



# Cambridge IGCSE™ (9–1)

**PHYSICS**

**0972/02**

Paper 2 Multiple Choice (Extended)

**For examination from 2023**

SPECIMEN PAPER

**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 9.8 N (acceleration of free fall =  $9.8 \text{ m/s}^2$ ).

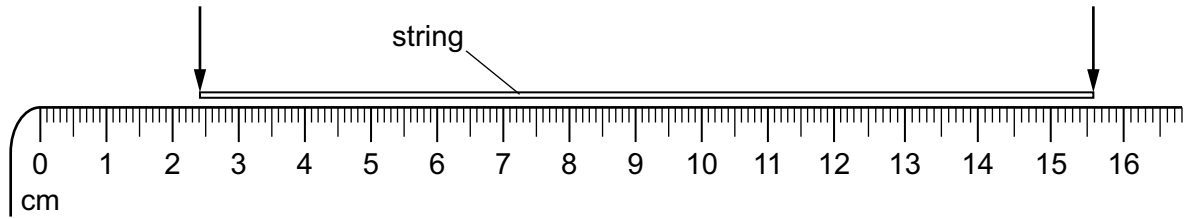
## INFORMATION

- 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.

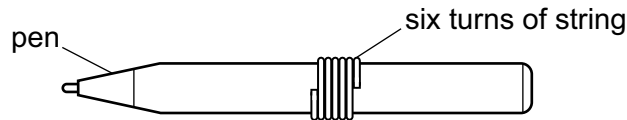
This document has **14** pages.



- 1 A length of string is measured between two points on a ruler.



When the length of string is wound closely around a pen, it goes round six times.



What is the distance once round the pen?

- A** 2.2 cm      **B** 2.6 cm      **C** 13.2 cm      **D** 15.6 cm
- 2 When does an object falling vertically through the air reach terminal velocity?
- A** when the acceleration of the object becomes negative  
**B** when the acceleration of the object is equal to  $g$   
**C** when the air resistance equals the weight of the object  
**D** when the air resistance is greater than the weight of the object
- 3 An athlete runs a 100 m race in a straight line. The table shows how his speed changes with time for the first 5.0 s of the race.

speed m/s	0	1.7	4.1	5.7	6.5	6.8
time/s	0	1.0	2.0	3.0	4.0	5.0

What is the average acceleration of the athlete between time 2.0 s and time 3.0 s?

- A**  $1.6 \text{ m/s}^2$       **B**  $1.9 \text{ m/s}^2$       **C**  $4.9 \text{ m/s}^2$       **D**  $5.7 \text{ m/s}^2$
- 4 The gravitational field strength on the Moon is  $1.6 \text{ N/kg}$ .
- An astronaut has a mass of 75 kg.
- What is the weight of the astronaut on the Moon?
- A** 47 N      **B** 75 N      **C** 120 N      **D** 740 N

- 5 Two objects P and Q are placed in a beaker containing a liquid.

Object P floats in the liquid and object Q sinks.

Which row for the densities of object P, object Q and the liquid is possible?

	<u>density of object P</u> g/cm <sup>3</sup>	<u>density of object Q</u> g/cm <sup>3</sup>	<u>density of liquid</u> g/cm <sup>3</sup>
<b>A</b>	1.2	0.6	0.8
<b>B</b>	1.2	1.4	1.0
<b>C</b>	11.3	8.9	13.6
<b>D</b>	11.3	19.3	13.6

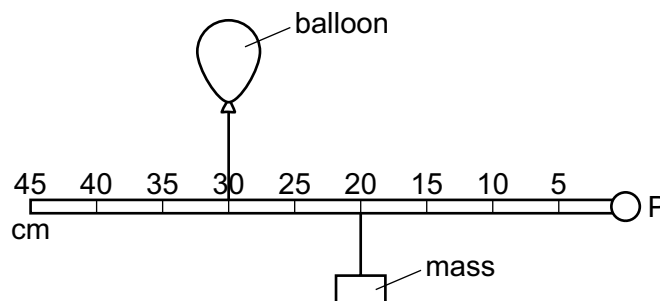
- 6 A ball of mass 0.12 kg is hit by a tennis player.

The velocity of the ball changes from 0 m/s to 5.0 m/s in 0.60 s.

What is the average resultant force acting on the ball while it is being hit?

