



Cambridge IGCSE™

PHYSICS

1524/22

Paper 2 Multiple Choice (Extended)

May/June 2021

45 minutes

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 10 N (acceleration of free fall = 10 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.



- 1 A micrometer screw gauge is used to determine the radius of a copper wire.

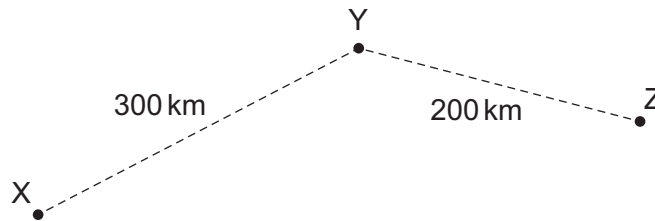
The reading on the screw gauge when measuring the diameter of the wire is 3.12 mm.

The reading on the screw gauge with no wire (zero error) is 0.04 mm.

What is the radius of the wire?

- A 1.52 mm B 1.54 mm C 1.56 mm D 1.58 mm

- 2 An aeroplane flies from town X to town Z, stopping for 1 hour at town Y to pick up more passengers. The distances between the towns are shown.



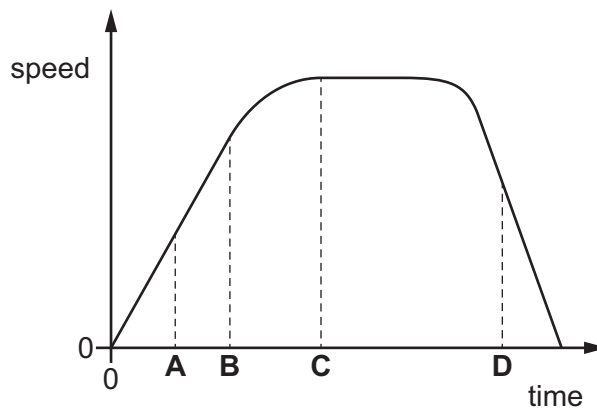
The total time taken between leaving X and arriving at Z is 3 hours.

What is the average speed of the aeroplane **in the air**?

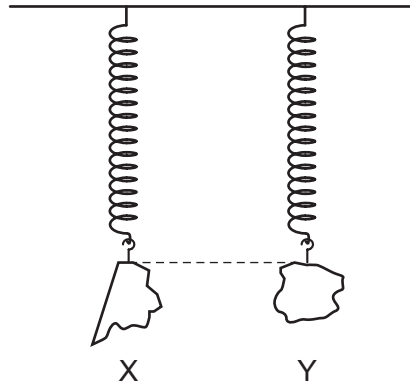
- A $\frac{500}{4}$ km/h B $\frac{500}{3}$ km/h C $\frac{500}{2}$ km/h D $\frac{500}{1}$ km/h

- 3 The graph shows how the speed of an object varies with time.

At which labelled time is the object decelerating?



- 4 Two objects, X and Y, are suspended from identical springs. The extension in both springs is the same.



What does this show about the masses and about the weights of objects X and Y?

	masses	weights
A	mass of X is equal to mass of Y	weight of X is equal to weight of Y
B	mass of X is equal to mass of Y	weight of X is less than weight of Y
C	mass of X is greater than mass of Y	weight of X is greater than weight of Y
D	mass of X is greater than mass of Y	weight of X is equal to weight of Y

- 5 Three students are asked what they understand by the term mass.

Their answers are listed.

- 1 Mass is the property of an object that resists a change in motion.
- 2 Mass is the quantity of matter an object contains.
- 3 Mass is the effect of a gravitational field on an object.

Which students are correct?

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

- 6 The mass and volume of four different materials, **A**, **B**, **C** and **D**, are measured.

Water has a density of 1000 kg/m^3 .

