



DUNMAN HIGH SCHOOL  
Preliminary Examinations  
Year 6  
Higher 1

CANDIDATE  
NAME

CLASS

INDEX NUMBER

## PHYSICS

8866/01

Paper 1 Multiple Choice

September 2015

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 in the spaces provided unless this has been done for you.

DO **NOT** WRITE IN ANY BARCODES.

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.

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

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This document consists of **17** printed pages and **1** blank page.

**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 Four students each made a series of measurements of a 1.000 kg mass. The table shows the results obtained.

Which student obtained a set of readings that is accurate but not precise?

student	reading / kg				
	1	2	3	4	5
<b>A</b>	1.000	1.000	1.002	1.001	1.002
<b>B</b>	1.011	0.999	1.001	0.989	0.995
<b>C</b>	1.012	1.013	1.012	1.014	1.014
<b>D</b>	0.993	0.987	1.002	1.000	0.983

- 2 A student uses a metre rule to measure the length of an elastic band before and after stretching it.

The lengths are recorded as follows:

length of band before stretching =  $50.0 \pm 0.1$  cm

length of band after stretching =  $51.6 \pm 0.1$  cm

What is the fractional uncertainty of the extension of the band?

- A** 0                      **B** 0.032                      **C** 0.063                      **D** 0.125
- 3 The initial velocity of a projectile is  $10 \text{ m s}^{-1}$  parallel to the ground. Its final velocity before hitting the ground is  $15 \text{ m s}^{-1}$  at an angle of  $20^\circ$  from the ground.

What is the change in velocity?

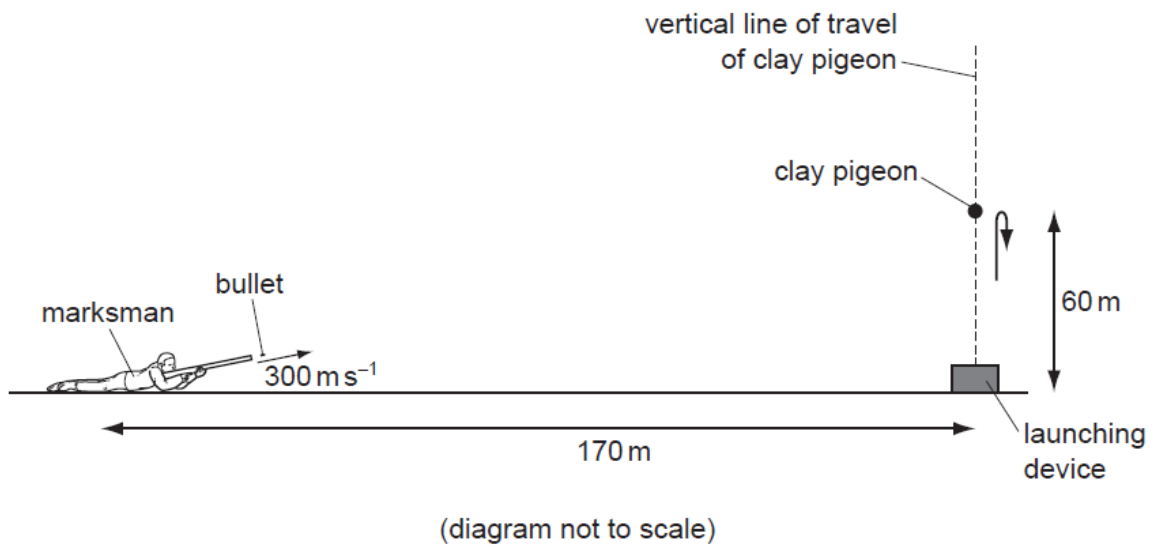
- A**  $3.6 \text{ m s}^{-1}$                       **B**  $5.1 \text{ m s}^{-1}$                       **C**  $6.6 \text{ m s}^{-1}$                       **D**  $14.9 \text{ m s}^{-1}$

- 4 An object is falling from rest. Before it reaches terminal velocity,

What is the change in velocity?

- A** its velocity is increasing and its acceleration is decreasing.  
**B** its velocity is decreasing and its acceleration is decreasing.  
**C** its velocity is decreasing and its acceleration is constant.  
**D** its velocity is increasing and its acceleration is constant.

