Cambridge Assessment International Education

Cambridge O Level

PHYSICS **5054/11**

Paper 1 Multiple Choice **May/June 2023**

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- There are **forty** 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- Take the weight of 1.0 kg to be 9.8 N (acceleration of free fall = 9.8 m / s^2).

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.

This document has **20** pages. Any blank pages are indicated.

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1 A student wishes to measure directly the circumference of a football.

What is the most suitable instrument to use?

A a clock only

B a measuring tape only

C a micrometer only

D a ruler only

2 Which equation contains two vector quantities?

A $\text{acceleration} = \dfrac{\text{change in velocity}}{\text{time taken}}$

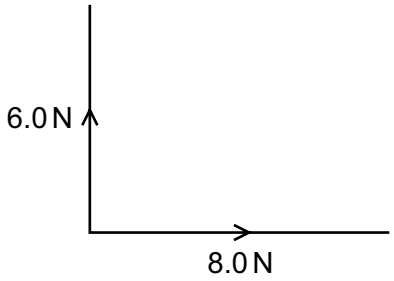
B $\text{average speed} = \dfrac{\text{distance travelled}}{\text{time taken}}$

C $\text{density} = \dfrac{\text{mass}}{\text{volume}}$

D volume = length $\times$ width $\times$ height

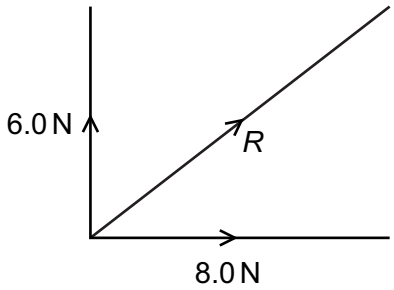
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3 Forces of 6.0 N and 8.0 N act as shown.

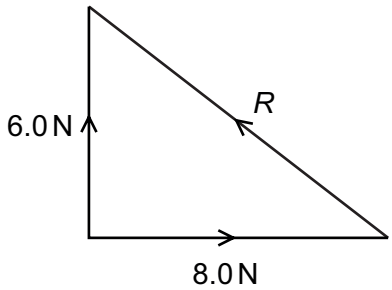


Which diagram shows the resultant *R* of these two forces?

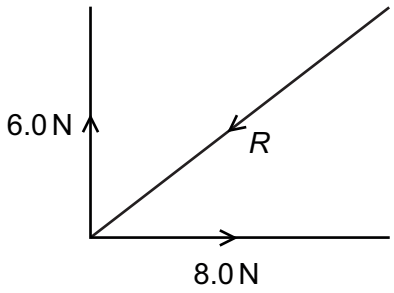
A



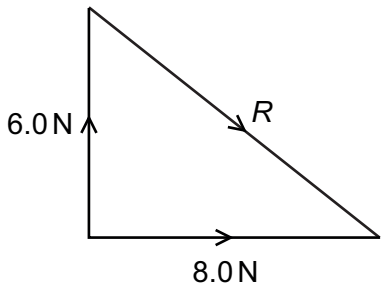
B



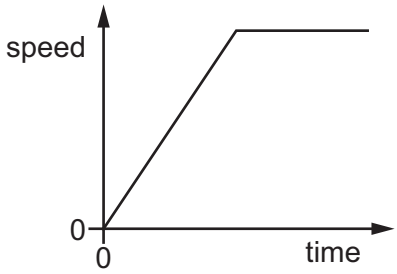
C



D

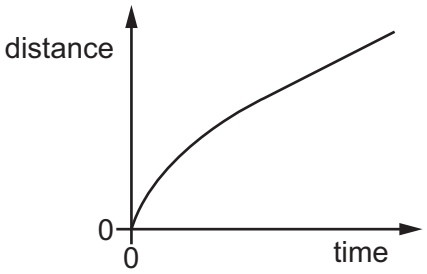


4 A speed–time graph for the journey of a car is shown.

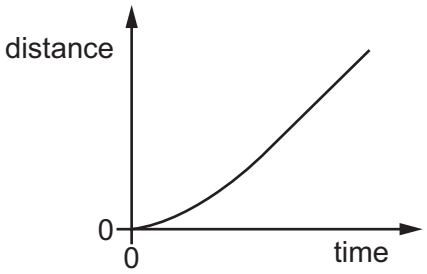


What is the distance–time graph for the journey?