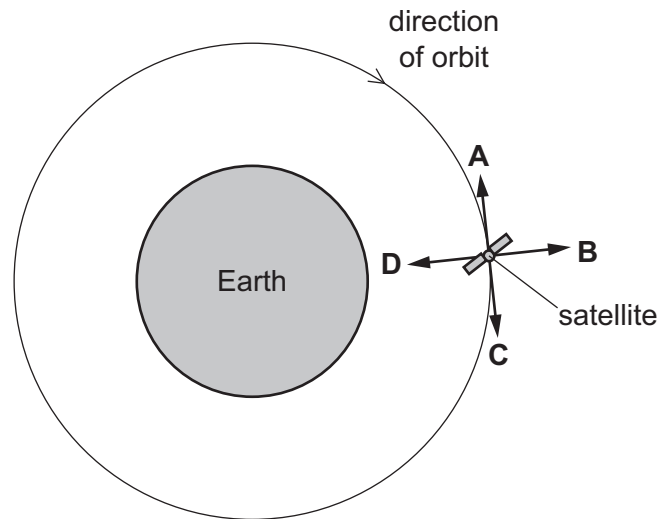
Which material will float in water?

	mass / kg	volume / m^3
A	452	0.04
B	2340	0.30
C	90	0.03
D	320	0.40

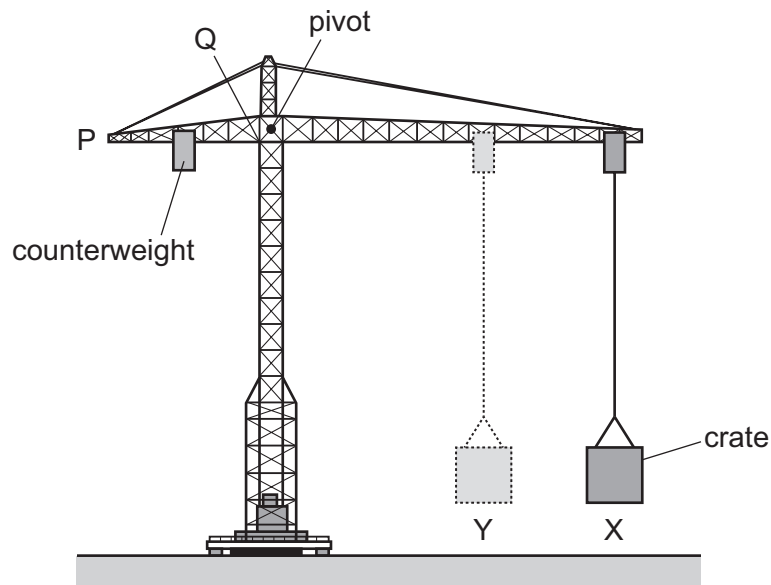
- 7 A satellite orbits the Earth above the atmosphere at a constant speed.

The diagram shows the satellite at one point in its circular orbit around the Earth.

Which labelled arrow shows the direction of the resultant force on the satellite at the position shown?



- 8 The diagram shows a tower crane lifting a crate. The crate begins at X. The counterweight can be moved between points P and Q to keep the crane balanced.



The crate is slowly moved from position X to position Y.

The table describes the effect that the movement has on the:

- clockwise moment about the pivot created by the crate
- direction the counterweight moves to keep the crane balanced.

Which row is correct?

	moment	counterweight
A	increases	moves towards P
B	increases	moves towards Q
C	decreases	moves towards P
D	decreases	moves towards Q

- 9 A car travels forwards along a straight horizontal road. Only the horizontal forces acting on the car are shown.



The length of each arrow represents the size of each force.

Which statement describes the effect of these forces on the motion of the car?

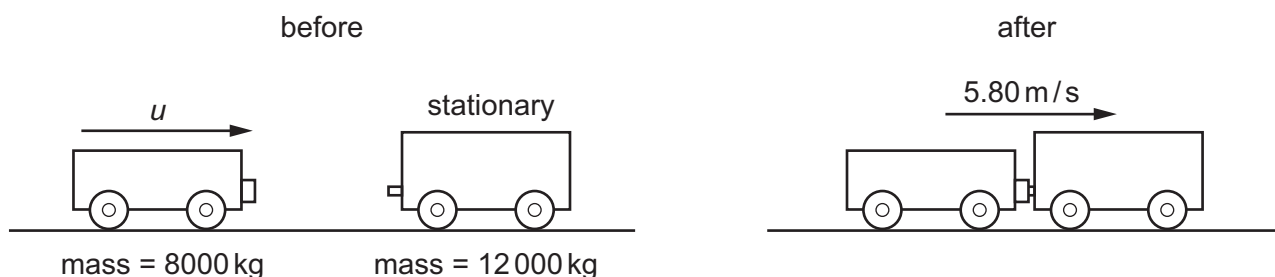
- A** The car moves at constant speed.
B The car starts to move backwards.
C The car slows down.
D The car's forward speed increases.
- 10 An object of mass 2.5 kg is acted upon by a force of 8.0 N. The object has an initial speed of 3.0 m/s and, after time t , the speed of the object has increased to 7.0 m/s.