- A** 1.0 N      **B** 2.5 N      **C** 3.6 N      **D** 8.3 N

- 7 A balloon and a mass are attached to a rod that is pivoted at a fixed point P.



The balloon is filled with helium, which is a gas that is less dense than air.

The balloon filled with helium applies an upward force on the rod.

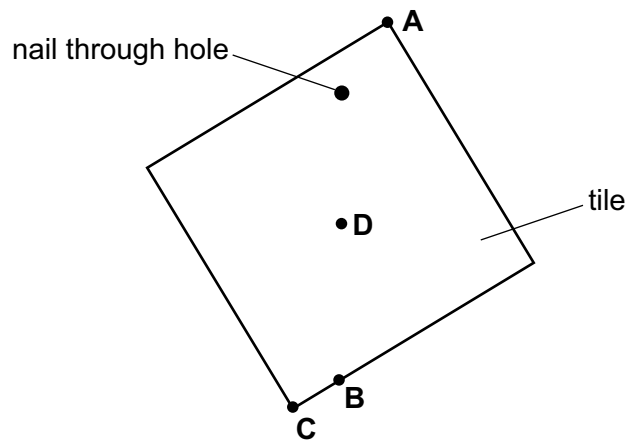
The rod is horizontal and in equilibrium.

Which action causes the rod to rotate clockwise?

- A** moving the balloon to the 40 cm mark and the mass to the 30 cm mark  
**B** moving the balloon to the 20 cm mark and the mass to the 10 cm mark  
**C** moving the balloon to the 25 cm mark and the mass to the 25 cm mark  
**D** moving the balloon to the 20 cm mark and the mass to the 30 cm mark

- 8 A hole is made in a square tile of uniform thickness. The diagram shows the tile hanging loosely on a nail.

Where is the centre of gravity of the tile?



- 9 An object of mass 0.16 kg is moving forwards at a speed of 0.50 m/s.  
A second object of mass 0.10 kg is at rest.  
The first object strikes the second object.  
After the collision, the second object moves forwards at a speed of 0.50 m/s.  
What is the speed of the first object after the collision?
- A** 0.0 m/s      **B** 0.19 m/s      **C** 0.31 m/s      **D** 0.50 m/s
- 10 A ball is at rest at the top of a hill.  
The ball rolls down the hill.  
At the bottom of the hill the ball hits a wall and stops.  
Which energy changes occur?
- A** gravitational potential energy → internal energy → kinetic energy  
**B** gravitational potential energy → kinetic energy → internal energy  
**C** kinetic energy → gravitational potential energy → internal energy  
**D** kinetic energy → internal energy → gravitational potential energy

- 11 A man climbs a ladder.

Which quantities can be used to calculate the useful power of the man?

- A the weight of the man and the time taken only
- B the weight of the man and the vertical distance moved only
- C the work done by the man and the time taken only
- D the work done by the man and the vertical distance moved only

- 12 A student uses her thumb to push a drawing pin (thumb tack) into a notice board.

The pin goes into the board but does not penetrate her thumb.

Which statement explains this?

- A The force exerted by the pin on her thumb is greater than the force exerted by the pin on the notice board.
- B The force exerted by the pin on the notice board is greater than the force exerted by the pin on her thumb.
- C The pressure of the pin on her thumb is greater than the pressure of the pin on the notice board.
- D The pressure of the pin on the notice board is greater than the pressure of the pin on her thumb.

- 13 A submarine is a boat that can travel below the surface of the sea.

A submarine is 20m below the surface of the sea. The pressure due to the sea water at this depth is  $P$ .

On another day, the submarine is 26 m below the surface of fresh water.

The density of sea water is 1.3 times the density of fresh water.

What is the pressure due to the fresh water at a depth of 26 m?

- A  $\frac{P}{1.3}$       B  $P$       C  $1.3 P$       D  $1.7 P$

- 14 When particles of a gas collide with a wall of a container, the wall experiences a pressure.

What is the cause of this pressure?

- A the change in energy of the particles
- B the change in momentum of the particles
- C the change in power of the particles
- D the change in speed of the particles

- 15 A substance can exist in three different states: solid, liquid or gas.

Each of the two statements below describes a change of state.

change 1: Particles move much closer together but continue to travel throughout the substance.

change 2: Particles stop travelling throughout the substance and just vibrate about fixed positions.