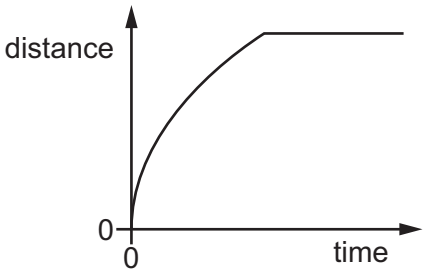
A



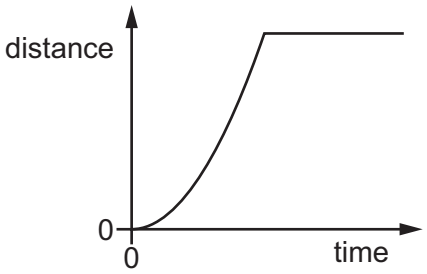
B



C



D



5 The gravitational field strength on Earth is 9.8 N / kg.

The gravitational field strength on Mars is 3.7 N / kg.

The difference between the weight of an object on Earth and the weight of the same object on Mars is 25 N.

What is the mass of the object?

A 1.9 kg **B** 2.6 kg **C** 4.1 kg **D** 6.8 kg

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6 A student determines the density of a solid metal cube.

Which pieces of equipment does the student use?

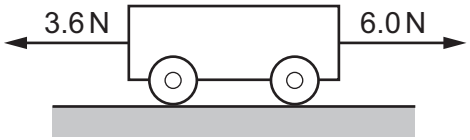
A a balance and a force meter

B a balance and a ruler

C a micrometer and a measuring cylinder

D a ruler and a measuring cylinder

7 The diagram shows the only two horizontal forces acting on a trolley that is accelerating at $0.12\,m/s^2$.

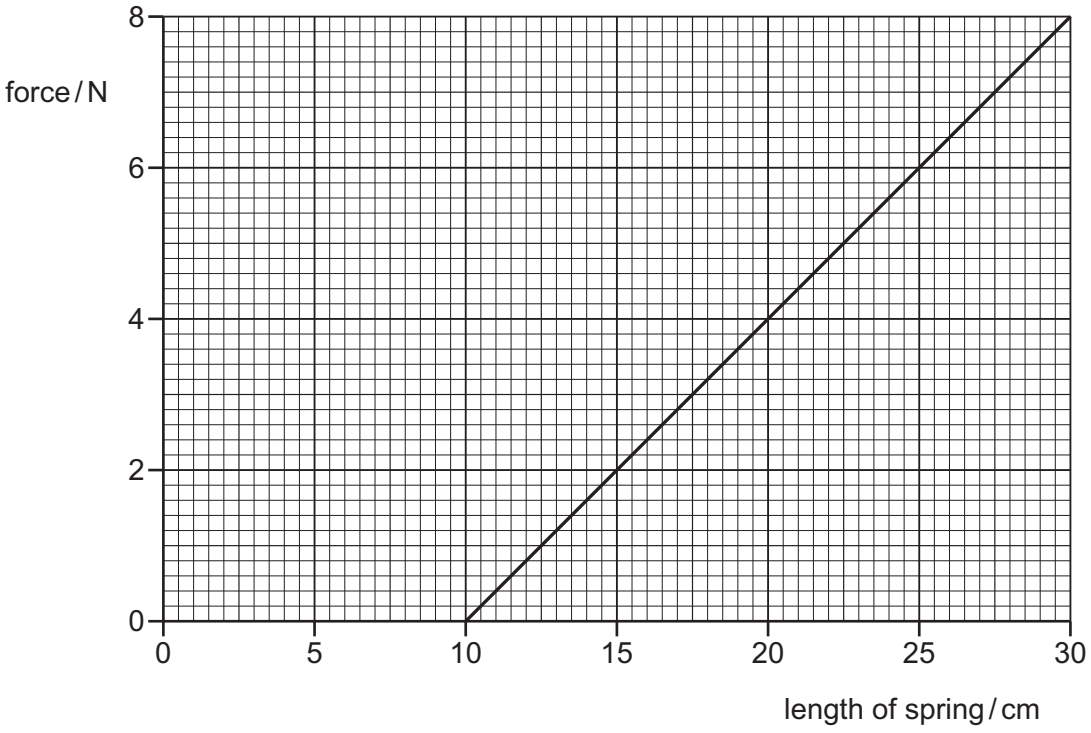


What is the mass of the trolley?

A 0.050 kg **B** 0.13 kg **C** 20 kg **D** 80 kg

8 A spring is stretched to different lengths by a variable force.

The graph shows how the size of the force depends on the length to which the spring is stretched.

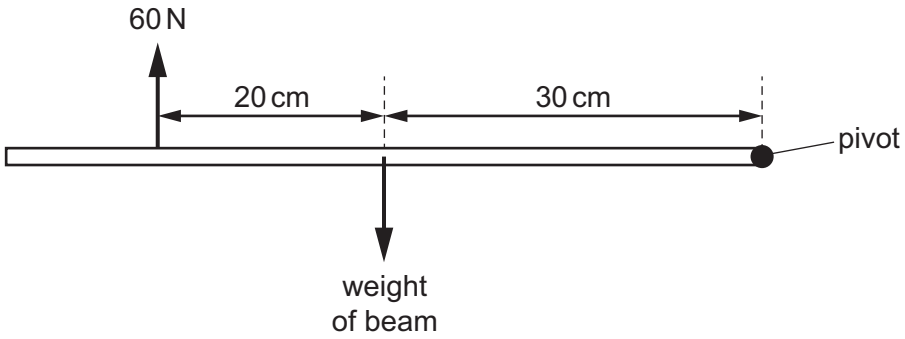


What is the spring constant *k* of the spring?

A 0.27 N / cm **B** 0.40 N / cm **C** 2.5 N / cm **D** 3.8 N / cm