For which time t does the force act?

- A** 0.32 s **B** 0.80 s **C** 1.3 s **D** 3.1 s
- 11 Two railway wagons are on the same straight horizontal track. One wagon is moving with initial velocity u and the other wagon is stationary.

The moving wagon collides with the stationary wagon.

The two wagons connect to each other and move with a velocity of 5.80 m/s.



What is the initial velocity u of the moving wagon before they collide?

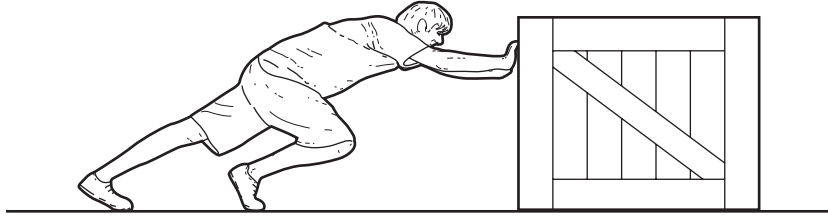
- A** 3.87 m/s **B** 8.70 m/s **C** 9.67 m/s **D** 14.5 m/s

12 A dog of mass 9.6 kg is running across a field. The kinetic energy of the dog is 9.4 J.

What is the speed of the dog?

- A 0.70 m/s B 0.98 m/s C 1.4 m/s D 2.0 m/s

13 A man pushes a heavy crate along a horizontal surface.



Which row shows the measurements he makes to calculate his average power?

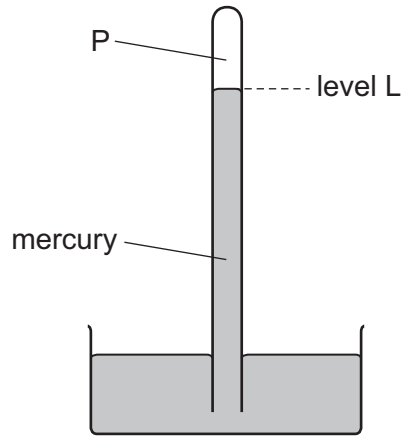
	distance moved	size of pushing force	time taken	weight of the crate
A	✓	✓	✓	x
B	✓	✓	x	✓
C	✓	x	✓	✓
D	x	✓	✓	✓

key

✓ = needed

x = not needed

- 14 The diagram shows a simple mercury barometer used to measure atmospheric pressure.



Atmospheric pressure decreases.

Which row states what happens to the pressure at point P and what happens to the level L of mercury?

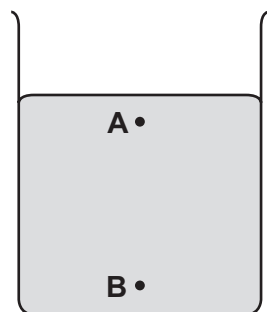
	pressure at P	level L
A	decreases	falls
B	decreases	rises
C	stays the same	falls
D	stays the same	rises

- 15 The diagrams show two identical containers filled to the same height with liquids of relatively high and low density.

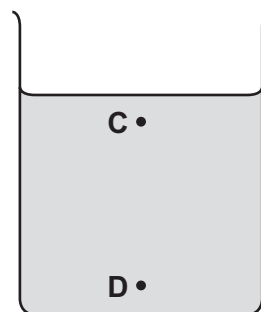
Points **A** and **C** are at the same small distance below the surfaces of the liquids.

Points **B** and **D** are at the same small distance above the bases of the containers.

Which point has the highest pressure?



liquid of high density



liquid of low density

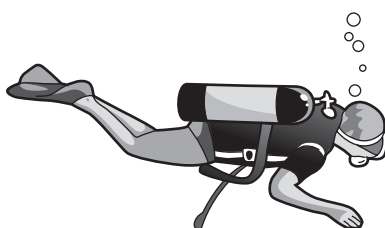
16 A student writes four statements about evaporation from a liquid.

- 1 Evaporation happens at any temperature.
- 2 Evaporation happens at one fixed temperature only.
- 3 Evaporation happens at the surface of the liquid only.
- 4 Evaporation happens throughout the liquid.