- 5 A clay pigeon is launched vertically into the air from the ground.

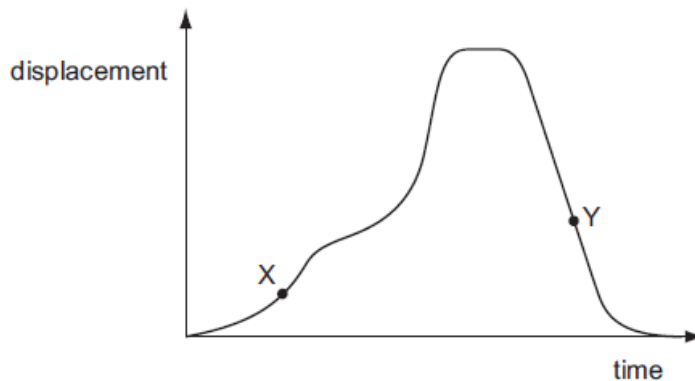


A marksman lies 170 m away from the launching device on level ground. Just as the clay pigeon reaches its maximum height 60 m, the marksman fires a bullet aimed directly at the clay pigeon. The bullet leaves the rifle with a speed of  $300 \text{ m s}^{-1}$ .

At what time after the bullet is fired is the clay pigeon hit? Assume air resistance is negligible.

- A** 0.17 s                      **B** 0.57 s                      **C** 0.60 s                      **D** 1.66 s

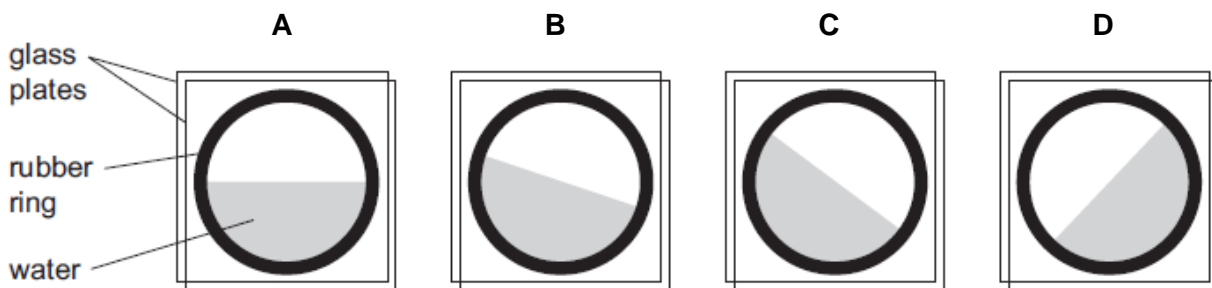
- 6 The graph shows how the horizontal displacement of a fairground car changes with time for part of its journey.



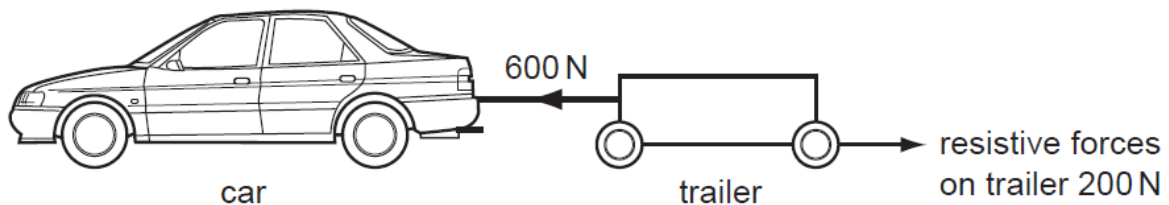
A simple accelerometer is made by sandwiching a rubber ring between two glass plates and introducing some coloured water insider the ring. The accelerometer is attached to the side of the car.

Diagram **B** corresponds to point X on the graph.

Which diagram shows the angle of water surface in the accelerometer at point Y?