Which changes of state do these statements describe?

	change 1	change 2
<b>A</b>	condensation	melting
<b>B</b>	condensation	solidification
<b>C</b>	solidification	condensation
<b>D</b>	solidification	melting

- 16 Copper is a type of metal.

A block of copper has a mass of 2.0 kg.

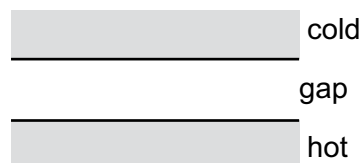
The block of copper absorbs 12 000 J of thermal energy.

The specific heat capacity of copper is 385 J/(kg °C).

What is the temperature rise of the copper?

- A** 15.6 °C      **B** 31.2 °C      **C** 46.8 °C      **D** 62.4 °C

- 17 The diagram shows the gap between a hot surface and a cold surface. The gap can contain air (gas), iron (solid), a vacuum or water (liquid).



Which material in the gap allows the quickest transfer of thermal energy between the surfaces by conduction?

- A** air (gas)  
**B** iron (solid)  
**C** vacuum  
**D** water (liquid)

18 Which row about boiling and about evaporation is correct?

	boiling	evaporation
<b>A</b>	takes place only at the surface	takes place only at the surface
<b>B</b>	takes place only at the surface	takes place throughout the liquid
<b>C</b>	takes place throughout the liquid	takes place only at the surface
<b>D</b>	takes place throughout the liquid	takes place throughout the liquid

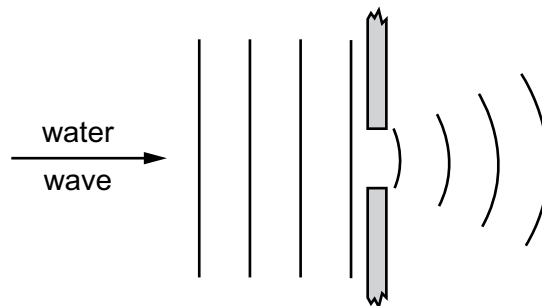
19 Light travels at a speed of  $2.0 \times 10^8$  m/s in a glass block.

In the glass, the wavelength of the light is  $4.0 \times 10^{-7}$  m.

What is the frequency of the light?

- A**  $2.0 \times 10^{-15}$  Hz
- B**  $1.3 \times 10^{-2}$  Hz
- C** 80 Hz
- D**  $5.0 \times 10^{14}$  Hz

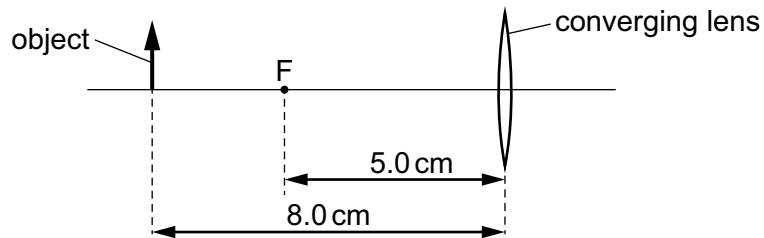
20 In a shallow tank, a water wave moves through a barrier with a narrow gap. The diagram shows the waves on the left-hand side and the right-hand side of the barrier.



Which term describes the effect shown?

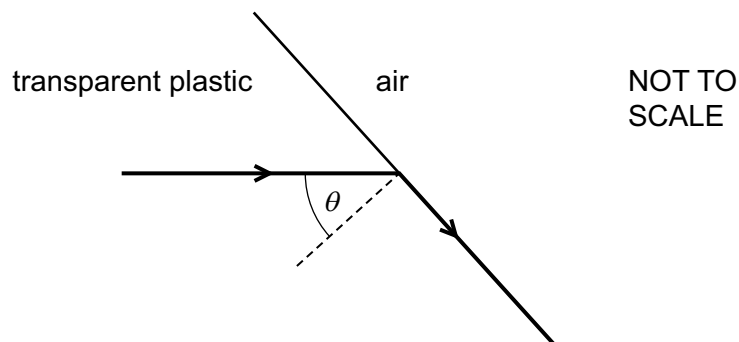
- A** reflection
- B** dispersion
- C** refraction
- D** diffraction

- 21 Which statement describes monochromatic light?
- A light that never diffracts
  - B light that has a single frequency
  - C light that spreads out when shone through a glass prism
  - D light that travels at the same speed in all materials
- 22 An object is placed 8.0 cm from a thin converging lens of focal length 5.0 cm.



