EUNOIA JUNIOR COLLEGE
JC2 MID YEAR EXAMINATIONS 2023
General Certificate of Education Advanced Level
Higher 1

CANDIDATE NAME	
CIVICS GROUP	**2 2 -**
REGISTRATION NUMBER	

PHYSICS

8867/01

Multiple Choice Questions

5th July 2023

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, civics group and registration number on all the work you hand in.
The use of an approved scientific calculator is expected where appropriate.
Answer **all** questions.

There are **thirty** questions in this section.
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 rough working should be done in this booklet.

This document consists of **19** printed pages and **1** blank page.

Data

speed of light in free space	$c = 3.00 \times 10^{8}$ m s^{-1}
elementary charge	$e = 1.60 \times 10^{-19}$ C
unified atomic mass constant	$u = 1.66 \times 10^{-27}$ 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
the Avogadro constant	$N_A = 6.02 \times 10^{23}$ mol^{-1}
gravitational constant	$G = 6.67 \times 10^{-11}$ N m^2 kg^{-2}
acceleration of free fall	$g = 9.81$ m s^{-2}

Formulae

uniformly accelerated motion	$s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$
resistors in series	$R = R_1 + R_2 + \ldots$
resistors in parallel	$1/R = 1/R_1 + 1/R_2 + \ldots$

1 Which estimate is realistic?

A The kinetic energy of a bus travelling on an expressway is 30 000 J

B The power of a domestic light is 300 W.

C The temperature of a hot oven is 300 K.

D The volume of air in a car tyre is 0.03 m^3.

2 Which quantity could have units of N m V^{-1}?

A acceleration

B charge

C current

D resistance

3 Four students each made a series of measurements of the acceleration of free fall *g*. The table shows the results obtained.

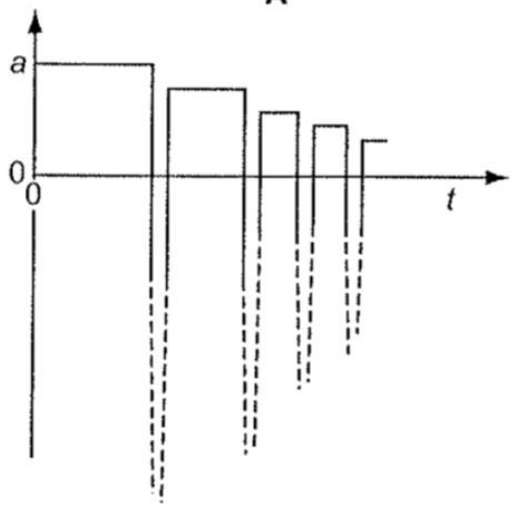
Which student obtained a set of results that could be described as precise but not accurate?

student	results, *g* / m s^{-2}			
A	9.81	9.79	9.84	9.83
B	9.81	10.12	9.89	8.94
C	9.45	9.21	8.99	8.76
D	8.45	8.46	8.50	8.41

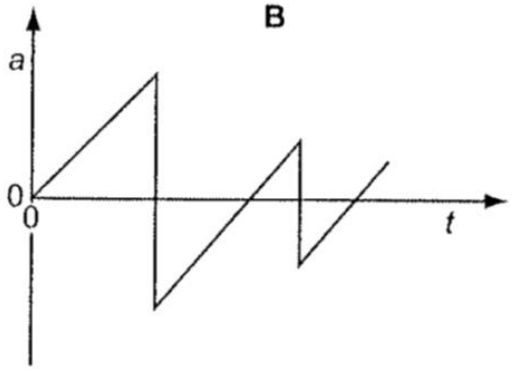
4 A steel ball is released from rest at a distance above a rigid horizontal surface and is allowed to bounce.

Which graph best represents the variation with time t of acceleration a?

