

Class	Full Name	Index Number
-------	-----------	--------------



I believe, therefore I am

Preliminary Examination 2024

O
6091 / 01

PHYSICS

Paper 1 Multiple Choice
Secondary 4 Express

26 August 2024

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name and index number on the Answer Sheet in the spaces provided unless this has been done for you.

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 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.

- 1 The symbol ' g ' can be used to refer to the acceleration due to gravity.
The acceleration due to gravity has the unit m/s^2 .

Which of the following is an alternative unit for ' g ' when it refers to the gravitational field strength?

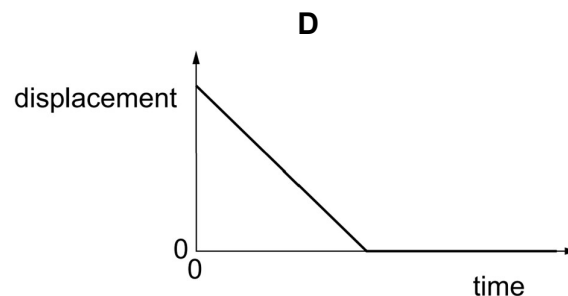
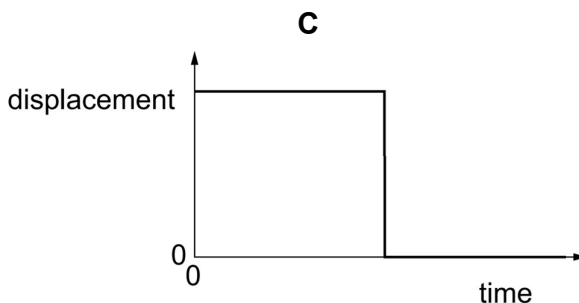
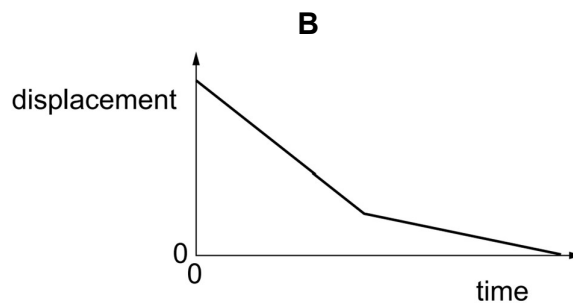
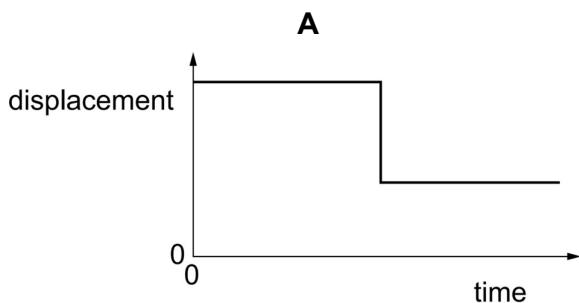
- A** J/kg **B** J/kg^2 **C** N/kg **D** N/kg^2

- 2 A moving bicycle cruising at a speed of 5.0 m/s brakes to stop at a traffic light.
Given that it brakes uniformly and stops in 3.0 m , how long does the cyclist take to stop?

- A** 0.60 s **B** 1.2 s **C** 1.3 s **D** 3.0 s

- 3 A free-fall parachutist falls at a constant speed.
He then opens his parachute and continues to fall to Earth at a lower, constant speed.

Which diagram below represents the motion described above?

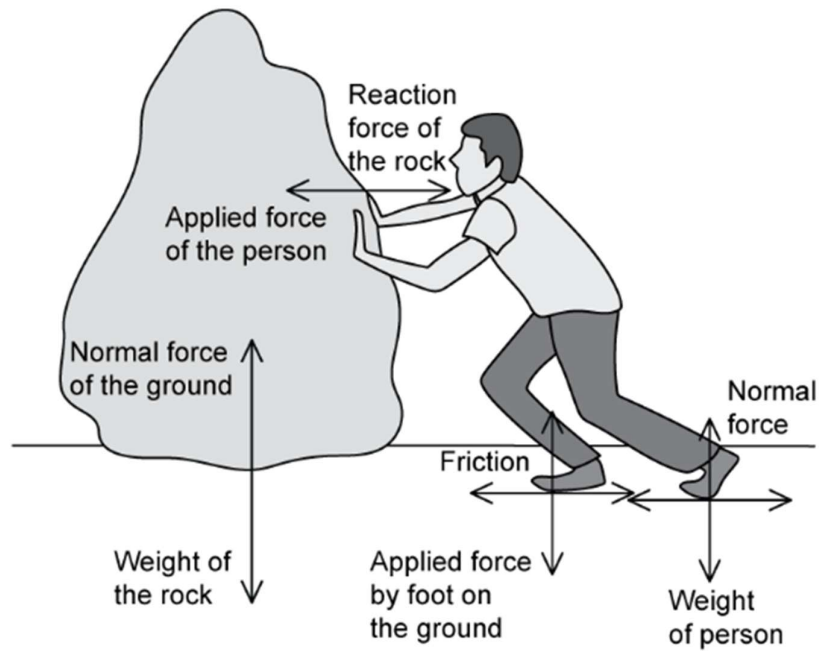


- 4 A force of 20 N pushes an object of weight 50 N along a rough horizontal surface where the frictional force is 5.0 N .