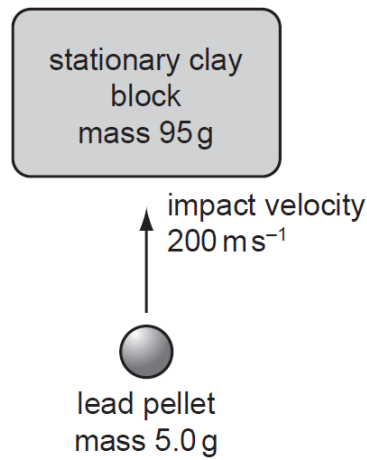
- 7 A trailer of mass 400 kg is pulled by a car of mass 1200 kg. The diagram shows the horizontal forces acting on the trailer.



What is the net force acting on the car?

- A** 400 N                      **B** 600 N                      **C** 1200 N                      **D** 1800 N

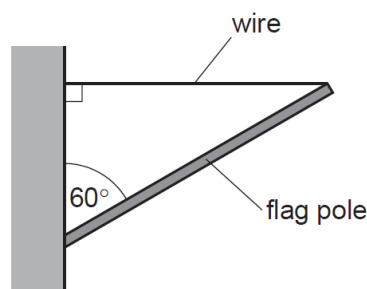
- 8 A lead pellet is shot vertically upwards into a clay block that is stationary at the moment of impact but is able to rise freely after impact.



The pellet hits the block with an initial velocity of  $200 \text{ m s}^{-1}$ . It embeds itself in the block and does not emerge.

How high above its initial position will the block rise?

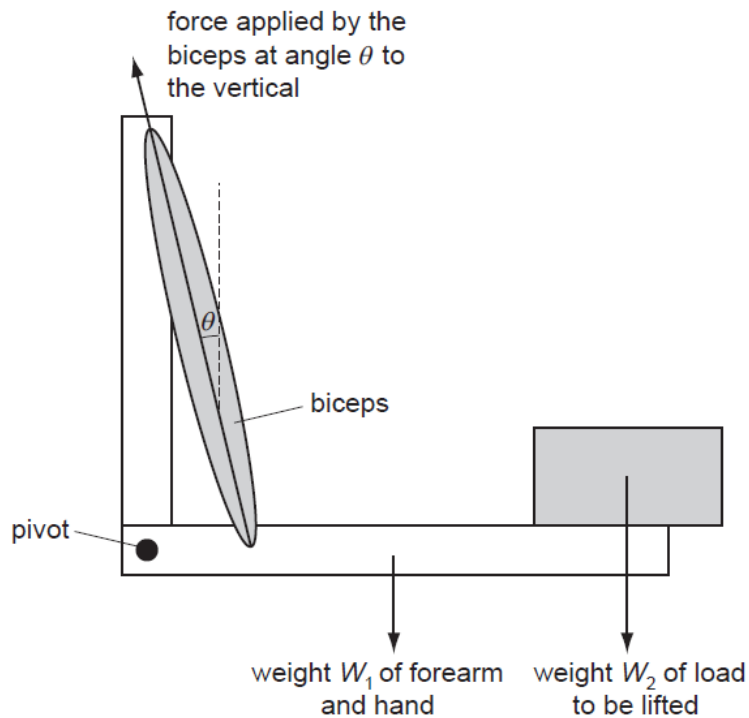
- A 5.1 m                      B 5.6 m                      C 10 m                      D 102 m
- 9 A flag pole of length 3.0 m and mass 75 kg is attached to a building. The angle between the pole and the building is  $60^\circ$ . The end of the pole is supported by a wire attached to the building at a right angle.



What is the tension in the wire?

- A 65 N                      B 210 N                      C 640 N                      D 1300 N

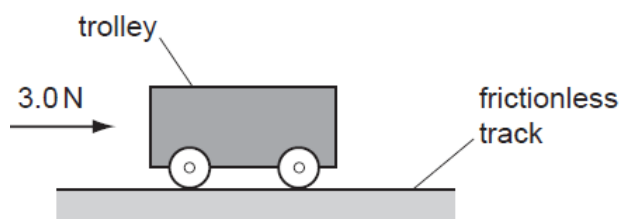
- 10** The diagram shows a model of an arm. A force applied by the biceps muscle can hold the arm in equilibrium while it supports a load.