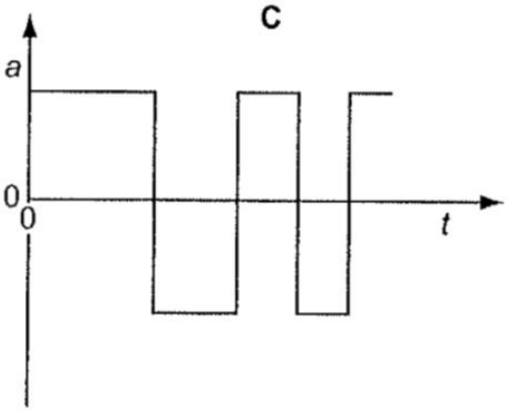
A



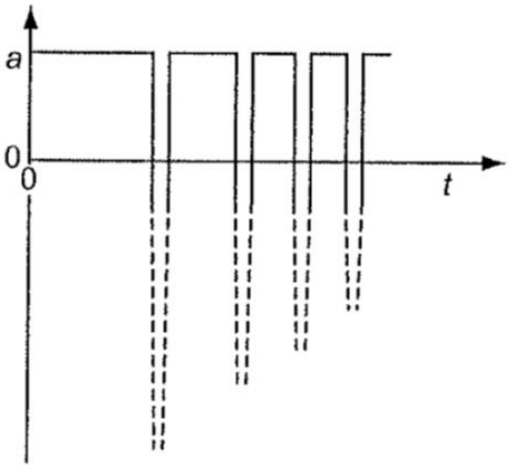
B



C



D



5 A train, initially at rest at a station, has a uniform acceleration of 0.20 m s^{-2} until it reaches a speed of 20 m s^{-1}. It travels for some time at this constant speed and then has a uniform deceleration of 0.40 m s^{-2} until it comes to a rest at the next station. The distance between the two stations is 3000 m.

What is the time taken by the train to travel between the two stations?

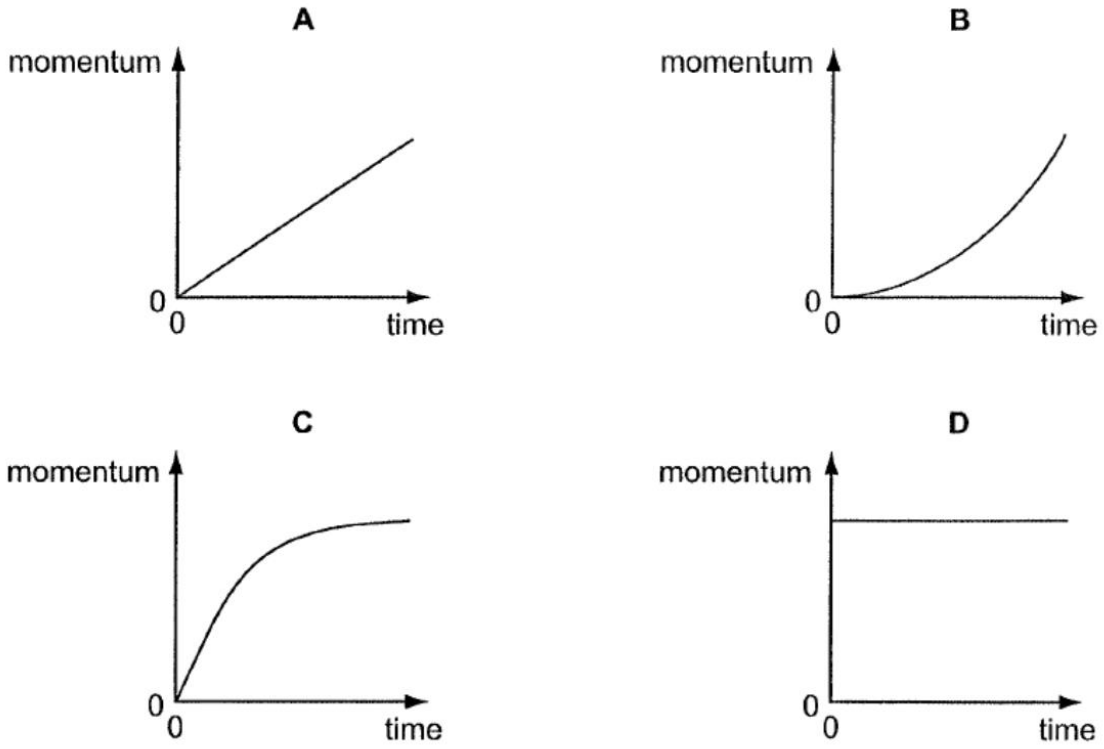
A 75 s **B** 150 s **C** 225 s **D** 300 s

6 An object is thrown with velocity 5.2 m s^{-1} vertically upwards on the Moon. The acceleration due to gravity on the Moon is 1.62 m s^{-2}.