What is the acceleration of the object?

- A** 0.30 m/s^2 **B** 3.0 m/s^2 **C** 30 m/s^2 **D** 300 m/s^2

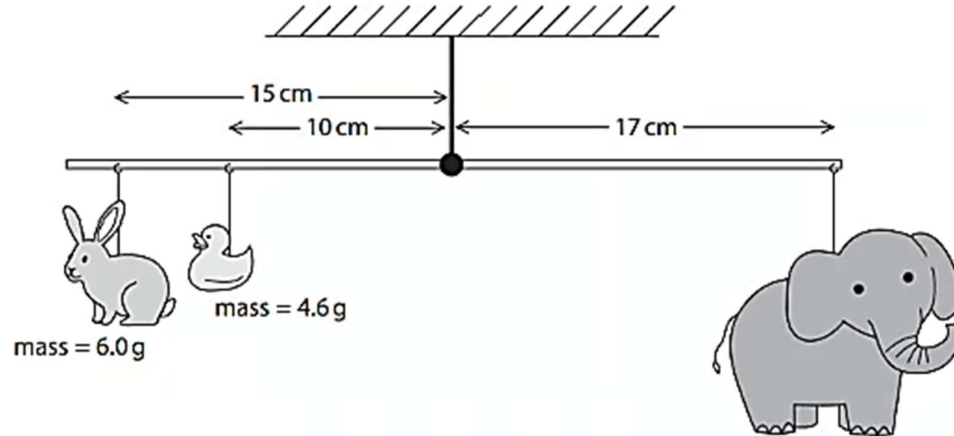
- 5 The diagram below shows a person attempting to push a large rock. Some forces acting in this system are identified as shown.



Which option correctly identifies the Newton's Third Law force pair in this scenario?

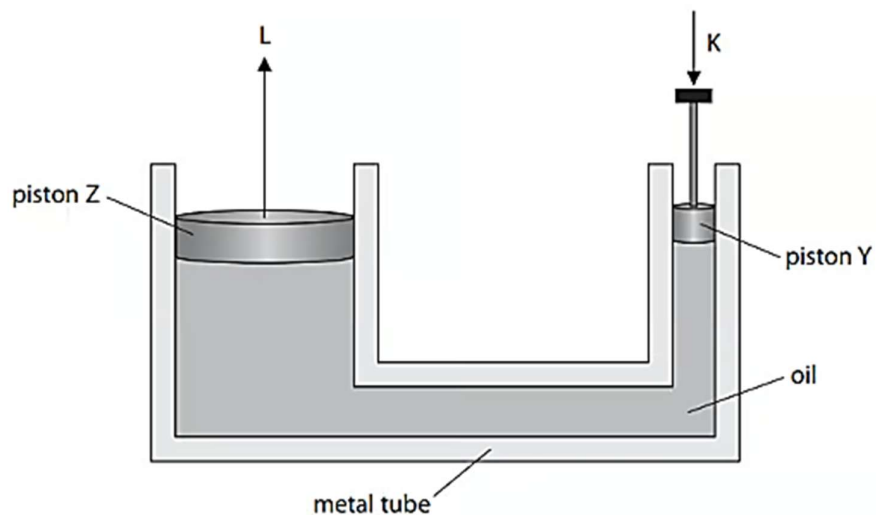
- A Weight of person and normal force.
- B Weight of rock and normal force of the ground.
- C Applied force by foot on the ground and weight of person.
- D Applied force of the person to rock and reaction force of the rock.

- 6 The diagram below shows three toy animals hanging from a rod. The rod hangs from the ceiling by a string tied to the centre of the rod.



Given that the system is in equilibrium, what is the mass of the toy elephant?

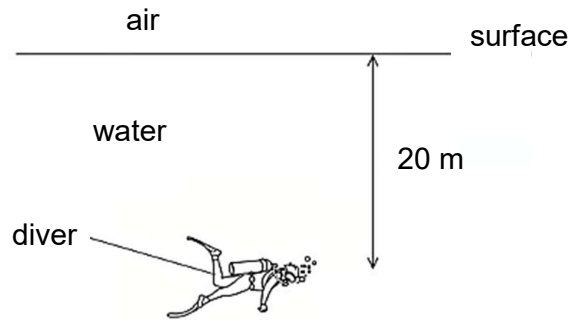
- A** 6.0 g **B** 8.0 g **C** 9.0 g **D** 16 g
- 7 The diagram below shows a hydraulic system.