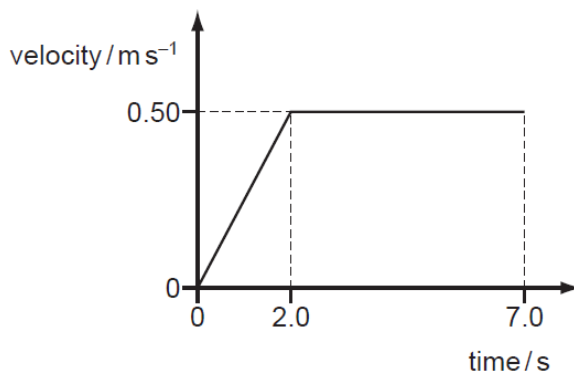
Which statement is correct when the arm is in equilibrium in the position shown?

- A** The force from the biceps is bigger when the load is moved nearer to the pivot.
- B** The force from the biceps is equal to  $W_1 + W_2$ .
- C** The resultant force on the biceps is zero.
- D** The force at the pivot is zero.

- 11 A trolley is pushed with a force of 3.0 N for 2.0 s along a frictionless track.

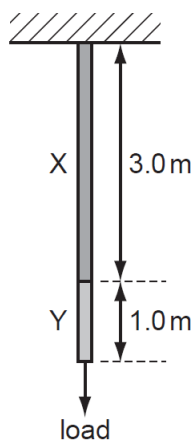


The graph shows the velocity of the trolley against time.



How much work is done by the force on the trolley?

- A 1.5 J                      B 3.0 J                      C 6.0 J                      D 9.0 J
- 12 A wire consists of a 3.0 m length of metal X joined to a 1.0 m length of metal Y. The cross-sectional area of the wire is uniform.



A load hung from the wire causes metal X to stretch by 1.5 mm and metal Y to stretch by 1.0 mm.

The same load is then hung from a second wire of the same cross-section, consisting of 1.0 m of metal X and 3.0 m of metal Y.

What is the total extension of this second wire?

- A 2.5 mm                      B 3.5 mm                      C 4.8 mm                      D 5.0 mm

- 13** The Kingda Ka, the tallest and fattest rollercoaster in the world, was opened in 2005 in New Jersey, USA.

A car carrying passengers starts from rest at a height of 139.5 m. It then descends to a height of 12.5 m.

What is the velocity of the car at the lowest point? (Ignore energy losses due to friction).

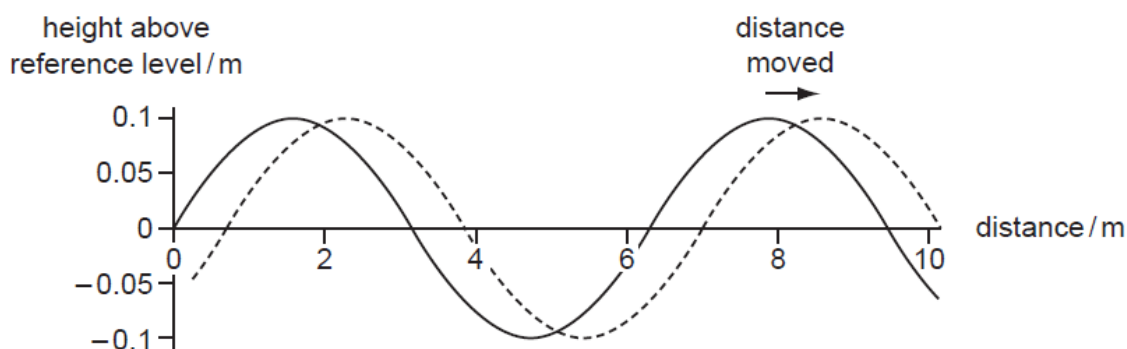
- A**  $16 \text{ m s}^{-1}$                       **B**  $35 \text{ m s}^{-1}$                       **C**  $50 \text{ m s}^{-1}$                       **D**  $52 \text{ m s}^{-1}$

- 14** A motor of power 10 W is used to lift a load of 20 N. The efficiency of the motor is 25 %.

How long does it take to lift the load through a vertical distance of 0.50 m?