Which statements are correct?

- A** 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

17 A diver uses breathing apparatus under water at a depth where the pressure is 1.25×10^5 Pa.



A bubble of gas breathed out by the diver has a volume of 20 cm^3 when it is released. The bubble moves upwards to the surface of the water.

At the surface of the water, the atmospheric pressure is 1.00×10^5 Pa.

The temperature of the water is the same at all depths.

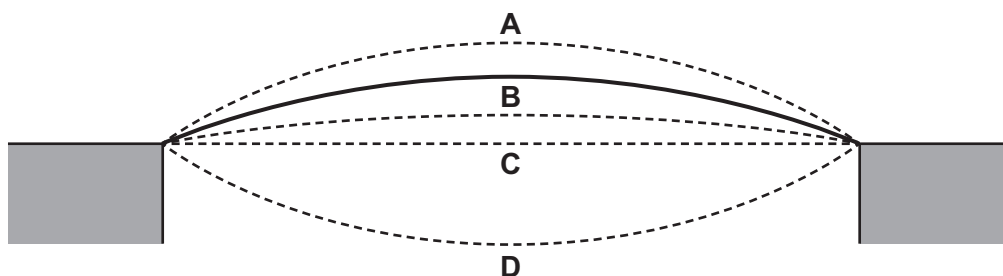
What is the volume of this bubble when it reaches the surface of the water?

- A** 15 cm^3 **B** 16 cm^3 **C** 20 cm^3 **D** 25 cm^3

18 The diagram shows a metal bridge. The ends of the bridge are fixed to the sides of a valley. The air temperature is much less at night than it is during the day.

The solid line shows the bridge during the coldest part of the night.

Which dashed line shows the bridge at the hottest part of the day?



19 Which statement describes the thermal capacity of a mass of water at 20 °C?

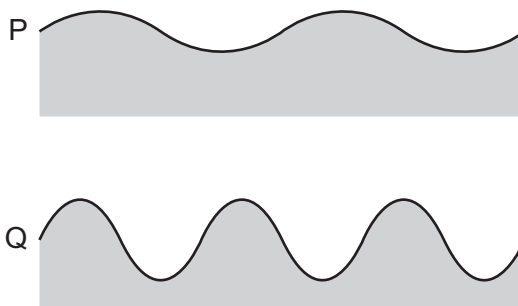
- A the energy needed to evaporate all of the water
- B the energy needed to raise the temperature of the water from 0 °C to 20 °C
- C the energy needed to raise the temperature of the water from 20 °C to 21 °C
- D the energy needed to raise the temperature of the water to its boiling point

20 A chef tests different types of saucepans. She wants the material that is the best conductor for the bottom of the pan and the best insulator for the handle.

Which materials should she use?

	bottom of the pan	handle
A	metal	metal
B	metal	wood
C	plastic	wood
D	wood	wood

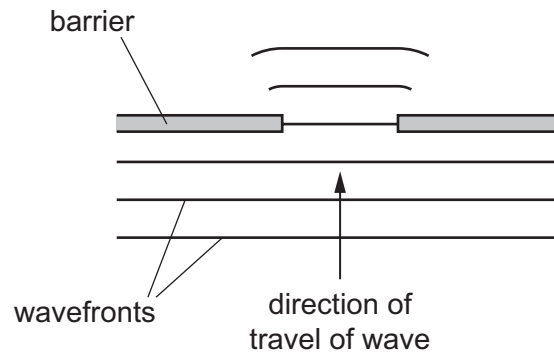
21 The diagrams show two water waves, P and Q, that are travelling at the same speed on the surface of a pond. The diagrams are drawn to the same scale.



Which wave has the greater amplitude and which wave has the greater frequency?

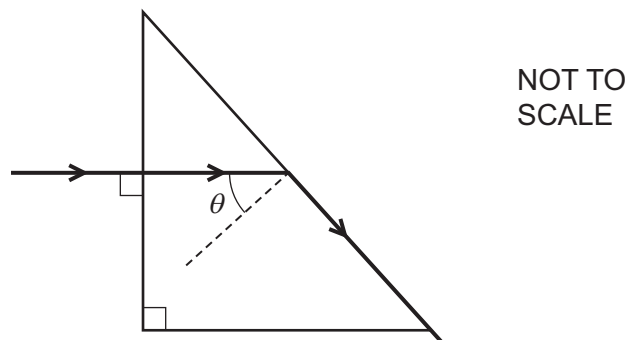
	greater amplitude	greater frequency
A	P	P
B	P	Q
C	Q	P
D	Q	Q

- 22 The wavefronts in the diagram spread out after passing through a gap in a barrier. This is an example of diffraction.



