Name:		Index Number:		Class:	

CATHOLIC HIGH SCHOOL
Preliminary Examination
Secondary 4 (O-Level Programme)

PHYSICS 6091/01

Paper 1 Multiple Choice

28 August 2024
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use paper clips, glue or correction fluid.
Write your name, index number and class on this paper and on the Answer Sheet in the spaces provided.

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.

For examiner's use only:

Total	**/ 40**

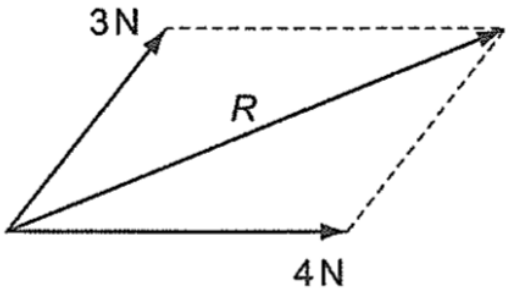
Overall	**Marks**	**%**
Paper 1	40	30%
Paper 2A	70	50%
Paper 2B	10	
Paper 3	40	20%

1 A length of copper wire is labelled: length 0.50 m and diameter 0.50 mm.

Which instrument(s) is/are **most** suitable to measure accurately the volume of the copper wire?

A measuring cylinder and digital calipers
B metre rule and digital calipers
C metre rule and digital micrometer
D tape measure and digital micrometer

2 The diagram shows how to find the resultant *R* of a 3 N and 4 N force acting at a point.



The angle between the two forces can be any value from 0° to 180°.

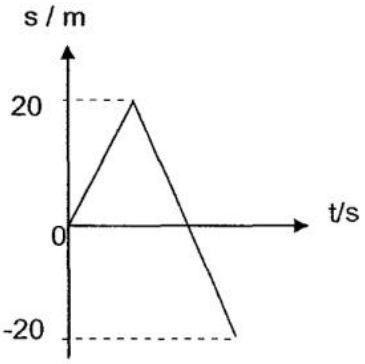
Which value of *R* is **not** possible?

A 1 N **B** 4 N **C** 7 N **D** 10 N

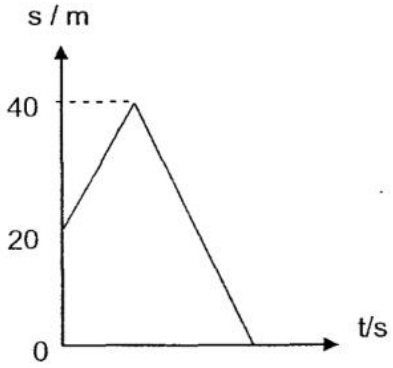
3 A ball is thrown vertically up from the top of a building 20 m high with an initial velocity of 20 m / s. The displacement of the ball is measured from the point that the ball is thrown, with an upward displacement taken as positive.

Which of the following graphs represents the displacement of the ball with time *t*?

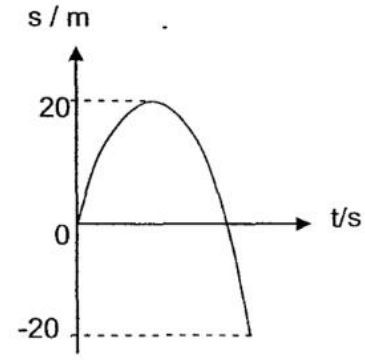
A



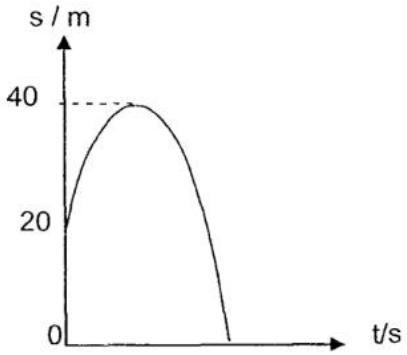
C



B



D



4 A car moving at 40 km / h speeds up with constant acceleration for 3 minutes, reaching a final speed of 80 km / h.

What is the distance travelled during this time?