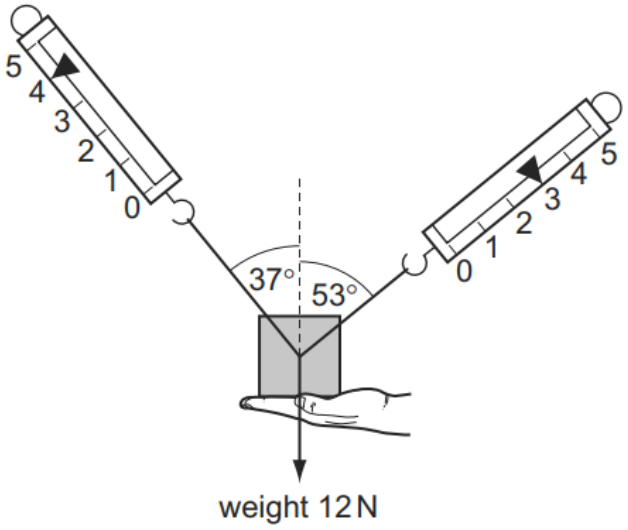
What is the time taken for the object to return to its starting point?

A 2.5 s **B** 3.2 s **C** 4.5 s **D** 6.4 s

7 Which graph best shows the variation with time of the momentum of a body accelerated by a constant force?



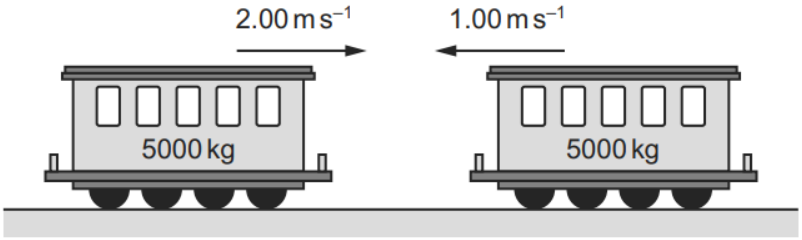
8 A mass is supported by a person's hand and two newton-meters as shown.



When the person's hand is removed, what is the initial vertical acceleration of the mass?

A 0.6 m s^{-2} **B** 2.8 m s^{-2} **C** 4.3 m s^{-2} **D** 5.7 m s^{-2}

9 Two train carriages each of mass 5000 kg roll toward one another on a level track. One is travelling at 2.00 m s^{-1} and the other at 1.00 m s^{-1}, as shown.



They collide and join together.

What is the kinetic energy lost during the collision?

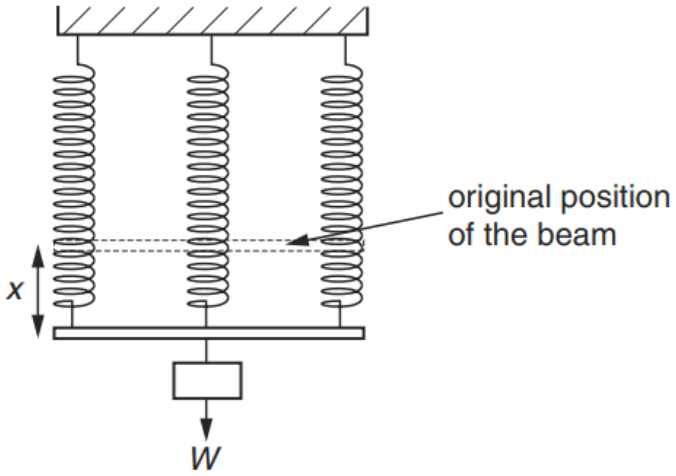
A 1250 J

B 7500 J

C 11 250 J

D 12 500 J

10 A beam, the weight of which may be neglected, is supported by three identical springs. When a weight *W* is hung from the middle of the beam, the extension of each spring is *x*.



The middle spring and the weight are removed.

What is the extension when a weight of 2*W* is hung from the middle of the beam?