- A** 0.040 s                      **B** 0.25 s                      **C** 4.0 s                      **D** 39 s

- 15** The solid line shows a diagram of a rope on which there is a progressive wave travelling to right. The dotted line shows the same rope 0.2 s later.

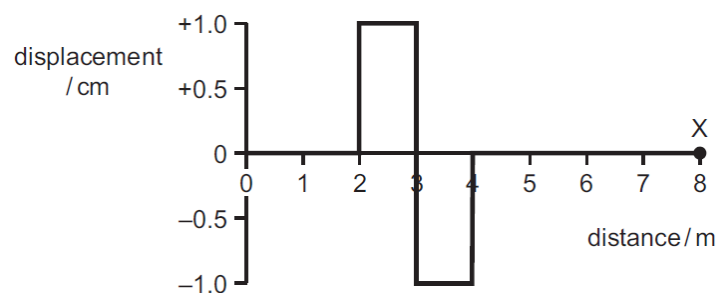


Which statement is correct?

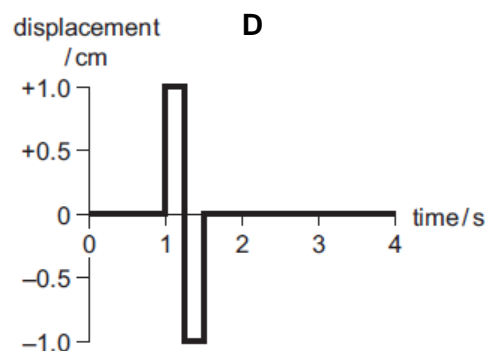
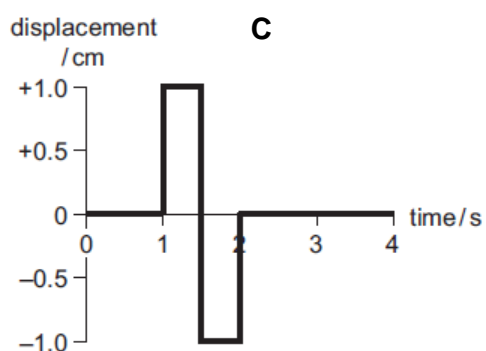
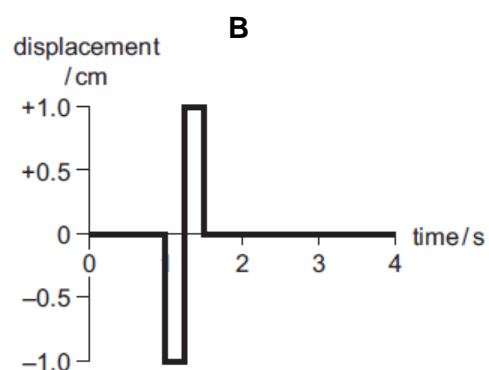
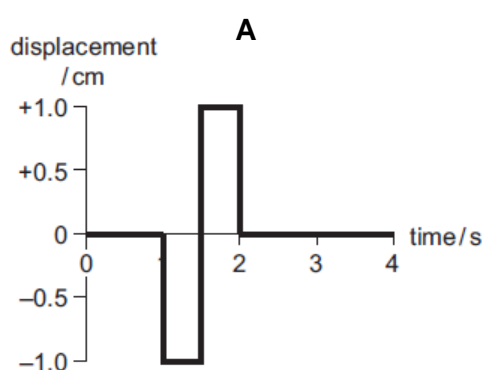
- A** The amplitude of the wave is about 0.2 m.  
**B** The frequency of the wave is about 0.6 Hz.  
**C** The speed of the wave is about  $30 \text{ m s}^{-1}$ .  
**D** The wavelength of the portion shown is about 10 m.

- 16 The diagram shows a wave pulse at time  $t = 0$ .

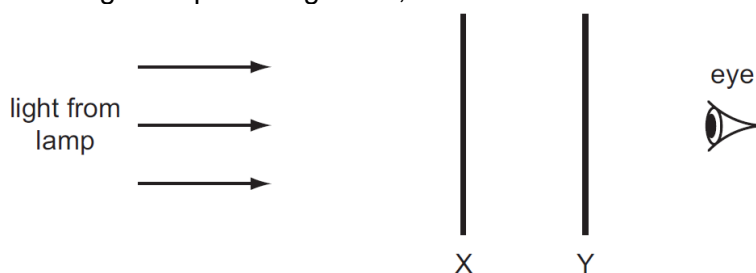
The pulse is travelling to the right at a speed of  $4.0 \text{ m s}^{-1}$ .