Which statement is correct?

- A** The force exerted on the oil by piston Y is greater than the force exerted by the oil on piston Z.
- B** The pressure exerted on the oil by piston Y is greater than the pressure exerted by the oil on piston Z.
- C** The force exerted on the oil by piston Y is the same as the force exerted by the oil on piston Z.
- D** The pressure exerted on the oil by piston Y is the same as the pressure exerted by the oil on piston Z.

- 8 The diagram below shows a diver swimming in a sea.



Given that atmospheric pressure at sea level is 1 atm and that 10 m of water can exert a pressure equivalent to 1 atm, what is the pressure experienced by the diver at a depth of 20 m below the water surface?

- A** 1 atm **B** 2 atm **C** 3 atm **D** 4 atm
- 9 A child drinks a liquid of density ρ through a vertical straw.

Atmospheric pressure is p_o and the child is capable of lowering the pressure at the top of the straw by 10%. The acceleration of free fall is g .

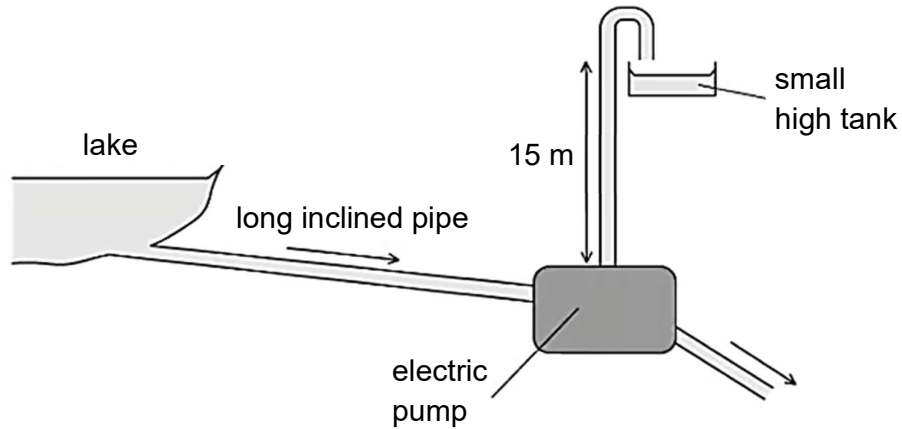
What is the maximum length of straw that would enable the child to drink the liquid?

- A** $\frac{p_o}{10 \rho g}$ **B** $\frac{9 p_o}{10 \rho g}$ **C** $\frac{p_o}{\rho g}$ **D** $\frac{10 p_o}{\rho g}$
- 10 A stone drops from height at constant speed.

What is the principal energy transfer taking place as it falls?

- A** kinetic store to internal (thermal) store of energy
B kinetic store to gravitational potential store of energy
C gravitational potential store to kinetic store of energy
D gravitational potential store to internal (thermal) store of energy

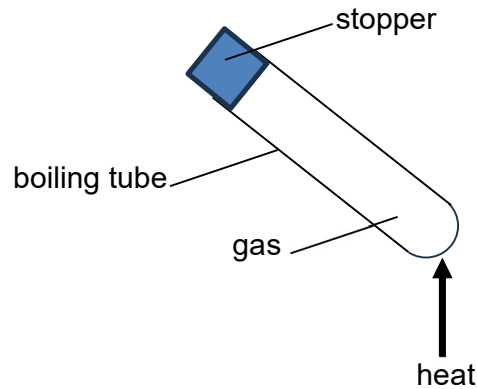
- 11** The diagram shows a 10 kW electric pump that is used to lift water into a small high tank. Water from the lake flows through the long inclined pipe and reaches a speed of 2.0 m/s when it enters the electric pump. With the aid of the electric pump, a small amount of water is lifted through a height of 15 m into the small high tank.



Given that the efficiency of the electric pump is 10%, what is the mass of water lifted every one second?

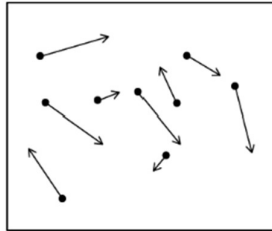
- A** 0.068 kg **B** 0.15 kg **C** 1.5 kg **D** 6.8 kg
- 12** Which operation involves the greatest power?
- A** A crane lifting a weight of 3.0 kN at a speed of 2.0 m/s
- B** A crane lifting a weight of 5.0 kN at a speed of 1.0 m/s
- C** A car moving against a resistive force of 0.40 kN at a constant speed of 20 m/s
- D** A load being pulled across a horizontal surface at a speed of 6.0 m/s against a frictional force of 1.5 kN

- 13** A sealed boiling tube contains gas. The boiling tube is heated as shown.