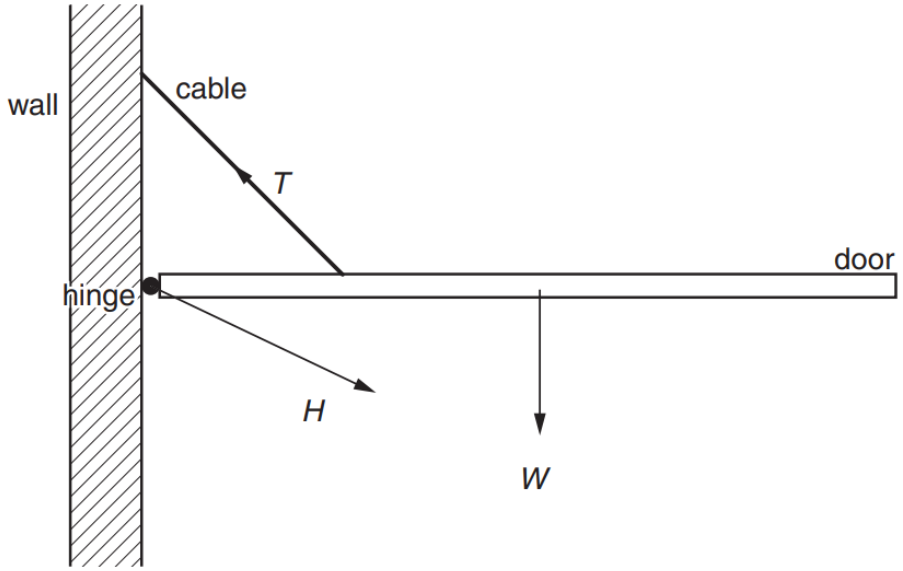
A $\frac{3x}{2}$

B $\frac{4x}{3}$

C $2x$

D $3x$

11 A hinged door is held closed in the horizontal position by a cable.



Three forces act on the door: the weight *W* of the door, the tension *T* in the cable, and the force *H* at the hinge.

Which list gives the three forces in **increasing** order of magnitude?

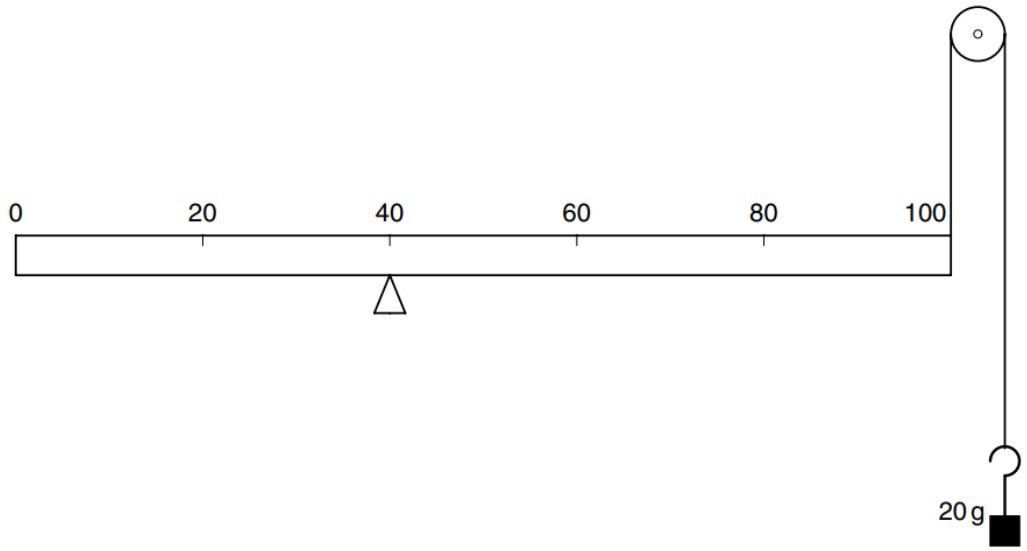
A *H*, *T*, *W*

B *T*, *H*, *W*

C *W*, *H*, *T*

D *W*, *T*, *H*

12 A uniform metre rule of mass 100 g is supported by a knife-edge at the 40 cm mark and a string at the 100 cm mark. The string passes round a frictionless pulley and carries a mass of 20 g as shown in the diagram.



At which mark on the rule must a 50 g mass be suspended so that the rule balances?

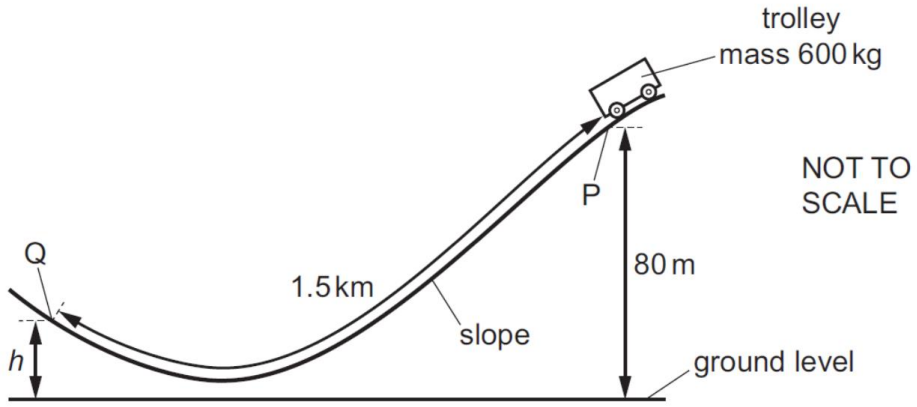
A 4 cm

B 36 cm

C 44 cm

D 96 cm

13 A trolley of mass 600 kg is initially at point P on a slope, at a height of 80 m above ground level, as shown. The trolley is released from rest and moves along the slope, first coming to rest at point Q, at height *h* above ground level.