A 3.0 km **B** 6.0 km **C** 180 km **D** 360 km

5 An object of mass *M* travelling to the right with velocity 2*v* collides with another object of mass 2*M* travelling to the left with velocity *v*.

It can be assumed there are no energy transfers from the objects to the surface they are moving on and to the surrounding air.

Which statement is true about both objects during the collision?

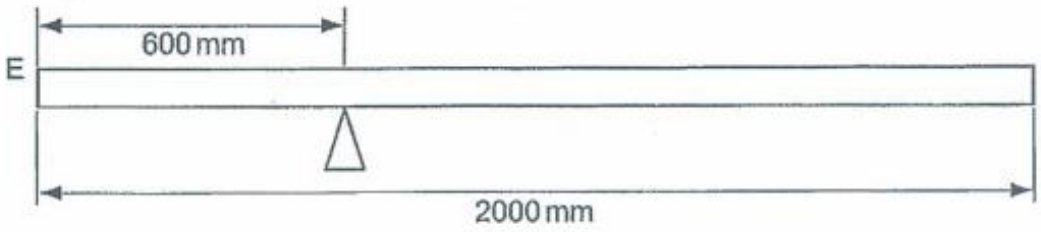
A The inertia of each object changes.
B The sum of the total energy in their stores decreases.
C They experience a deceleration of the same magnitude.
D They experience a force of the same magnitude.

6 A car is travelling on a flat road with constant velocity. It can be assumed that there is negligible air resistance acting on the car during its motion.

How many forces are acting on the car?

A 0 **B** 2 **C** 3 **D** 4

7 A uniform plank of weight 60 N is 2000 mm long. It rests on a support that is 600 mm from end E.

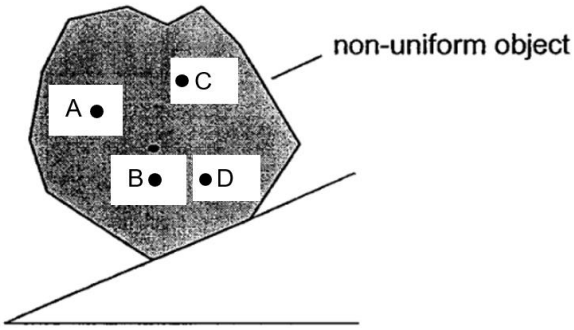


At what distance from end E must a 160 N weight be placed in order to balance the plank?

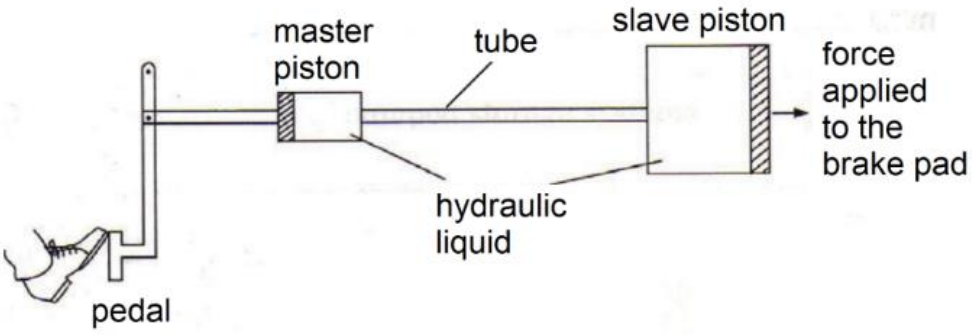
A 150 mm **B** 225 mm **C** 375 mm **D** 450 mm

8 A non-uniform object is placed on an inclined plane as shown below.

If the object is just about to topple, which position is its centre of gravity?