Which statement about the image formed by the lens is correct?

- A The image is real and inverted.
  - B The image is real and upright.
  - C The image is virtual and inverted.
  - D The image is virtual and upright.
- 23 A ray of light travels through transparent plastic to air.



The ray of light enters the air travelling parallel to the surface of the plastic.

The refractive index of the plastic is 1.25.

What is angle  $\theta$ ?

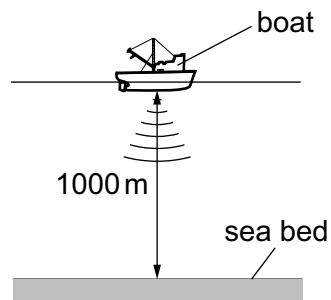
- A  $37^\circ$
- B  $39^\circ$
- C  $51^\circ$
- D  $53^\circ$



24 What is the speed of electromagnetic waves in a vacuum?

- A  $3.0 \times 10^4$  cm/s
- B  $3.0 \times 10^5$  km/s
- C  $3.0 \times 10^6$  cm/s
- D  $3.0 \times 10^{11}$  km/s

25 A pulse of sound is produced at the bottom of a boat. The sound travels through the water and is reflected from the sea bed. The sound reaches the boat again after 1.3 s. The sea bed is 1000 m below the boat.



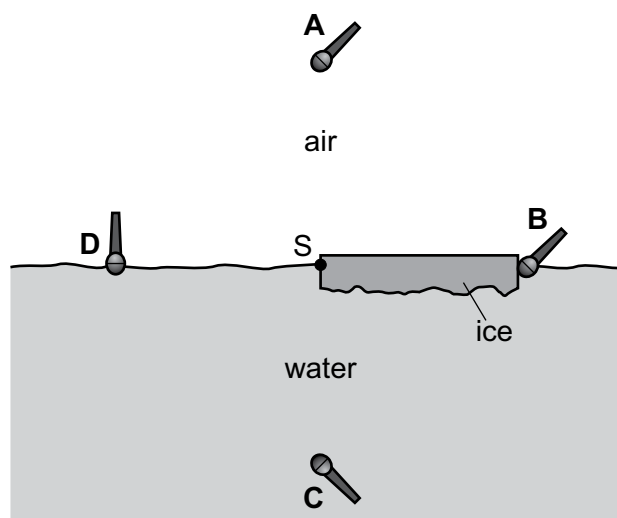
Using this information, what is the speed of sound in the water?

- A 770 m/s
- B 1300 m/s
- C 1500 m/s
- D 2600 m/s

26 A sheet of ice floats on water. A source of sound S is positioned at the edge of the ice sheet.

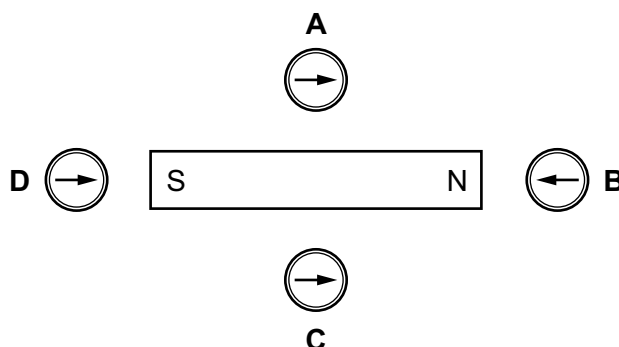
Four microphones are placed equal distances from S.

Which microphone detects the sound from S first?



27 The diagram shows a bar magnet and four plotting compasses.

Which compass correctly shows the direction of the magnetic field due to the magnet?



28 A plastic rod is rubbed with a cloth. The rod becomes positively charged.

What happens to the plastic rod and what is the charge on the cloth?