Which change will increase the spreading out of the wavefronts?

- A Reduce the size of the gap and keep the wavelength the same.
 - B Increase the size of the gap and keep the wavelength the same.
 - C Keep the size of the gap the same and reduce the wavelength.
 - D Keep the size of the gap the same and increase the frequency.
- 23 A prism is made from transparent plastic. In this plastic, light travels at $0.80c$, where c is the speed of light in air. Light enters one face of the prism at right angles, as shown.

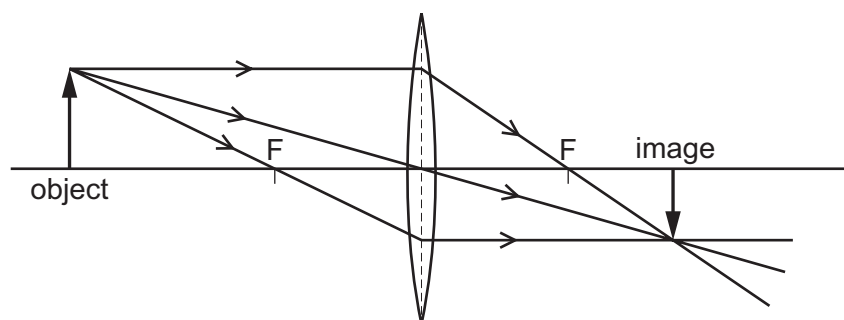


The light just escapes from the sloping face of the prism.

What is angle θ ?

- A 37°
- B 40°
- C 50°
- D 53°

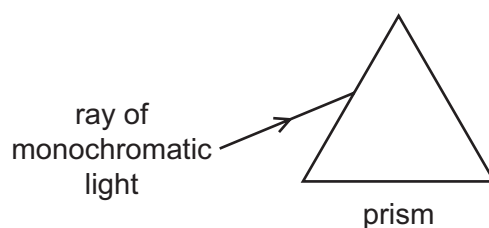
24 The diagram shows the formation of an image by a thin converging lens.



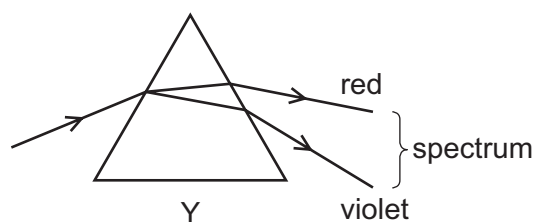
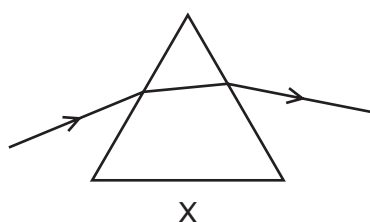
Which description of the image is correct?

- A diminished and upright
- B diminished and inverted
- C enlarged and upright
- D enlarged and inverted

25 A ray of monochromatic light is incident on a glass prism.



What is monochromatic light and which ray diagram shows this ray as it passes through the prism and emerges from the opposite side?



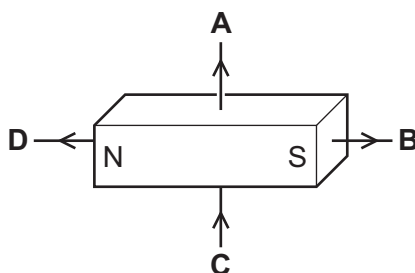
	meaning of monochromatic light	correct diagram
A	multicoloured light	X
B	multicoloured light	Y
C	light of a single frequency	X
D	light of a single frequency	Y

26 In which way does ultrasound differ from audible sound?

- A Ultrasound can travel through a vacuum.
- B Ultrasound has a longer wavelength.
- C Ultrasound has a higher frequency.
- D Ultrasound travels at the speed of light.

27 The diagram shows a permanent bar magnet. A student draws arrows to show the direction of the magnetic field at four points.

Which arrow correctly shows the direction of the magnetic field at that position?