9 The diagram shows a hydraulic brake system used in vehicles.

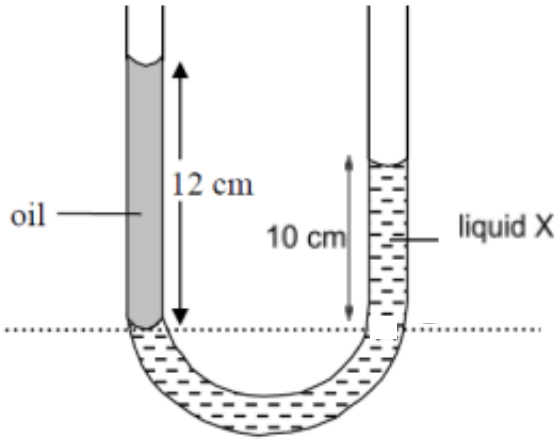


A tube links the master piston to the slave piston. Both pistons are cylindrical and the diameter of the slave piston is **twice** that of the master piston. The driver presses down on the pedal and a force of 450 N is applied on the master piston.

What is the force applied by the slave piston to the brake pad?

A 113 N **B** 225 N **C** 900 N **D** 1 800 N

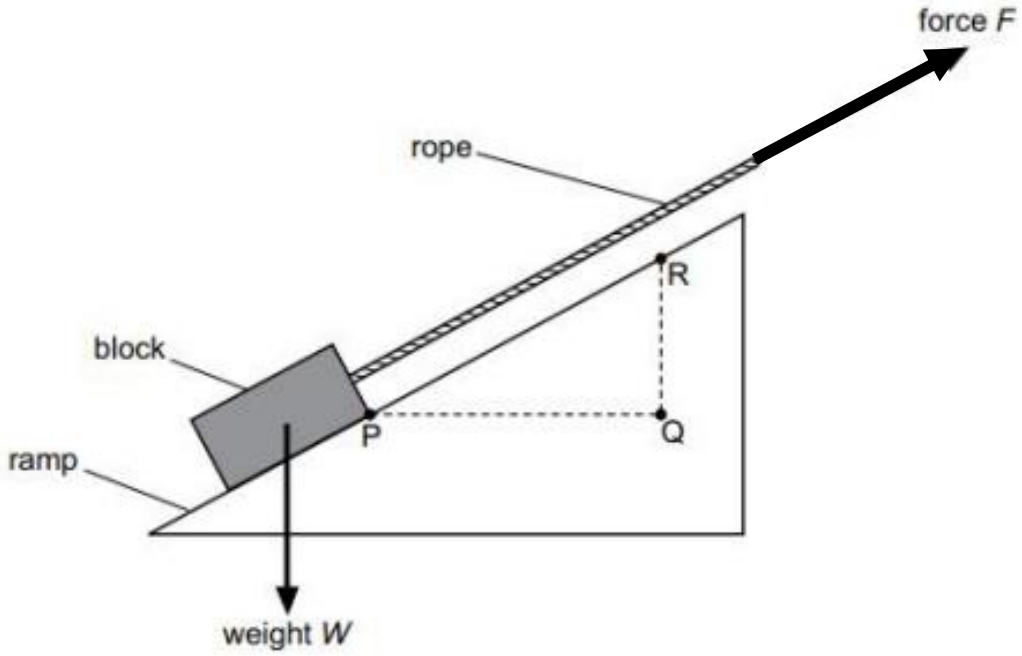
10 A U-tube containing oil and liquid X is shown in the figure below. The two liquids do not mix. The density of oil is 900 kg / m^3.



What is the density of liquid X?

A 750 kg / m^3 **B** 1 000 kg / m^3 **C** 1 080 kg / m^3 **D** 1 200 kg / m^3

11 The diagram shows a block being pulled up a **rough** ramp by a rope.
The block has weight *W* and the rope is pulled with force *F*. The block moves a distance PR along the ramp and is raised through a height QR.



What is the equation for the work done on the block by the rope?