What happens?

- A** The particles in the gas expand.
 - B** The particles in the gas evaporate.
 - C** The particles in the gas move faster.
 - D** The particles in the gas move slower.
- 14** The diagram below shows smoke particles suspended in air. The arrows indicate directions in which the particles are moving at a particular instant.



Why do the smoke particles move?

- A** Air particles are in constant random motion and so collide with the smoke particles.
- B** Smoke particles are in constant random motion and so collide with the air particles.
- C** Air particles were heated by the smoke particles and collide with the smoke particles.
- D** Smoke particles receive energy from the air particles and bounce off the sides of the container.

15 Which statement describes what happens when water solidifies into ice?

- A** There is a transfer of energy and a change in temperature.
- B** There is a transfer of energy but no change in temperature.
- C** There is no transfer of energy and no change in temperature.
- D** There is no transfer of energy but there is a change of temperature.

16 A volatile liquid evaporates rapidly.

Why does this cause the liquid to cool?

- A** Energy is rapidly conducted away.
- B** Energy is removed as some of the most energetic molecules leave the liquid.
- C** Energy is dissipated due to the rapid movements of the liquid as a result of convection currents.
- D** The volume of the liquid reduces rapidly and the molecules have less space to move around.

17 An ice cube, with an initial temperature of -5.0°C has a mass of 7.50 g. The specific latent heat of fusion of ice is 334 J/g and the specific heat capacity of ice is 2.11 kJ/kgK.

Energy from the surroundings is transferred to the ice cube at an average rate of 1.25 W. How long does it take for the ice cube to completely melt?

- A** 630 s **B** 2000 s **C** 2070 s **D** 65 300 s

18 Ultrasound waves are used to produce images.

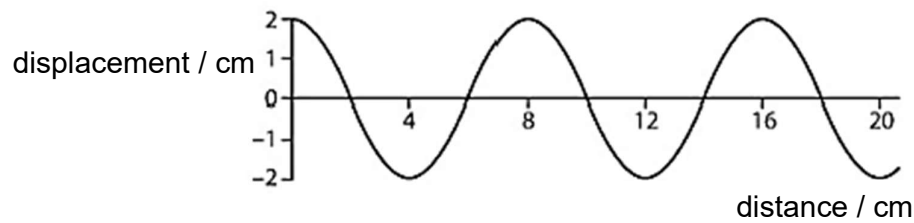
The picture below shows an ultrasound image of a fetus surrounded by fluid.



The ultrasound image is an example of waves that are

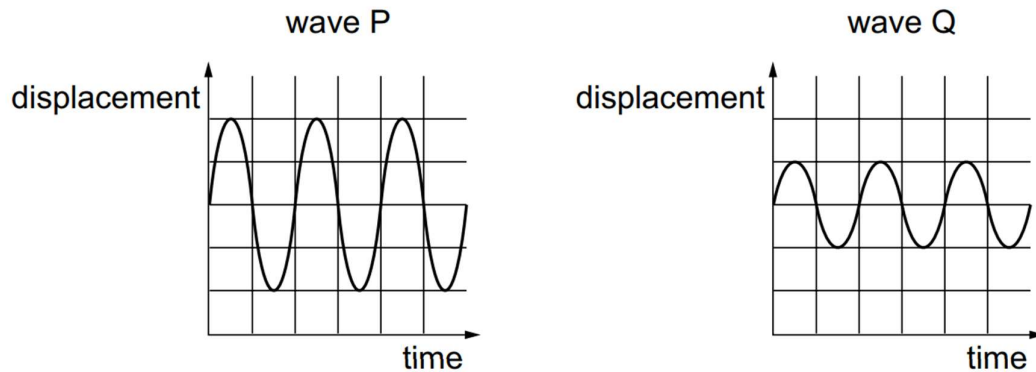
- A** absorbed **B** repelled **C** refracted **D** reflected

- 19 The displacement against distance graph below shows a water wave travelling at 2.8 m/s.



What is the period of this wave?

- A** 0.029 s **B** 2.9 s **C** 8.0 s **D** 35 s
- 20 The diagrams represent two different sound waves, P and Q.



Given that the scales of both sets of axes are the same, how do the frequency and the pitch of P compare with that of Q?