Which graph correctly shows how the displacement of point X will vary over the next 4 seconds?



- 17 A lamp is viewed through two polarising filters, X and Y.

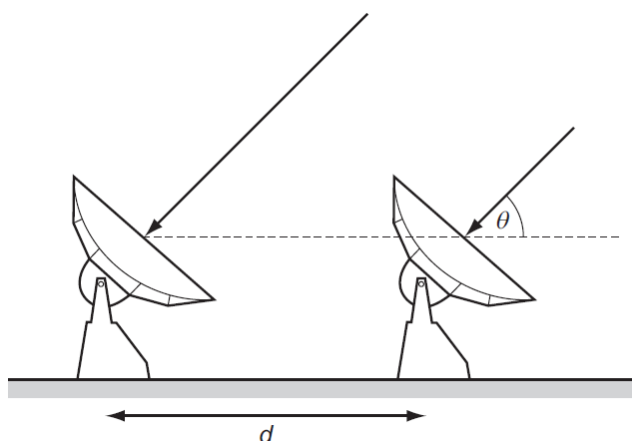


The filters are initially orientated so that the lamp appears with maximum brightness.

Which change in the orientation of the filters will again make the lamp appear with maximum brightness?

	X	Y
<b>A</b>	not turned	turned 90° anticlockwise
<b>B</b>	turned 45° clockwise	turned 45° anticlockwise
<b>C</b>	turned 45° clockwise	turned 90° anticlockwise
<b>D</b>	turned 90° clockwise	turned 90° anticlockwise

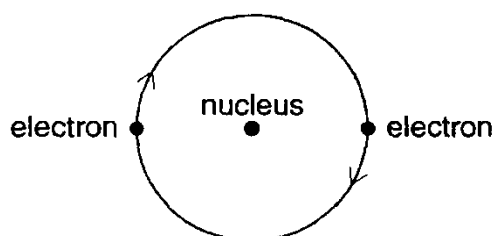
- 18 Two radio telescopes separated by a distance  $d$  detected parallel waves of wavelength  $\lambda$  from the same distant radio source.



What is the correct expression for the path difference between the waves received at the telescopes?

- A**  $d \sin \theta$ 
**B**  $d \cos \theta$ 
**C**  $\frac{d \sin \theta}{\lambda}$ 
**D**  $\frac{d \cos \theta}{\lambda}$

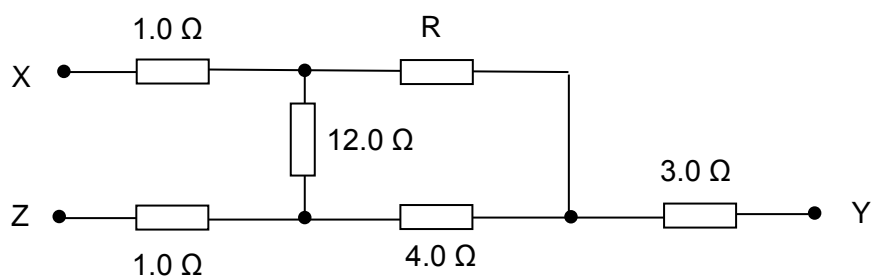
- 19** Two waves are defined to be coherent if
- A** they are emitted by identical sources close together.
  - B** they have a constant phase difference between them.
  - C** they have the same amplitude and frequency.
  - D** they have the same wavelength and speed.
- 20** A strip of wet cardboard is fixed on the bottom of a microwave oven. The microwave oven is turned on for a short time. When the card is removed a pattern of dry spots is observed on the cardboard. This is because a standing wave is set up inside the oven.
- The dry spots are measured and found to occur at 14 mm, 86 mm, 156 mm, 225 mm and 293 mm from the end of the strip.
- From this information, what is the frequency of the microwaves?
- A** 2.2 GHz
  - B** 2.6 GHz
  - C** 4.3 GHz
  - D** 5.1 GHz
- 21** Which statement describes the electrical potential difference between two points in a wire carrying a current?
- A** The force required to move a unit positive charge between the points.
  - B** The ratio of the energy dissipated between the points to the current.
  - C** The ratio of the power dissipated between the points to the current.
  - D** The ratio of the power dissipated between the points to the charge moved.
- 22** The diagram shows a model of an atom in which two electrons move round a nucleus in a circular orbit. The electrons complete one full orbit in  $1.0 \times 10^{-15}$  s.