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9 A uniform horizontal beam, pivoted at its right-hand end, is in equilibrium. A force of 60 N acts vertically upwards on the beam as shown.



What is the weight of the beam?

A 36 N **B** 40 N **C** 90 N **D** 100 N

10 A constant frictional force acts on a moving object for a short amount of time causing the momentum of the object to decrease.

Which expression is used to calculate the time for which the force acts?

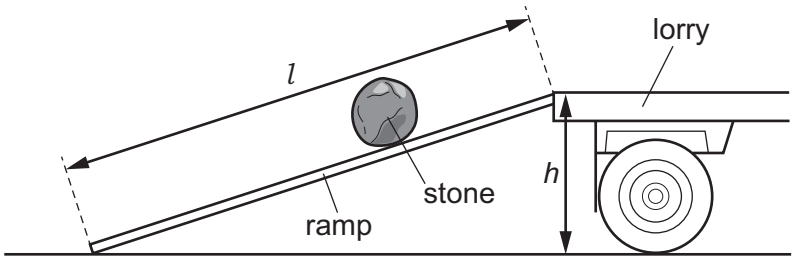
A $\text{time} = \dfrac{\text{change in momentum}}{\text{force}}$

B time = change in momentum × force

C $\text{time} = \dfrac{\text{momentum}}{\text{force}}$

D time = momentum × force

11 A large stone is rolled onto a lorry using a ramp.



The length of the ramp is l. The stone is lifted a height of h.

The mass of the stone is m. The weight of the stone is W.

Which expression is equal to the useful work done on the stone?

A $m \times h$ **B** $W \times h$ **C** $m \times l$ **D** $W \times l$

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12 The diagram shows a burning candle.



Which energy store is associated with the burning candle?

A chemical

B elastic

C electrostatic

D nuclear

13 An African elephant has a mass of 6000 kg and each of its four feet has an area of 0.20 m^2. The gravitational field strength g is 9.8 N / kg.