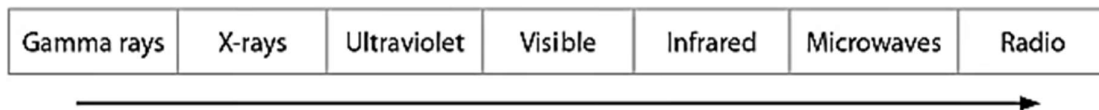
	frequency of P	pitch of P
A	greater than Q	higher than Q
B	greater than Q	same as Q
C	same as Q	higher than Q
D	same as Q	same as Q

- 21 A student stands 50 m from a wall and knocks two wooden blocks together. When the frequency of the knocking is 3 knocks per second, the echo of a knock is heard at the instant of the next one.

What is the speed of sound calculated using these measurements?

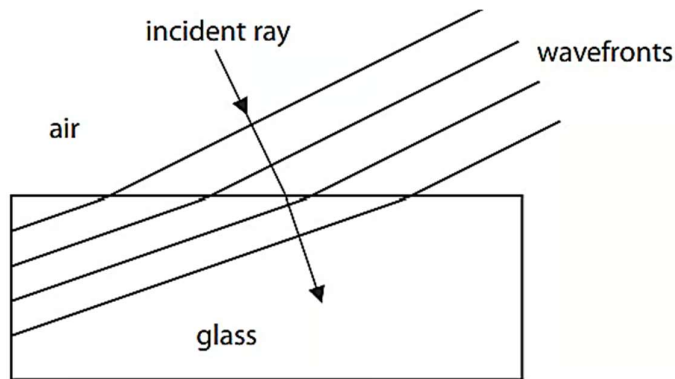
- A** 150 m/s **B** 200 m/s **C** 300 m/s **D** 350 m/s

- 22 The main sections of the electromagnetic spectrum are shown below.



Which statement is correct?

- A** The sections are arranged in order of increasing speeds.
 - B** The sections are arranged in order of increasing energies.
 - C** The sections are arranged in order of increasing frequencies.
 - D** The sections are arranged in order of increasing wavelengths.
- 23 Light waves pass from air into glass as shown.



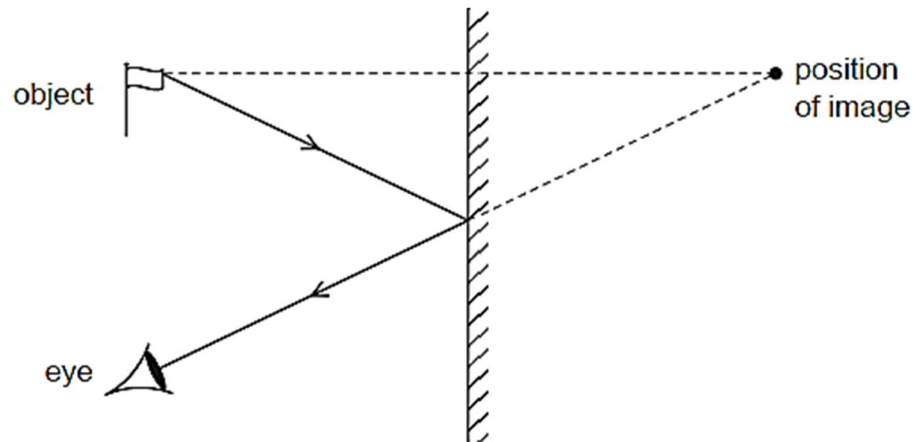
Some statements about the change in behaviour of the light waves are listed below.

- I. The speed of light reduces and its wavelength reduces.
- II. The speed of light reduces and its wavelength increases.
- III. Light bends towards the normal and its wavelength reduces.
- IV. Light bends towards the normal and its wavelength increases.
- V. Light bends away from the normal and its wavelength reduces.

Which statement(s) is/are correct?

- A** I and V
- B** II and IV
- C** I and III
- D** None of them

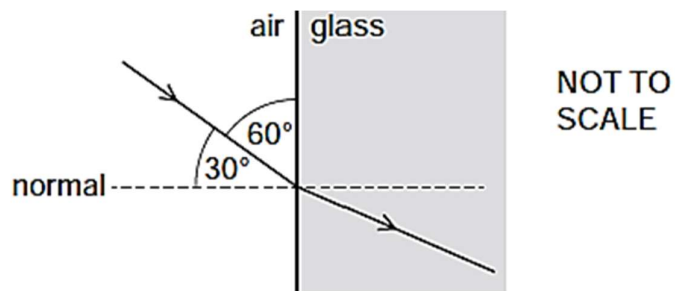
- 24 The image formed by a plane mirror is upright.