A force *F* × distance PR
B force *F* × distance QR
C weight *W* × distance PQ
D weight *W* × distance QR

12 The diagram below shows an arrow being shot upwards, reaching its maximum height after some time. Air resistance acts on the arrow during its flight.

Which one of the following correctly states the energy transfers taking place just before the arrow reaches its maximum height?

	energy in gravitational potential store (GPE)	energy in kinetic store (KE)	GPE + KE
A	decreases	increases	decreases
B	decreases	increases	unchanged
C	increases	decreases	decreases
D	increases	decreases	unchanged

13 A student is studying Brownian motion.

Using a microscope, she observes smoke particles in a glass container, illuminated by a strong light. The smoke particles move in a zig-zag path, constantly changing speed and direction.

What happens to the smoke particles, if the air in the container is heated?

A They change direction more frequently.
B They increase in volume.
C They move faster than air molecules in the container.
D They move further apart.

14 The list below gives three properties of different states of matter.

1 They are incompressible.
2 They can flow.
3 They completely fill the container they are placed in.

Which properties are correct for liquids?

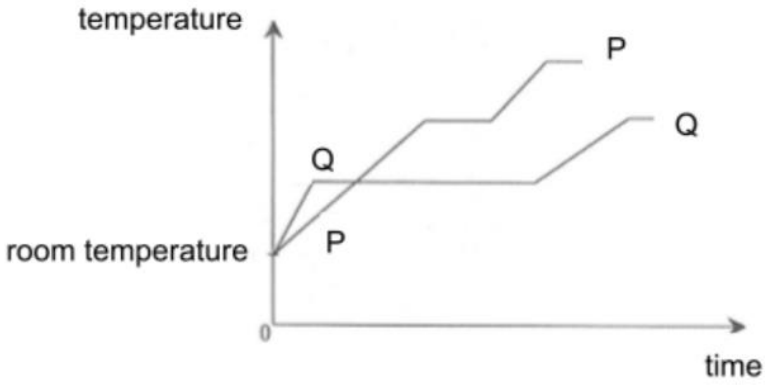
A 1 and 2 only.
B 2 and 3 only.
C 1 and 3 only.
D 1, 2 and 3.

15 Two objects, A and B, are placed in physical contact with one another. They have the same temperature. Assume there is no energy transfer to the surrounding media.

Which statement is correct?

A There is energy transfer from all molecules in A to all molecules in B.
B There is energy transfer from some molecules in A to some molecules in B, as well as from some molecules in B to some molecules in A.
C There is energy transfer from some molecules in A to some molecules in B, but no energy transfer from some molecules in B to some molecules in A.
D There is no energy transfer between any molecule in A to any molecule in B.

16 The graph shows the change in temperature of equal masses of two substances P and Q when they are heated separately by heaters of identical power.



Which of the following statements is correct?

A The energy required to raise the temperature of P from room temperature to boiling point is more than that of Q.
B The melting point of P is lower than Q.
C The specific heat capacity of P in solid state is larger than that of Q.
D The specific latent heat of fusion of P is larger than that of Q.

17 The temperature of a body increases by 1 °C. Its state remains the same.

Which other quantity of the body also increases?

A heat capacity
B internal energy
C latent heat
D potential energy of molecules

18 Which of the following quantities decreases when evaporation of water in a beaker occurs?

A average kinetic energy of water molecules
B average potential energy of water molecules
C humidity of air above water surface
D specific heat capacity of remaining water in beaker

19 Which of the following processes does **not** show that waves transfer energy without transferring matter?

A infra-red radiation emitted from the Sun to a planet with no atmosphere
B sound from a clarinet in a musical performance reaching the ear of the conductor
C transverse waves in a slinky (spring) by a person moving his hand up and down repeatedly
D water waves in the ocean due to a moving ship

20 A girl blows a whistle close to a cliff face.

The echo she hears has the same pitch as the original sound but it is quieter.