The total distance PQ moved by the trolley along the slope is 1.5 km. A constant resistive force of 300 N opposes the motion of the trolley on the slope.

What is *h*?

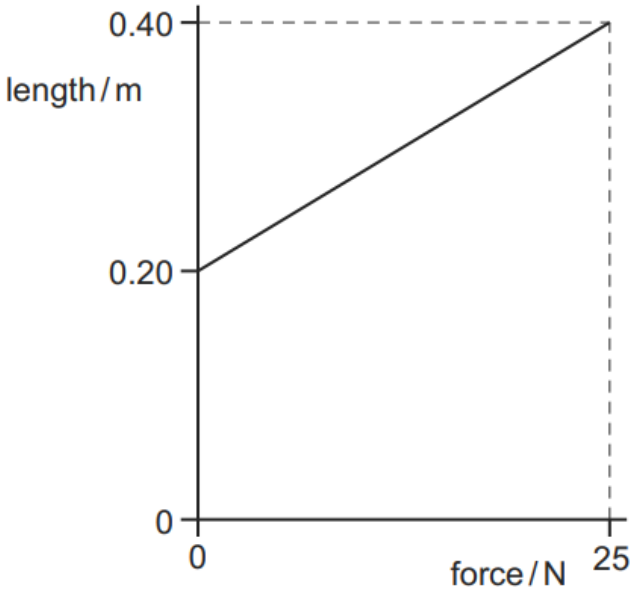
A 3.5 m **B** 76 m **C** 79 m **D** 80 m

14 A car travels along a road at a constant speed of 20 m s^{-1}. Its power output is 23 kW. The total frictional force on the car is proportional to the square of its speed.

What power will be required to travel at a constant speed of 40 m s^{-1}?

A 46 kW **B** 92 kW **C** 184 kW **D** 368 kW

15 The graph shows how the length of a particular rubber cord varies as force is applied.



What is the maximum elastic potential energy in this deformed rubber cord?

A 2.5 J **B** 5.0 J **C** 7.5 J **D** 10 J

16 Which of the following statements is correct for a particle moving in a horizontal circle with constant angular velocity?

A The linear momentum is constant but the kinetic energy varies.

B The kinetic energy is constant but the linear momentum varies.

C Both kinetic energy and linear momentum are constant.

D Neither the linear momentum nor kinetic energy is constant.

17 An experimental satellite is found to have a weight W when assembled before launching from a rocket site. It is placed in a circular orbit at a height, $h = 6R$ above the surface of the Earth (of radius R).

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

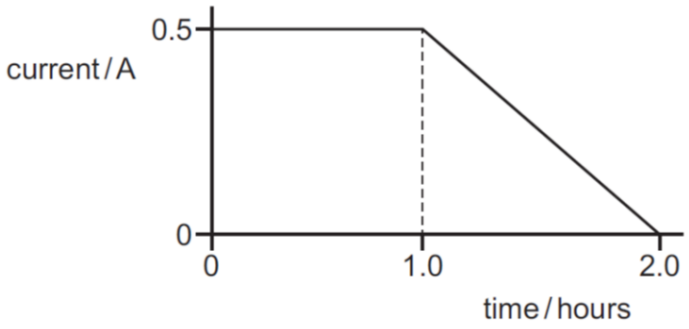
A $\frac{W}{6}$

B $\frac{W}{7}$

C $\frac{W}{36}$

D $\frac{W}{49}$

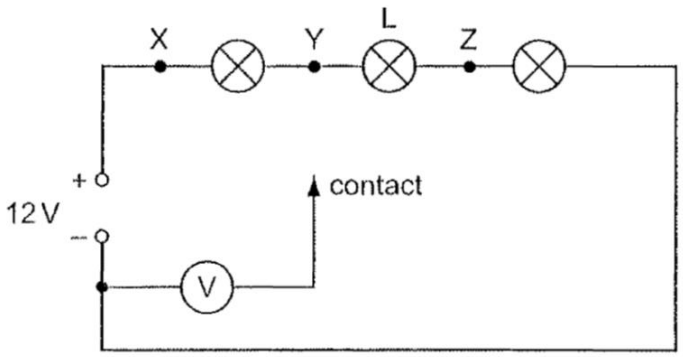
18 A mobile phone battery is charged by connecting it to a constant potential difference of 5.0 V. After a time of 1.0 hour, the initial current of 0.5 A slowly decreases to zero, as shown.