What is the average pressure due to the elephant when it is standing stationary on all four feet on level ground?

A 7.5 kPa **B** 30 kPa **C** 74 kPa **D** 290 kPa

14 Which row describes the shape and the volume of a liquid at constant temperature?

	shape	volume
A	fixed	fixed
B	fixed	not fixed
C	not fixed	fixed
D	not fixed	not fixed

15 Which row shows how the forces and the distances between the particles in a solid generally compare with the forces and distances in a liquid?

	forces between particles in a solid	distances between particles in a solid
A	stronger	greater
B	stronger	smaller
C	weaker	greater
D	weaker	smaller

16 An incomplete statement about latent heat is given.

Latent heat is the .....1..... required to overcome the bonds between molecules and change the .....2..... of a substance.

Which words are inserted into gap 1 and gap 2 to correctly complete the sentence?

	gap 1	gap 2
A	energy	state
B	force	state
C	energy	temperature
D	force	temperature

17 A cold solid is placed on top of a hot solid. Thermal energy is transferred from the hot solid to the cold one.

What is the explanation for this?

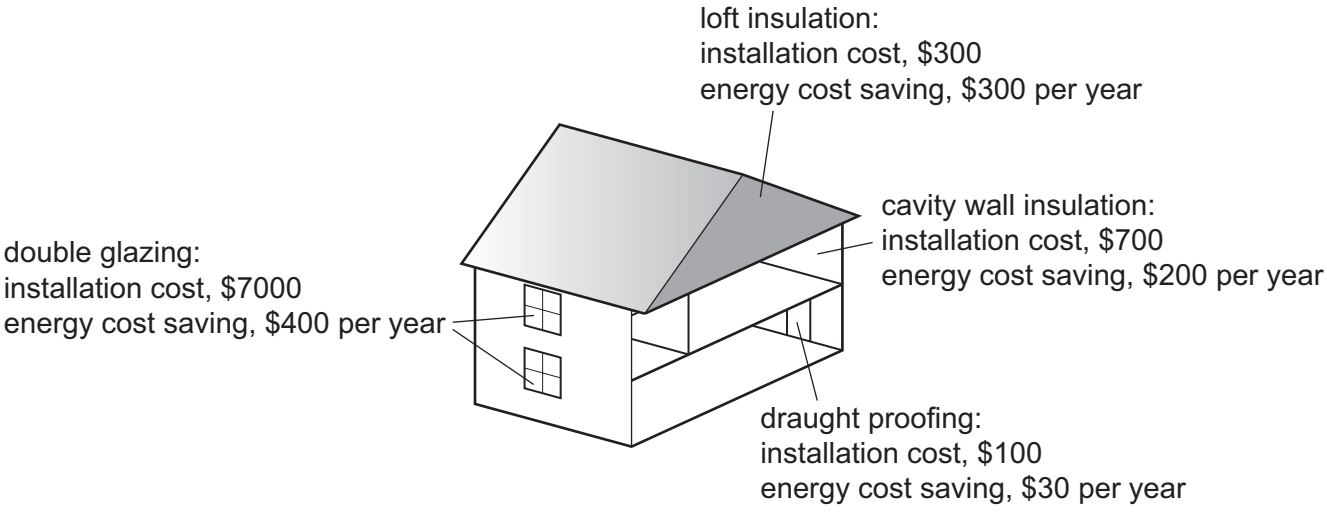
A A hot solid expands, so its particles will move further apart.

B Energy is transferred from one particle to the next.

C Heat always rises.

D Molecules are free to move randomly through the solids.

18 A house is to be thermally insulated to reduce thermal energy loss and reduce fuel costs.



Which type of thermal insulation pays back the cost of installation in the shortest time?