Which statement about the wave reflected from the cliff compared to the original sound is correct?

A It has the same amplitude but a lower frequency.
B It has the same frequency but a lower speed.
C It has the same speed but a lower wavelength.
D It has the same wavelength but a lower amplitude.

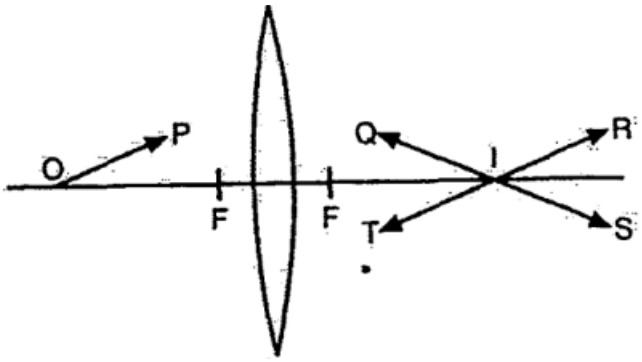
21 Which of the following, in the electromagnetic spectrum, has the shortest wavelength?

A gamma rays
B microwaves
C radio waves
D X-rays

22 Which statement applies to **both** gamma rays and X-rays?

A They are used for security screening at airports.
B They can be detected by Geiger-Muller counters.
C They can result in the growth of cancer cells.
D They travel at a faster speed in water than in vacuum.

23 A point object O moves from the principal axis of a converging lens in a direction OP as shown in the diagram.

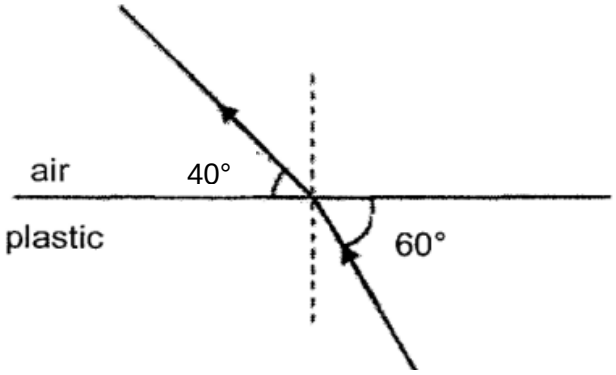


I is the image of O.

Which direction will I move subsequently?

A IQ **B** IR **C** IS **D** IT

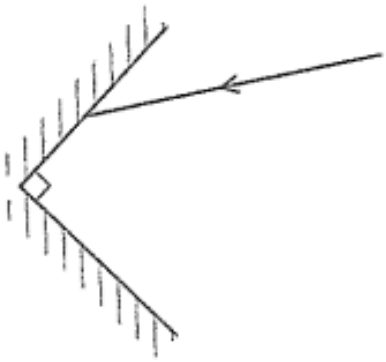
24 The diagram shows a ray of light travelling from plastic to air.



What is the refractive index of the plastic?

A 0.653 **B** 0.742 **C** 1.35 **D** 1.53

25 A ray of light hits the two mirrors placed at a right angle as shown in the diagram. The angle of incidence at the first mirror is 72°.