What are the other characteristics of the image?

	laterally inverted	magnified	virtual
A	no	yes	yes
B	yes	no	no
C	yes	no	yes
D	yes	yes	no

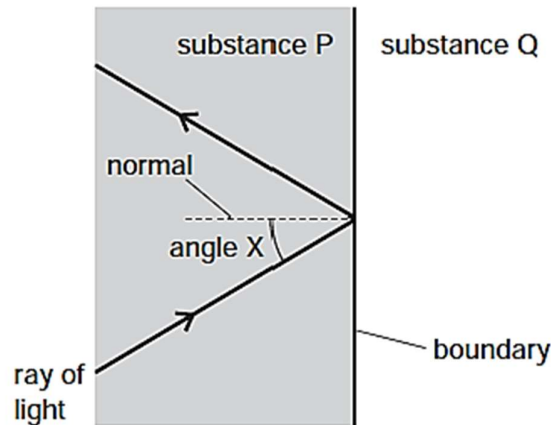
- 25 The diagram shows light passing from air into glass.



Given that the glass has a refractive index of 1.5, what is the angle of refraction in the glass?

- A** 19° **B** 22° **C** 35° **D** 49°

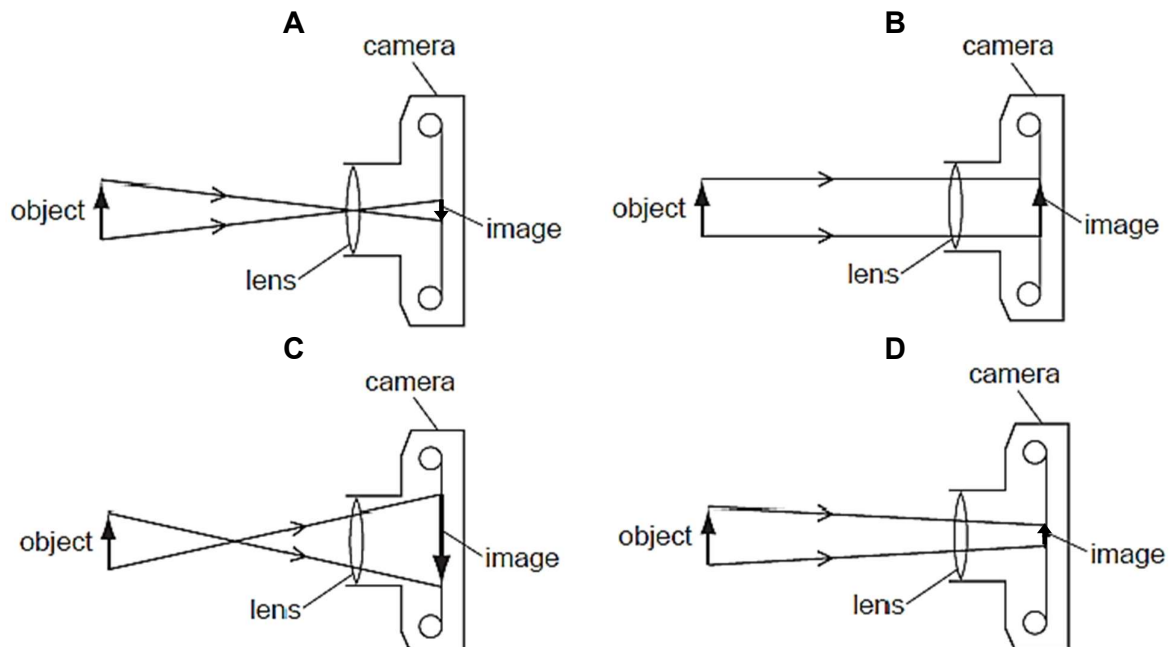
- 26** The diagram shows a ray of light travelling in a substance P. The ray reaches a boundary with a substance Q. Total internal reflection occurs at the boundary.



Which option about angle X and the optical density of substance Q is correct?

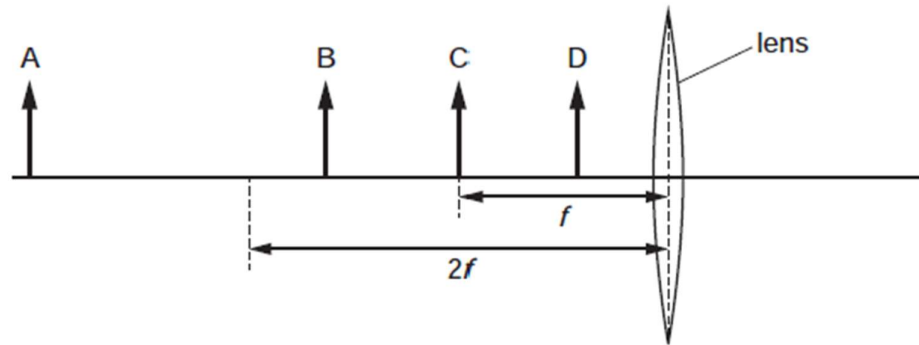
	angle X	substance Q
A	smaller than critical angle	less dense than substance P
B	smaller than critical angle	more dense than substance P
C	greater than critical angle	less dense than substance P
D	greater than critical angle	more dense than substance P

- 27** Which diagram correctly represents rays of light passing through a converging lens in a camera?