What is the best estimate of the energy transferred to the battery during the time of 2.0 hours as shown in the graph?

A 2700 J **B** 9800 J **C** 13 500J **D** 18 400J

19 The diagram shows three lamps in series with a 12 V supply.

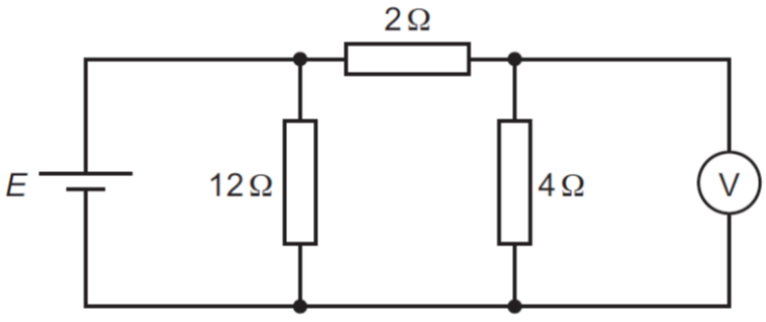


To test the circuit, the contact is connected in turn to points X, Y and Z. The lamps **do not light up** because the lamp L has a broken filament.

Which line of the table below shows the readings of the voltmeter?

	Reading at X	Reading at Y	Reading at Z
A	12 V	8 V	4 V
B	8 V	8 V	0 V
C	12 V	12 V	0 V
D	8 V	12 V	4 V

20 A cell of electromotive force (e.m.f) E and negligible internal resistance is connected into a circuit as shown.

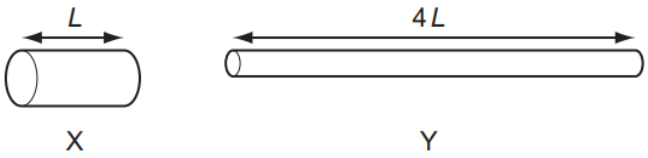


The voltmeter has a very high resistance and reads a potential difference V_{out}.

What is the ratio $\frac{V_{out}}{E}$?

A $\frac{1}{6}$ **B** $\frac{1}{3}$ **C** $\frac{1}{2}$ **D** $\frac{2}{3}$

21 Two copper wires X and Y have the same volume. Wire Y is four times as long as wire X.



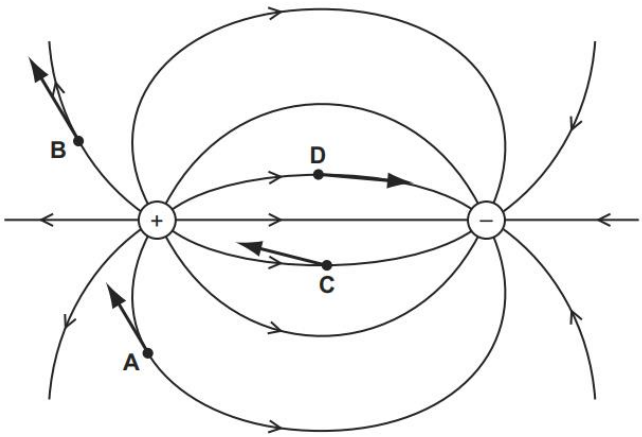
What is the ratio $\frac{\text{resistance of wire Y}}{\text{resistance of wire X}}$?

A 4 **B** 8 **C** 16 **D** 64

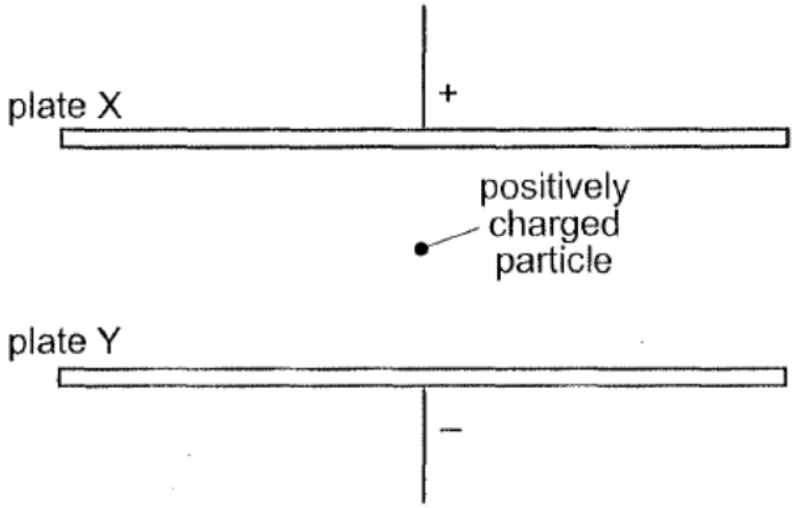
22 The diagram shows a non-uniform electric field near a positively charged and a negatively charged sphere.