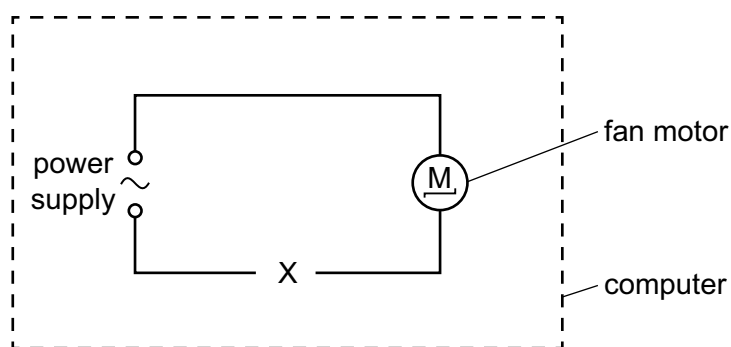
	plastic rod	charge on cloth
<b>A</b>	gains electrons	negative
<b>B</b>	gains electrons	positive
<b>C</b>	loses electrons	negative
<b>D</b>	loses electrons	positive

29 The electromotive force (e.m.f.) of a mobile phone battery is 3.7V.

What does this mean?

- A** 3.7 J is the maximum energy the battery can provide in 1.0 s.
- B** 3.7 J is the total energy the battery can provide before it has to be recharged.
- C** 3.7 J of energy is provided by the battery to drive a charge of 1.0 C around a complete circuit.
- D** 3.7 J of energy is provided by the battery to drive a current of 1.0 A around a complete circuit.

- 30 A computer engineer wants the speed of a fan to increase when the temperature inside a computer increases. The engineer knows that a larger current causes the fan to turn more quickly.



Which component should be placed at X to make this happen?

- A a relay
  - B a thermistor
  - C a transformer
  - D a variable resistor
- 31 A water heater is connected to a 230V supply and there is a current of 26A in the heater. It takes 20 minutes to heat the water to the required temperature.
- How much energy is supplied by the heater?
- A  $6.0 \times 10^3$  J
  - B  $1.0 \times 10^4$  J
  - C  $1.2 \times 10^5$  J
  - D  $7.2 \times 10^6$  J
- 32 An electric kettle has a metal casing. The cable for the kettle contains a wire that is connected to the earth pin of the plug.

Which danger does this guard against?

- A the cable to the kettle becoming too hot
- B the casing of the kettle becoming live
- C the casing of the kettle becoming wet on the outside
- D the casing of the kettle overheating

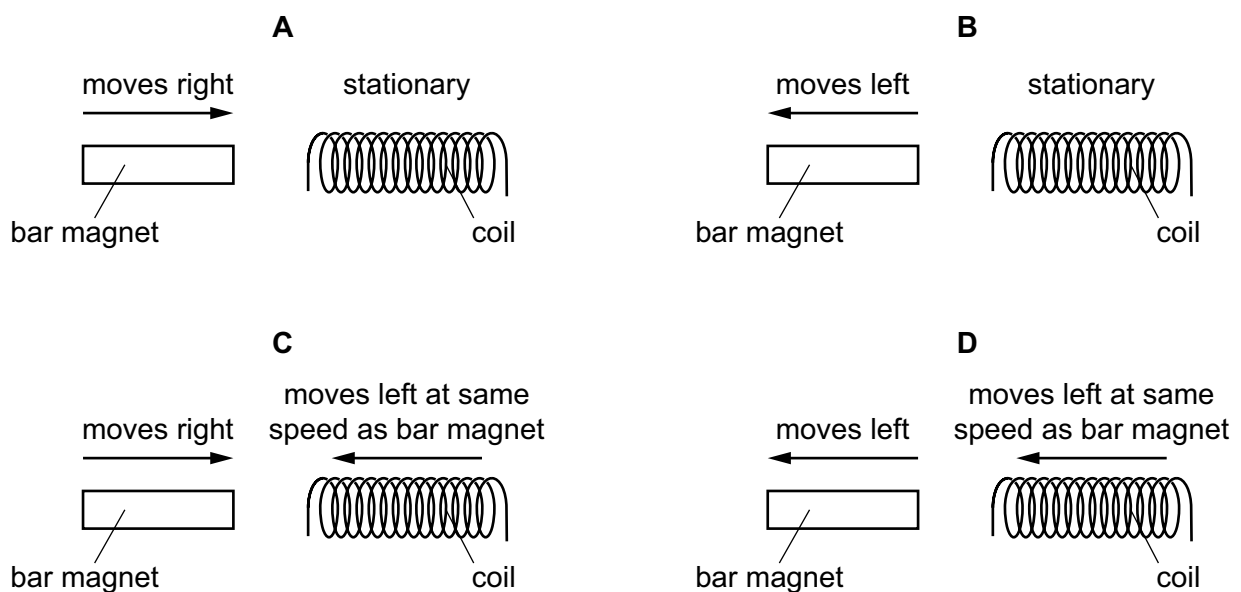
- 33 An electric current can produce a heating effect and a magnetic effect.