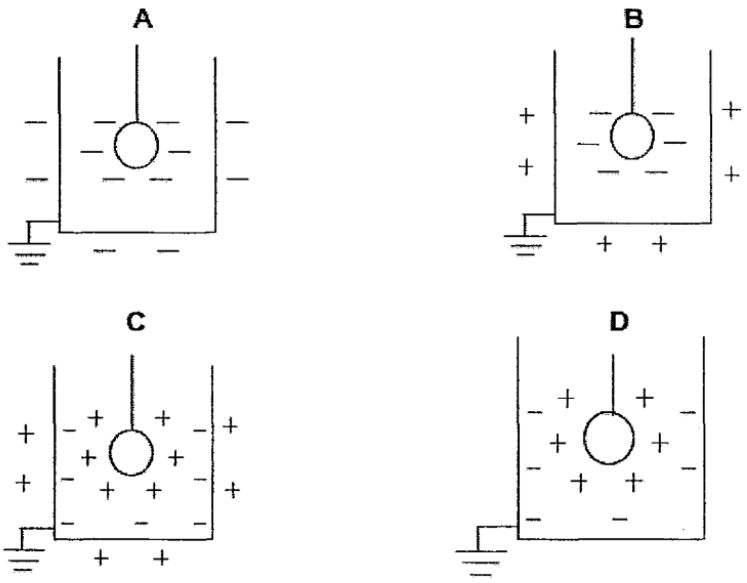


The ray is then reflected from the second mirror.

Through which angle has the direction of the ray changed due to the two reflections from both mirrors?

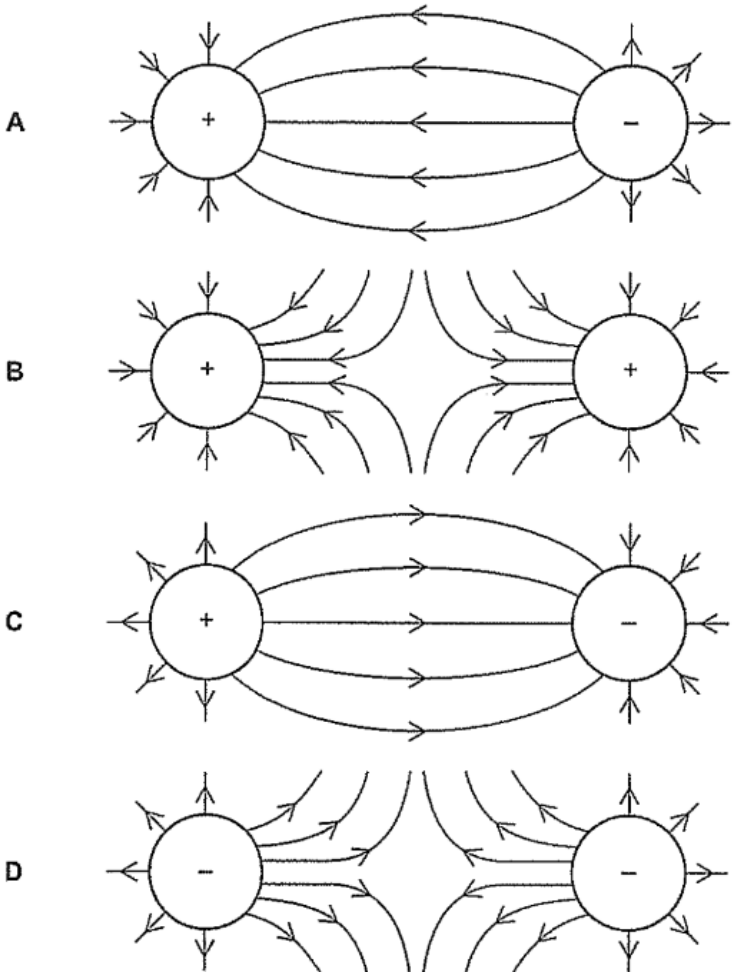
A 108° **B** 144° **C** 180° **D** 360°

26 A charged sphere is suspended by an insulating thread inside a metal can. The outside of the can is earthed.



Which diagram shows the final charges on the sphere and on the can?

27 Which diagram shows the electric field pattern between two charged spheres?

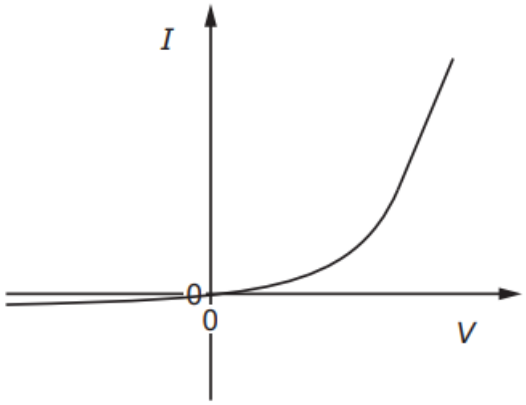


28 The potential difference between the ends of a resistance wire is 40 V. A current of 80 mA flows through the resistance wire in 350 µs.