Four electrons, **A**, **B**, **C** and **D**, are shown at different positions in the field.

On which electron is the direction of the force on the electron shown correctly?



23 Two large parallel metal plates X and Y are situated in a vacuum as shown.



Plates X and Y carry equal and opposite charges.

What happens to the force on a positively charged particle as it moves from plate X to plate Y?

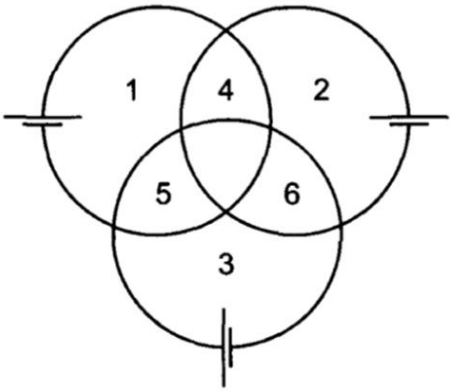
A It decreases because the positively charged particle is moving away from the positively charged plate.

B It decreases because the positively charged particle is moving in the direction of the electric field between the plates.

C It increases because the positively charged particle is moving closer to the negatively charged plate.

D It remained constant because the positively charged particle is in the uniform electric field between plates.

24 Three separate coils of insulated wires are connected to cells as shown. They are placed on a table on top of each other, partially overlapping.

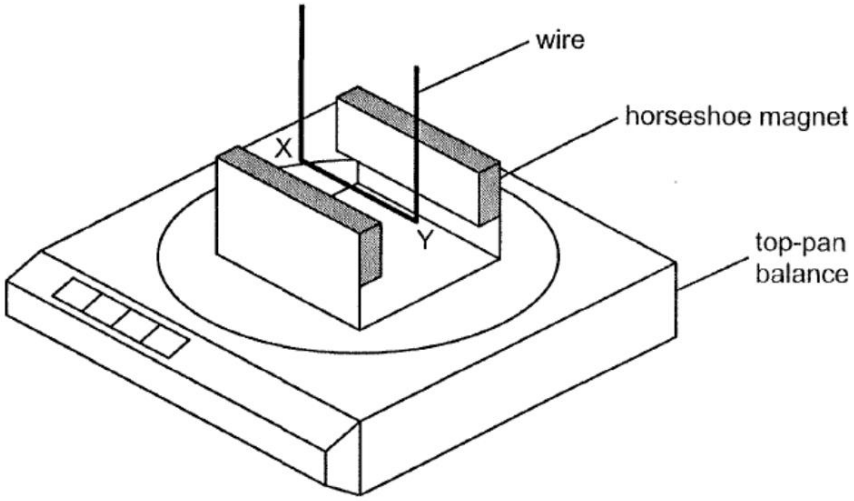


Six of the seven areas formed within the coils are numbered.

In which areas do the magnetic fields of all the coils reinforce each other?

A 1 and 6 **B** 2 and 5 **C** 3 and 4 **D** 4 and 6

25 A horseshoe magnet rests on a top-pan balance with a wire situated between the poles of the magnet.



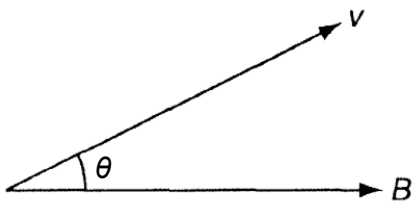
With no current, in the wire, the reading on the balance is 142.0 g.

With a current of 2.0 A in the wire in the direction XY, the reading on the balance changes to 144.6 g.

What is the reading on the balance when there is a current of 5.0 A in the wire in the direction YX?

A 135.5 g **B** 140.7 g **C** 148.5 g **D** 148.9 g

26 An electron of charge e and mass m_e is injected into a uniform magnetic field of flux density B in a vacuum. Its initial velocity v makes an angle θ with the direction of the field as shown.



Which of the following correctly describes the component of the electron velocity that is in the plane perpendicular to B in the subsequent motion?