What is the current caused by the motion of the electrons in the orbit?

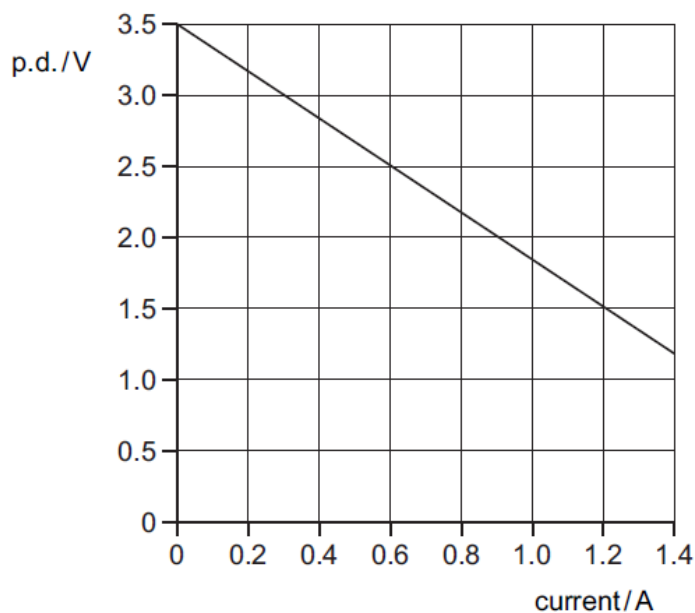
- A**  $1.6 \times 10^{-34}$  A
- B**  $3.2 \times 10^{-34}$  A
- C**  $1.6 \times 10^{-4}$  A
- D**  $3.2 \times 10^{-4}$  A

- 23 The diagram shows a network of six resistors. The resistance between X and Z is  $8.0\ \Omega$ .



What is the value of resistance  $R$ ?

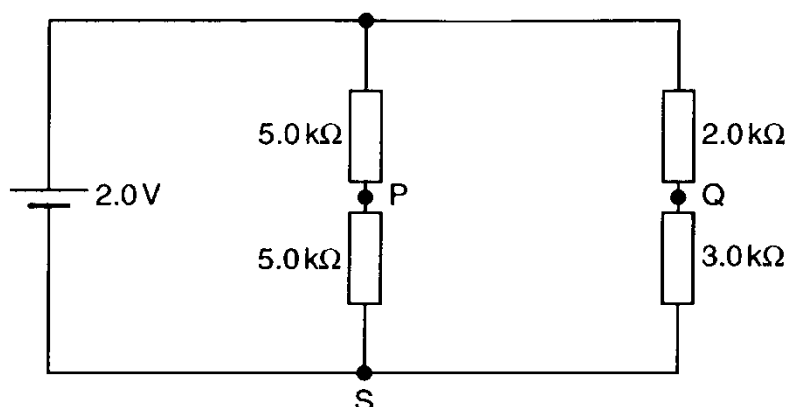
- A  $4.0\ \Omega$                       B  $8.0\ \Omega$                       C  $12.0\ \Omega$                       D  $16.0\ \Omega$
- 24 The diagram shows how the potential difference (p.d.) across a battery varies with the current that it supplies.



What is the internal resistance of the battery?

- A  $0.60\ \Omega$                       B  $1.2\ \Omega$                       C  $1.7\ \Omega$                       D  $2.3\ \Omega$

- 25 A cell of e.m.f. 2.0 V and negligible internal resistance is connected to the network of resistors shown.