Which row shows the effect that a relay uses and one application of a relay?

	effect used by a relay	one application of a relay
<b>A</b>	heating effect	allowing a small current to switch on a large current
<b>B</b>	heating effect	changing the voltage of an a.c. supply
<b>C</b>	magnetic effect	allowing a small current to switch on a large current
<b>D</b>	magnetic effect	changing the voltage of an a.c. supply

- 34 The diagram shows a bar magnet and a coil of wire. The bar magnet is moved at the same speed in each experiment.

In which situation is the largest electromotive force (e.m.f.) induced?



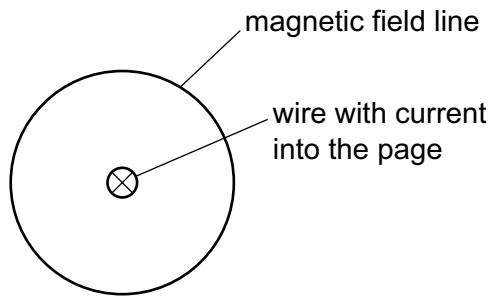
- 35 Increasing the transmission voltage in transmission cables reduces power losses.

What is the explanation for this reduction?

- A** The current decreases, reducing thermal energy losses.
- B** The current increases, increasing the flow of charge.
- C** The resistance of the cable increases, reducing the current.
- D** The resistance of the cable decreases.

- 36 There is an electric current in a straight wire in the direction into the page. This produces a magnetic field around the wire.

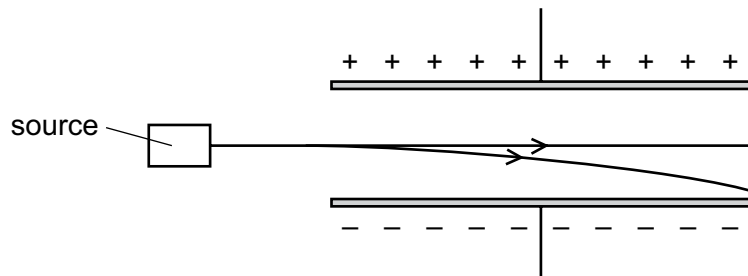
All the field lines are circles but only one field line is shown.



Which row describes the magnetic field?

	direction of the field lines	spacing of the field lines
<b>A</b>	anti-clockwise	equally spaced over the whole field
<b>B</b>	anti-clockwise	more widely spaced further from the wire
<b>C</b>	clockwise	equally spaced over the whole field
<b>D</b>	clockwise	more widely spaced further from the wire

- 37 The diagram shows emissions from a source passing into the electric field between two charged plates.



What is emitted by this source?

- A** neutrons and  $\gamma$ -rays only
- B**  $\alpha$ -particles and  $\beta$ -particles only
- C**  $\alpha$ -particles and  $\gamma$ -rays only
- D**  $\beta$ -particles and  $\gamma$ -rays only

- 38 Which row in the table describes the process of nuclear fusion and identifies the change in total mass of the particles involved?

	process	change in total mass of the particles
<b>A</b>	a large nucleus splits into two smaller nuclei	decreases
<b>B</b>	a large nucleus splits into two smaller nuclei	increases
<b>C</b>	two small nuclei combine to form a larger nucleus	decreases
<b>D</b>	two small nuclei combine to form a larger nucleus	increases

- 39 The orbit of the Moon around the Earth is modelled as a circular path of radius  $3.8 \times 10^5$  km.

The orbital period is 29.5 days (710 hours).

What is the orbital speed of the Moon?

- A**  $5.4 \times 10^2$  km/h
- B**  $1.1 \times 10^3$  km/h
- C**  $1.7 \times 10^3$  km/h
- D**  $3.4 \times 10^3$  km/h
- 40 Which statement does **not** describe redshift?
- A** All the light emitted from all distant galaxies is at the red end of the spectrum.
- B** The light arriving at the Earth from a receding star is always redshifted.
- C** During redshift, the wavelength of the observed light is longer than it is if the redshift had not occurred.
- D** The light from stars in all distant galaxies is moved towards the red end of the spectrum.

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