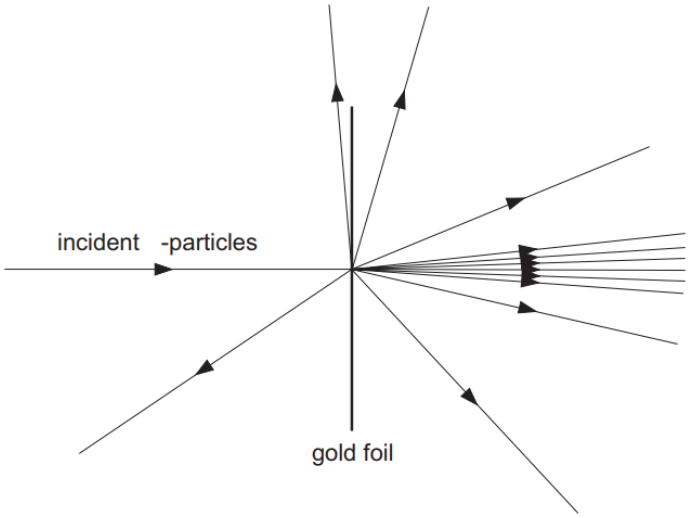
A Constant speed equal to $v \sin\theta$

B Constant speed equal to $v \cos\theta$

C Speed increasing with acceleration $\frac{Bev}{m_e}$

D Speed increasing with acceleration $\frac{Bev\cos\theta}{m_e}$

27 A thin gold foil is bombarded with α-particles as shown.



What can be deduced from this experiment?

A the binding energy of a gold nucleus

B the energy levels of electrons in gold atoms

C the small size of a gold nucleus

D the structure of a gold nucleus

28 Which of the following sequences of radioactive decays will result in the formation of an isotope of the original nuclide?

A one alpha and one beta

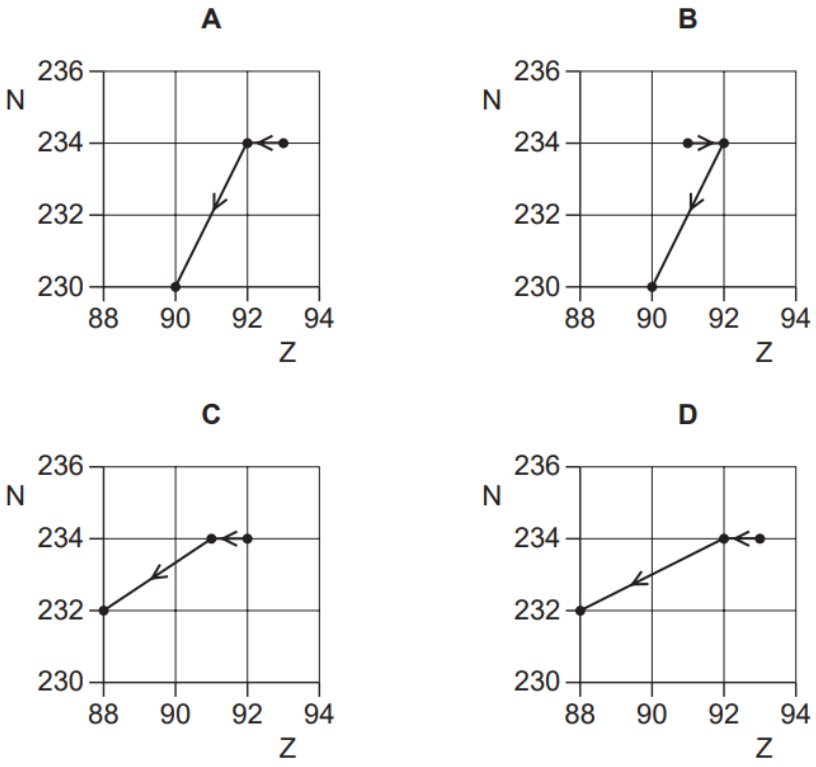
B one alpha and two beta

C one alpha and four beta

D two alpha and two beta

29 A radioactive nucleus is formed by β-decay. This nucleus then decays by α-emission.

Which graph of proton number Z plotted against nucleon number N shows the β-decay followed by α-emission?



30 In an experiment to determine the half-life of a radioactive substance, the average value of the background radiation was found to be 10 counts per second.

At the start of the experiment with a source of this substance, the average count rate was found to be 90 counts per second. After 300 s this had fallen to 30 counts per second.

What is the value this experiment gives for the half-life of the substance?

A 75 s **B** 150 s **C** 300 s **D** 600 s

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