A cavity wall insulation

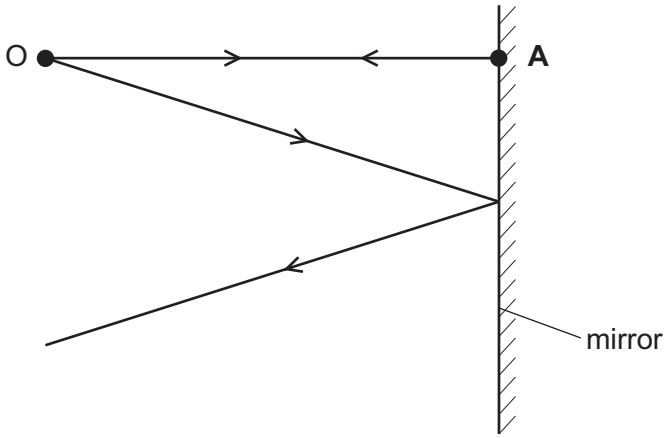
B double glazing

C draught proofing

D loft insulation

19 The diagram shows two divergent rays of light from an object O being reflected from a plane mirror.

At which position is the image formed?

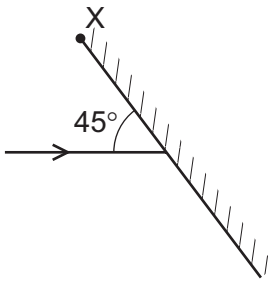


● **B**

● **C**

● **D**

20 Light is incident on a mirror at an angle of 45° as shown. The mirror can be rotated about an axis into the page through point X.



The mirror is rotated until the light is reflected back along its original path.

Through which angle is the mirror rotated?

A 22.5° clockwise

B 22.5° anticlockwise

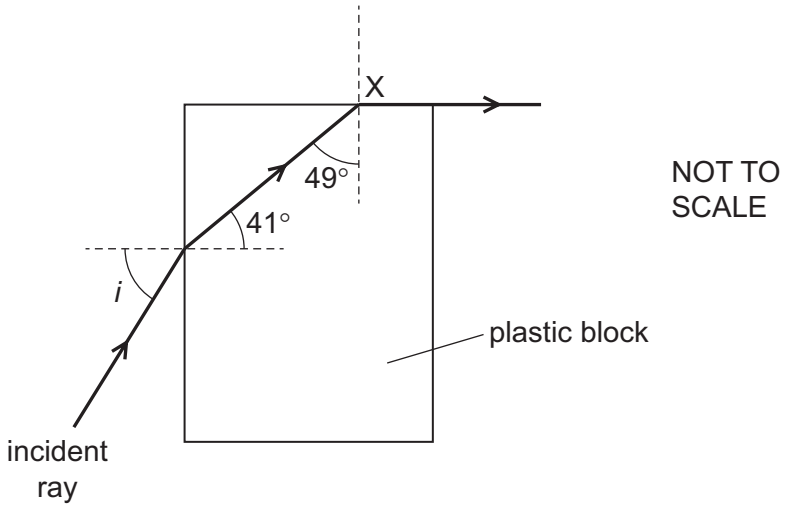
C 45° clockwise

D 45° anticlockwise

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21 A ray of light is incident on a plastic block in air, at an angle of incidence *i*. The refractive index of the plastic is *n*.

The light ray refracts along the plastic-air boundary when it reaches X.



Which equation is correct?

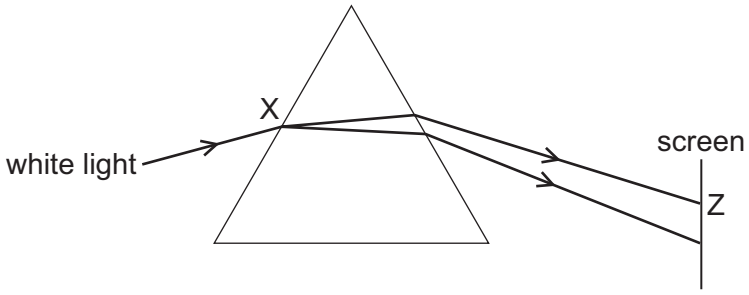
A $\sin i = \frac{\sin 41°}{n}$

B $\sin i = \frac{n}{\sin 49°}$

C $\sin i = n \times \sin 41°$

D $\sin i = n \times \sin 49°$

22 The diagram shows white light entering a prism.



What happens at point X and what is the colour of the light that strikes the screen at point Z?

