143}$ V **C** $\frac{64}{143}$ V **D** $\frac{98}{143}$ V
- 24** Two resistors are connected across three cells of negligible internal resistance as shown in the figure below.



What is the potential difference across points A and B?

- A** 0 V **B** 1.2 V **C** 3.0 V **D** 4.2 V

- 25** Four particles are moving at the same speed in the same magnetic field. All four particles are moving perpendicular to the magnetic field.

Which of the four particles is deflected the most?

- A** a copper ion
- B** a helium nucleus (made up of 2 protons and 2 neutrons)
- C** an electron
- D** a proton

- 26** A straight, horizontal wire lies perpendicular to a horizontal magnetic field as shown in Fig. 26.1. A current flows through the wire and the magnetic field exerts a vertical force of magnitude 9.0 mN on the wire. Assume that the wire has negligible mass.

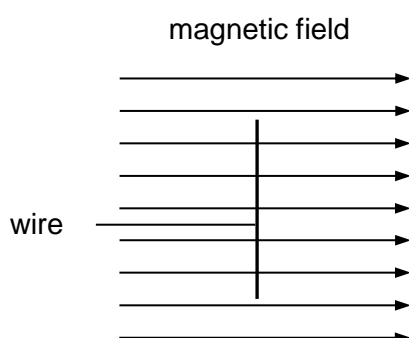


Fig. 26.1

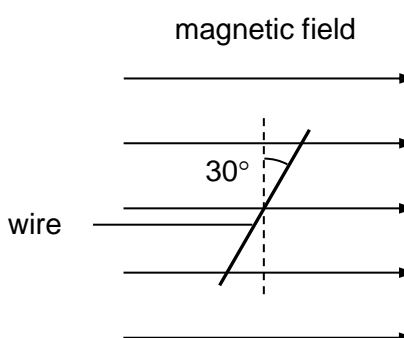


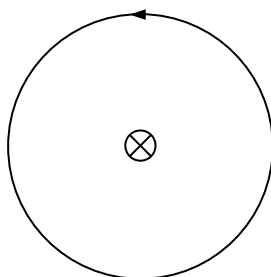
Fig. 26.2

The wire is then rotated through 30° as shown in Fig. 26.2. The flux density of the magnetic field is now halved while the same current flows through the wire.

What is the magnitude of the new vertical force acting on the wire?

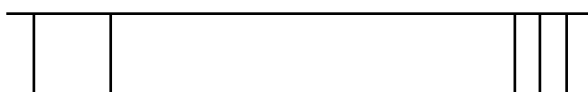
- A** 2.3 mN
- B** 3.9 mN
- C** 9.0 mN
- D** 15.6 mN

- 27** A coil of wire has current flowing through it in the anticlockwise direction. A long straight wire located along the axis of the coil has current flowing into the paper, as shown in the figure below.



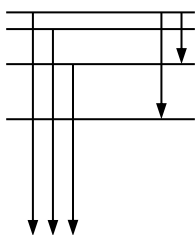
What is the effect of this set-up on the coil?

- A** It does not experience any force.
 - B** The resultant force acting on the coil is directed out of the paper.
 - C** It experiences attractive forces that are directed towards the centre of the coil.
 - D** It experiences repulsive forces that are directed away from the centre of the coil.
- 28** The figure below shows the emission spectrum of a gas. The frequency scale increases to the right.

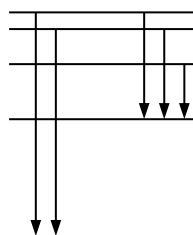


Which of the options below best illustrates the electron transitions which give rise to the emission spectrum?

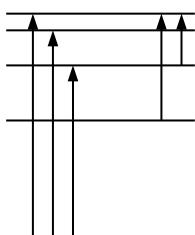
A



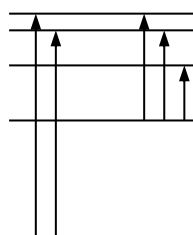
B



C



D



29 What is the de Broglie wavelength of a particle of mass m and kinetic energy E ?

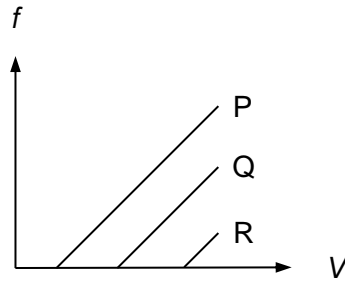
A $\frac{h}{\sqrt{2mE}}$

B $h\sqrt{\frac{m}{2E}}$

C $\frac{\sqrt{2mE}}{h}$

D $\frac{mh}{2E}$

30 When electromagnetic radiation of frequency f falls on a particular metal surface, photoelectrons may be emitted. The graph below shows the variation with f of the stopping potential V of these electrons for different materials P, Q and R.



Which of the following statements is correct?

- A P has the smallest work function because f is higher for the same V .
- B R has the smallest work function because V is higher for the same f .
- C P emits the most number of photoelectrons because its work function is the smallest.
- D R emits the most number of photoelectrons because its work function is the smallest.