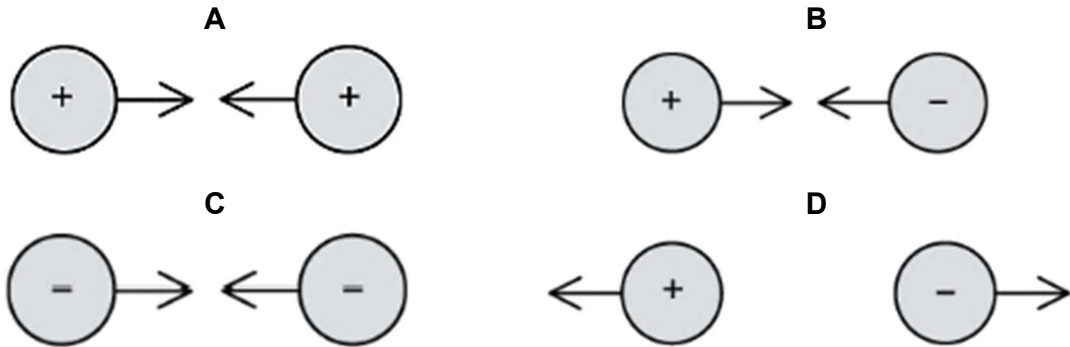


- 28** An object is placed in front of a converging lens of focal length f . The lens produces a real, enlarged image of the object.

In which labelled position is the object placed?



- 29** Which of the following pairs of charges shows the correct electric force between them?



- 30** A student has a rubber balloon tied to a long piece of cotton thread. He gives it an overall negative charge.

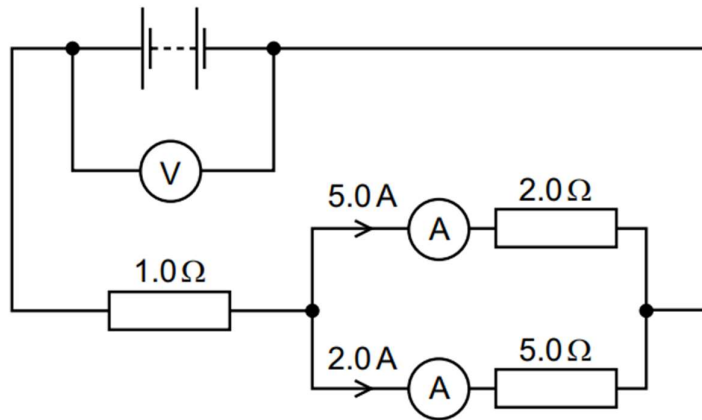
Which statement explains why the overall charge on the balloon is negative?

- A** Positive charge has been added to the balloon.
B Negative charge has been added to the balloon.
C Positive charge has been removed from the balloon.
D Negative charge has been removed from the balloon.
- 31** A charge of 60 C passes through a resistor in 120 s. In 1.0 s, the energy transferred in the resistor is 5.0 J.

What is the potential difference across the resistor?

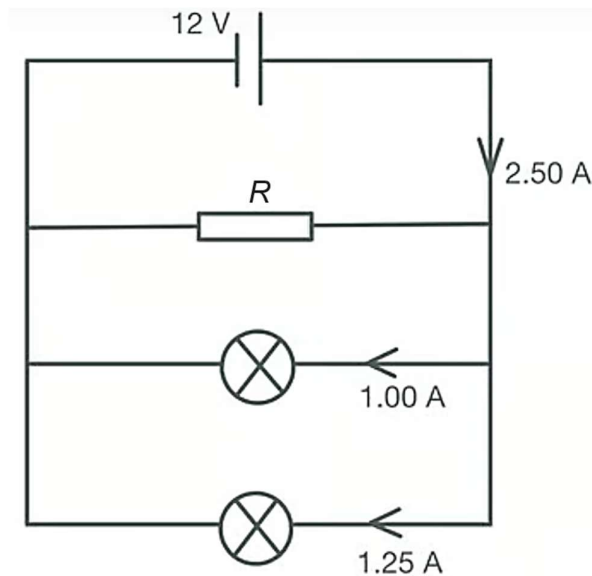
- A** 5.0 V **B** 10 V **C** 12 V **D** 24 V

- 32** The circuit diagram shows a $1.0\ \Omega$ resistor connected in series with a parallel arrangement of a $2.0\ \Omega$ resistor and a $5.0\ \Omega$ resistor. The current readings for the parallel arrangement are shown.



What is the reading on the voltmeter?