28 A negatively charged insulating rod P is suspended from an insulating thread.

A second insulating rod Q is brought close to rod P.

Rod P swings towards rod Q.

What can be deduced from this experiment?

- A Rod Q is either negatively charged or is uncharged.
- B Rod Q is either positively charged or is uncharged.
- C Rod Q is negatively charged.
- D Rod Q is positively charged.

29 A piece of wire is 40 cm long and has a diameter of 2.0 mm.

The resistance of the piece of wire is $0.30\ \Omega$.

Which wire of the same material has a resistance of $0.15\ \Omega$?

	length / cm	diameter / mm
A	20	1.0
B	20	4.0
C	80	1.0
D	80	4.0

- 30 A resistor transfers 240 J of energy when a charge of 60 C flows through it in 15 s.

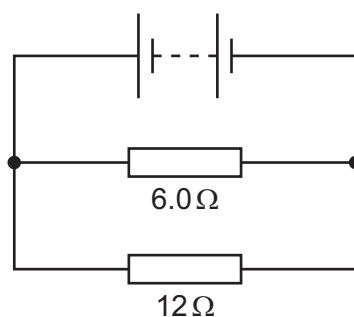
What is the potential difference (p.d.) across the resistor and what is the current in the resistor?

	p.d./V	current/A
A	0.25	0.25
B	0.25	4.0
C	4.0	0.25
D	4.0	4.0

- 31 Three resistors are connected in series with a cell. The values of the resistances are $1.0\ \Omega$, $2.0\ \Omega$ and $3.0\ \Omega$.

Which statement is correct?

- A** The current in each resistor is different and the potential difference across each resistor is different.
- B** The current in each resistor is the same and the potential difference across each resistor is different.
- C** The potential difference across each resistor is the same and the current in each resistor is different.
- D** The potential difference across the cell is greater than the sum of the potential differences across each resistor.
- 32 The diagram shows two resistors connected in a circuit.

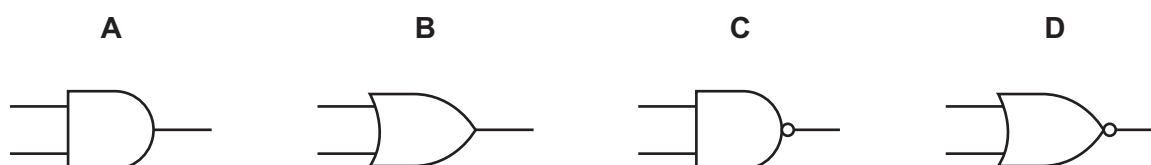


What is the combined resistance of the resistors in this circuit?

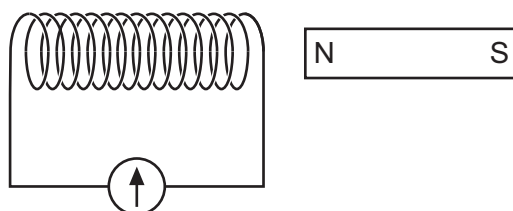
- A** $4.0\ \Omega$ **B** $6.0\ \Omega$ **C** $9.0\ \Omega$ **D** $18\ \Omega$

33 Which logic gate has the truth table shown?

input		output
0	0	1
0	1	1
1	0	1
1	1	0



34 A student holds a bar magnet next to a coil of wire connected to a galvanometer.



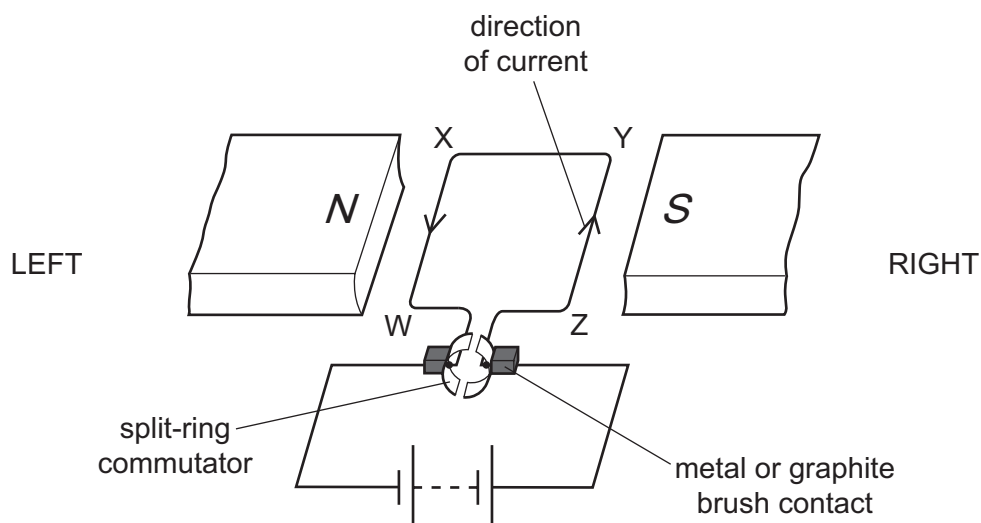
What will cause a reading on the galvanometer?