	at point X	at point Z
A	dispersion only	blue light
B	dispersion and refraction	blue light
C	dispersion and refraction	red light
D	refraction only	red light

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23 Which row names a region of the electromagnetic spectrum with a wavelength longer than that of visible light and a region with a frequency that is greater than that of visible light?

	wavelength longer than visible light	frequency greater than visible light
A	infrared	ultraviolet
B	microwave	radio
C	radio	microwave
D	ultraviolet	infrared

24 Sound travels at different speeds in different states of matter.

Which list gives the three states of matter arranged in order of the speed of sound from slowest to fastest?

A gas → liquid → solid

B liquid → solid → gas

C solid → gas → liquid

D solid → liquid → gas

25 Bar magnets and various non-magnetic and demagnetised metal bars are placed in the different arrangements shown.

In which arrangement do the bars repel?

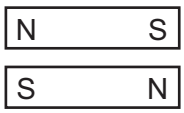
A



B



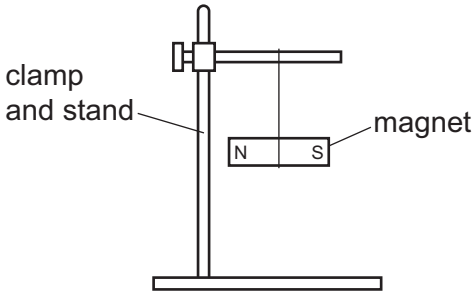
C



D

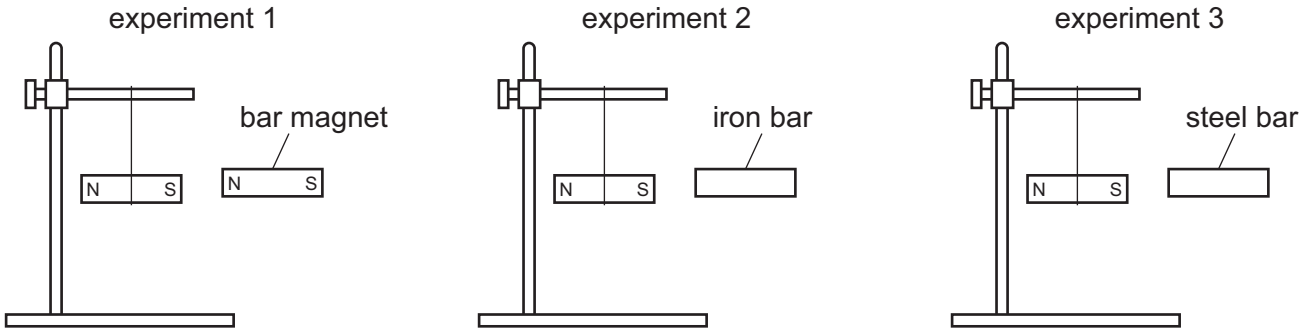


26 A student uses a wooden clamp and a stand to hold a freely suspended bar magnet.



The diagrams show that:

- in experiment 1, the student holds a bar magnet next to the suspended magnet
- in experiment 2, the student holds an iron bar next to the suspended magnet
- in experiment 3, the student holds a steel bar next to the suspended magnet.



In which experiments does the suspended magnet move?

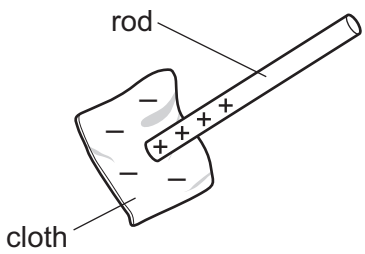
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

27 In an electrostatics experiment, a plastic rod is rubbed with a cloth.

The **cloth** becomes negatively charged.