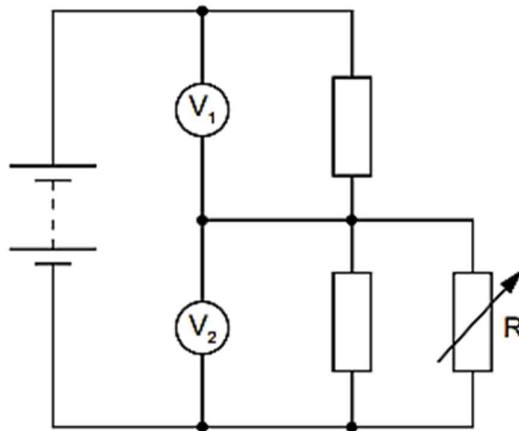
- A** 10 V **B** 12 V **C** 15 V **D** 17 V
- 33** A resistor R is connected to two bulbs as shown below.



What is the power dissipated by resistor R ?

- A** 3.0 W **B** 12 W **C** 15 W **D** 30 W

- 34** The circuit diagram shows a variable resistor R connected in parallel to the lower half of a potential divider.



The resistance of R increases.
What happens to the voltmeter readings?

	reading on V_1	reading on V_2
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

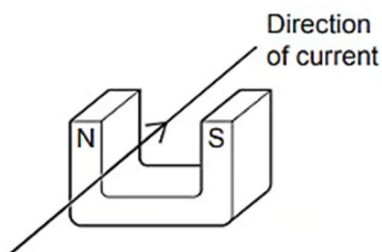
- 35** The metal case of an electrical heater is earthed.
The plug to the heater contains a 5 A fuse.
There is a current of 4.0 A when the heater works normally.

The insulation on the cable to the heater becomes so worn that the live wire makes electrical contact with the metal case.

What happens?

- A** The metal case becomes very hot.
- B** The metal case becomes live and dangerous.
- C** The fuse melts and switches off the circuit to protect the user.
- D** There is a large current in the earth wire but the fuse is not affected.

- 36** Which statement explains why an unmagnetized piece of iron is attracted to a magnet?
- A** The iron has magnetism induced by the magnet.
 - B** The iron is attracted by the Earth's magnetic field.
 - C** The iron has charged particles which attracts the protons in the magnet.
 - D** The iron has charged particles which attracts the electrons in the magnet.
- 37** A wire is placed between the poles of a magnet, perpendicular to the magnetic field lines.

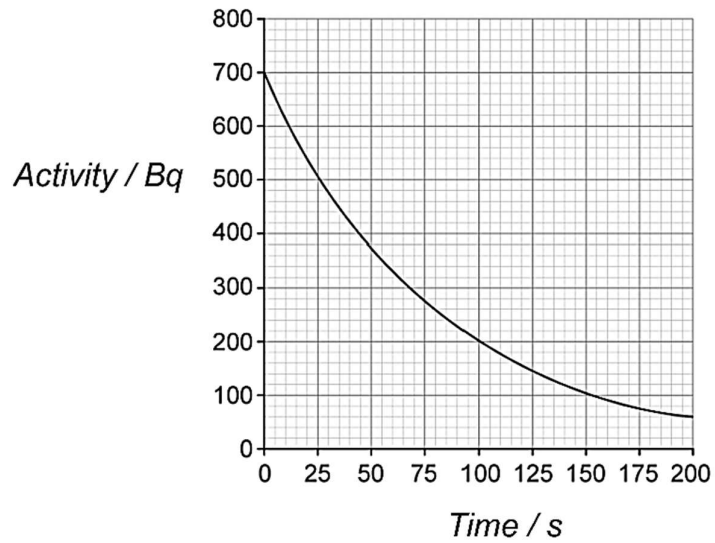


Which direction will the wire move when a current flows?

- A** Down
 - B** Left
 - C** Right
 - D** Up
- 38** Beta radiation is used to check the thickness of thin aluminium foil at a factory.
- Which statement best explains why beta radiation is used?
- A** Beta radiation is reflected by aluminium foil.
 - B** Beta radiation will not pass through aluminium foil.
 - C** Beta radiation will partially pass through aluminium foil depending on thickness.
 - D** All electromagnetic radiation is reflected by aluminium foil no matter how thick or thin.
- 39** Which option best describes isotopes of an element?

	isotopes of an element	
A	same atomic number	different number of neutrons
B	same atomic number	different number of protons
C	same mass number	different number of neutrons
D	same mass number	different number of protons

- 40** The diagram below shows how the activity of an alpha radioactive sample changes with time.



Which statement explains why the activity of the radioactive sample decreases?

- A** The radioactive nuclei decayed.
- B** Background radiation count reduced.
- C** The alpha radiation was stopped in air.
- D** The source changed from an alpha source to a beta source.