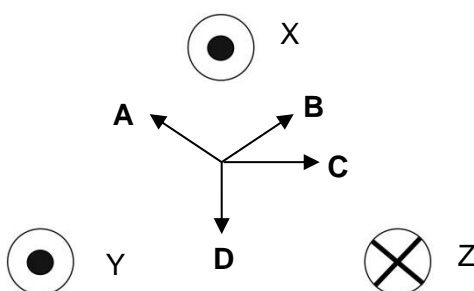


$V_1$  is the potential difference between S and P.  $V_2$  is the potential difference between S and Q.

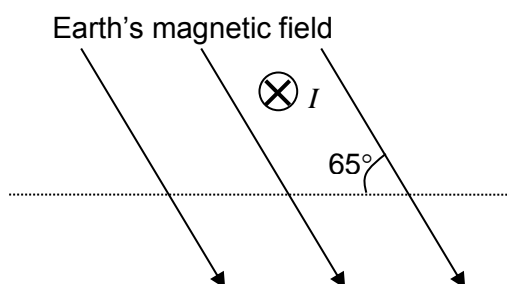
What is the value of  $V_1 - V_2$ ?

- A +0.50 V                      B +0.20 V                      C -0.20 V                      D -0.50 V
- 26 Three wires, X, Y and Z, each carrying the same current, are arranged in an equilateral triangle as shown in the following diagram. The current in wires X and Y are directed out of the plane of the paper, while current in wire Z is directed into the plane of the paper.

The direction of magnetic field at the centre is

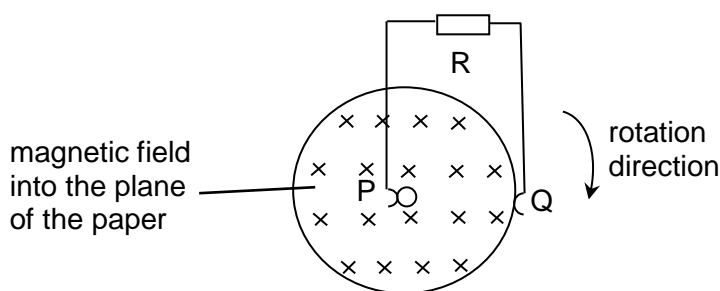


- 27** A horizontal power cable of length 2.0 m carries a steady current of 3.0 A into the plane of the diagram.



What is the force acting on the cable that is caused by the Earth's magnetic field of flux density  $4.0 \times 10^{-5} \text{ T}$ , in a region where this field is at  $65^\circ$  to the horizontal?

- A**  $100 \mu\text{N}$                       **B**  $220 \mu\text{N}$                       **C**  $240 \mu\text{N}$                       **D**  $660 \mu\text{N}$
- 28** In the following figure, a copper disc rotates uniformly between the pole-pieces of a powerful magnet (not shown in figure) in a clockwise direction. P and Q are metallic brushes making contact with the axle and the edge of the disc respectively.



Which statement is correct?

- A** No current flows through R because P and Q are at the same horizontal level.  
**B** No current flows through R because the disc is rotating uniformly.  
**C** A steady current flows from P, through R, to Q.  
**D** Q is at a higher potential compared to P.

- 29** Which piece of evidence about the photoelectric effect cannot be explained using a wave model?
- A** Increasing the intensity of the illumination increases the rate at which electrons are ejected.
  - B** Shining ultraviolet radiation onto a zinc surface ejects electrons.
  - C** Shining visible light onto a potassium surface ejects electrons.
  - D** There is a threshold frequency below which no electrons are ejected from a metal surface.
- 30** In a photoelectric emission experiment, a metal is irradiated with photons of wavelength  $\lambda$ . The minimum frequency to cause photoelectric emission is  $f_0$ . If  $c$  is the speed of light, what fraction of the photon energy is converted to kinetic energy in the electron travelling with the greatest speed?
- |  |                                      |
|--|--------------------------------------|
| <b>A</b> $\frac{\lambda}{\lambda - f_0 c}$ | <b>B</b> $1 - \frac{f_0 c}{\lambda}$ |
| <b>C</b> $\frac{c}{c - f_0 \lambda}$       | <b>D</b> $1 - \frac{f_0 \lambda}{c}$ |

**End of paper**

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