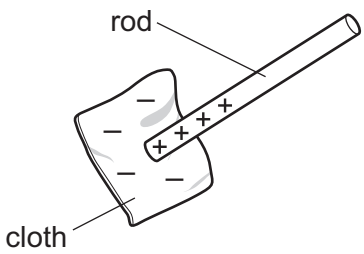
Which diagram shows the charge on the rod and describes the movement of charge?

A



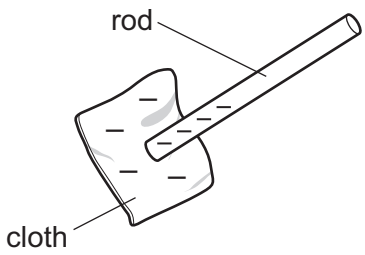
electrons move from the rod on to the cloth

B



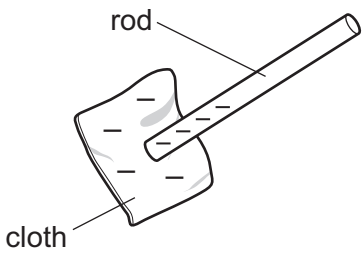
protons move from the cloth on to the rod

C



electrons move from the cloth on to the rod

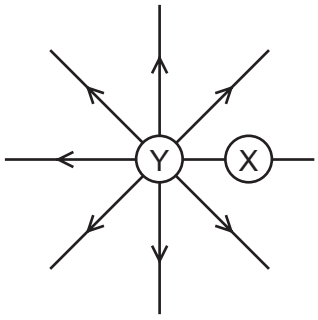
D



protons move from the rod on to the cloth

28 Object X is stationary and positively charged. It experiences a force due to the field produced by object Y.

The arrows show the direction of the field produced by Y.



Which statement about the direction of the force on X is correct?

A It is towards the right because it is in an electric field.

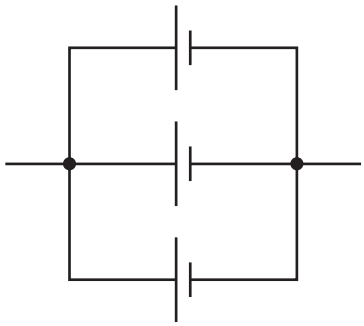
B It is towards the left because it is in an electric field.

C It is towards the right because it is in a magnetic field.

D It is towards the left because it is in a magnetic field.

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29 The diagram shows a battery of three 1.5 V cells.



What is an advantage of this arrangement of cells?

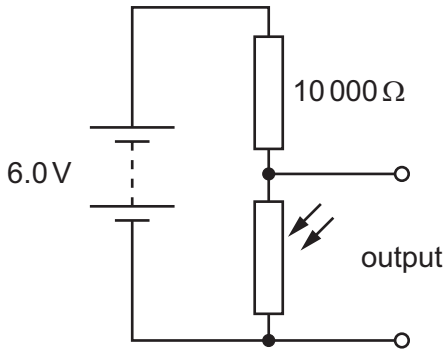
A The battery can supply a current for a longer time than a single 1.5 V cell.

B The battery can supply any e.m.f. between 0 V and 4.5 V.

C The battery supplies more energy to each coulomb of charge than a single 1.5 V cell.

D The e.m.f. of the battery is 4.5 V.

30 A potential divider consists of a light-dependent resistor (LDR) and a resistor connected to a 6.0 V battery.



The output is 3.0 V.

What is the resistance of the LDR?

A 0

B between 0 and 10 000 Ω

C 10 000 Ω

D more than 10 000 Ω

31 Three students each suggest a consequence of wiring lamps in parallel rather than in series.

student 1 If one lamp breaks, the other lamps stay lit.

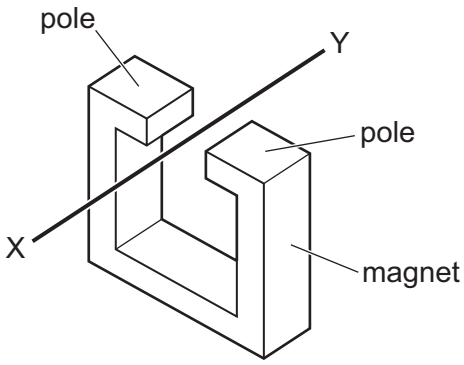
student 2 The lamps can be switched on and off separately.

student 3 The p.d. across each lamp is equal to the p.d. across the supply.