- A** holding the magnet stationary inside the coil
 - B** holding the magnet stationary with the S pole next to the coil
 - C** moving both the magnet and the coil to the right at the same speed
 - D** moving the magnet and the coil towards each other at the same speed
- 35 High voltages are used to transmit electricity over large distances.

Which row states the effect on the current and explains why this is a benefit?

	effect on current	explanation
A	current increases	decreases thermal energy losses
B	current increases	decreases sparking across insulators that support the cables
C	current decreases	decreases thermal energy losses
D	current decreases	decreases sparking across insulators that support the cables

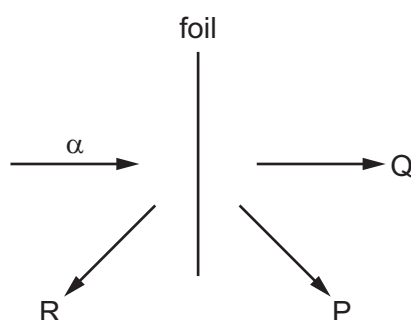
36 The diagram shows a d.c. motor.



In which direction will side WX of the coil move?

- A towards the bottom of the page
- B to the left
- C to the right
- D towards the top of the page

37 The diagram shows α -particles being scattered by a very thin metal foil.



P, Q and R represent three directions in which α -particles are scattered. The number of α -particles scattered in each direction is N_P , N_Q and N_R .

Which sequence correctly shows the number of α -particles from lowest to highest being scattered in each direction?

- A N_P, N_Q, N_R
- B N_P, N_R, N_Q
- C N_Q, N_R, N_P
- D N_R, N_P, N_Q

38 Which statement about different isotopes of a certain element **must** be correct?

- A They have a different number of electrons.
- B They have the same number of neutrons.
- C They have the same number of nucleons.
- D They have the same number of protons.

39 Ba-137 is a radioactive isotope of barium.

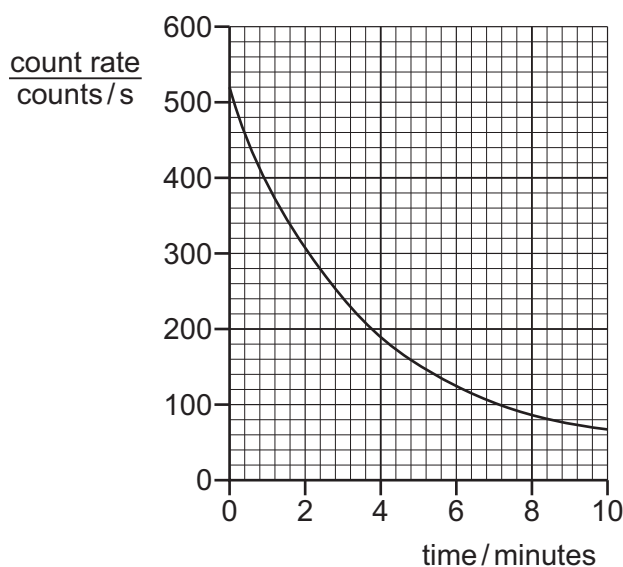
When a nucleus of this isotope decays, there is no change in its composition.

Which type of radiation is emitted?

- A α -particles
- B β -particles
- C γ -rays
- D neutrons

40 A detector is placed near a sample of a radioactive isotope of polonium to monitor the activity of the sample.

The graph shows how the activity measured by the detector varies with time. It includes the activity due to background radiation, which is 40 counts/s.



What is the half-life of this isotope of polonium?

- A 2.2 minutes
- B 2.4 minutes
- C 3.2 minutes
- D 5.0 minutes

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