Which students are correct?

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

32 When wire XY is moved downwards between the poles of a stationary magnet, an e.m.f. is produced across X and Y.



Which action produces an e.m.f. across X and Y in the opposite direction?

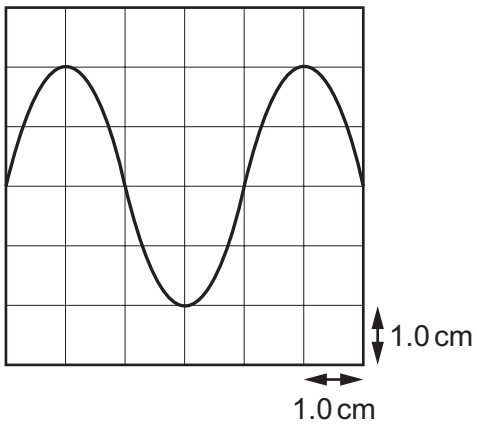
A Move both the wire and the magnet upwards at the same speed.

B The wire is kept stationary and the magnet is moved upwards.

C The wire is moved downwards and the magnet is moved upwards.

D The wire is moved upwards and the magnet is kept stationary.

33 An a.c. voltage is displayed on an oscilloscope screen. The Y-gain is set at 2.0 V / cm.



What is the maximum value of the voltage?

A 2.0 V **B** 4.0 V **C** 8.0 V **D** 12 V

34 The results of a scattering experiment show that a very small nucleus contains most of the matter in an atom.

What is scattered in this experiment?

A alpha-particles

B beta-particles

C gamma radiation

D gold nuclei

35 Atoms P and Q are isotopes of the same element.

How does the composition of an atom of P compare with the composition of an atom of Q?

	number of protons	number of neutrons
A	different	different
B	different	same
C	same	different
D	same	same

36 The nucleus of an atom emits an alpha-particle.

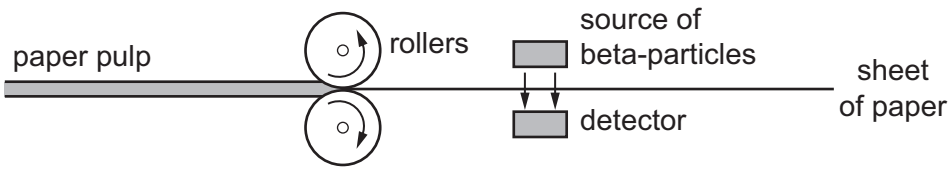
How do the proton number and nucleon number change?

	proton number	nucleon number
A	decreases by 2	decreases by 4
B	decreases by 4	decreases by 2
C	increases by 2	increases by 4
D	increases by 4	increases by 2

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37 The diagram shows how the thickness of paper is measured during manufacture.

If the sheet is too thick, fewer beta-particles can reach the detector.



Why are beta-particles used for this purpose?

A Alpha-particles are all stopped by the paper.

B Alpha-particles make the paper radioactive.

C Gamma radiation is all stopped by the paper.

D Gamma radiation is only produced by sources with a short half-life.

38 A sample of tritium has a mass of 32 mg.

Tritium has a half-life of 12 years.

How much of the sample of tritium decays in 36 years?

A 4.0 mg **B** 8.0 mg **C** 24 mg **D** 28 mg

39 It takes 27 days for the Moon to orbit the Earth.

The average value of the radius of the Moon's orbit is 3.8×10^8 m.

What is the average orbital speed of the Moon?

A 160 m / s

B 1000 m / s

C 1.4×10^8 m / s

D 8.8×10^8 m / s

40 What is the nuclear reaction that takes place in stable stars?

A fission of helium to produce hydrogen

B fission of hydrogen to produce helium

C fusion of helium into hydrogen

D fusion of hydrogen into helium

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