How much energy is transferred electrically to the resistance wire?

A 0.7 µJ **B** 1.12 mJ **C** 1.12 MJ **D** 700 J

29 The graph shows the I-V characteristic for a semiconductor diode.



Which statement can be deduced from the graph?

A Above a certain positive potential difference, the diode obeys Ohm's Law.
B The current is directly proportional to potential difference when the current in the diode is in one direction.
C The diode has zero resistance when the current through the diode is in one direction.
D The resistance of the diode depends on the potential difference across it.

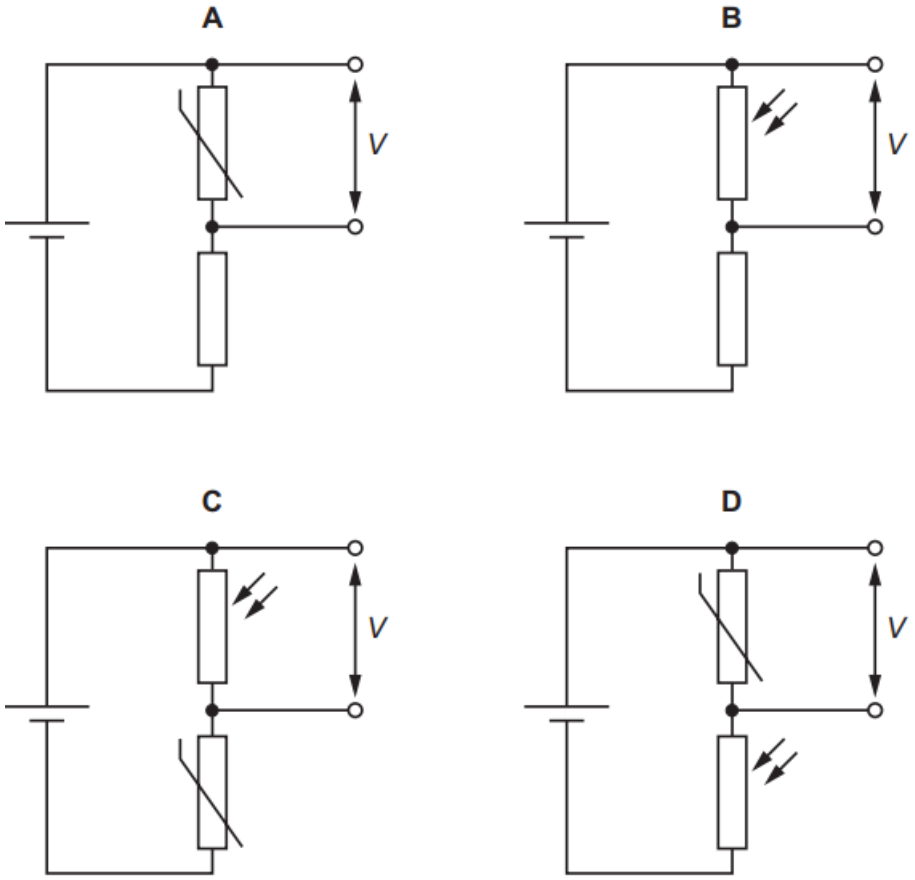
30 The sum of the currents entering a junction in an electrical circuit is always equal to the sum of the currents leaving the junction.

What is this due to?

A conservation of charge
B conservation of electromotive force
C conservation of energy
D conservation of potential difference

31 In the circuits shown, the light intensity remains constant.

In which circuit does the potential difference (p.d.) *V* increase with increasing temperature?



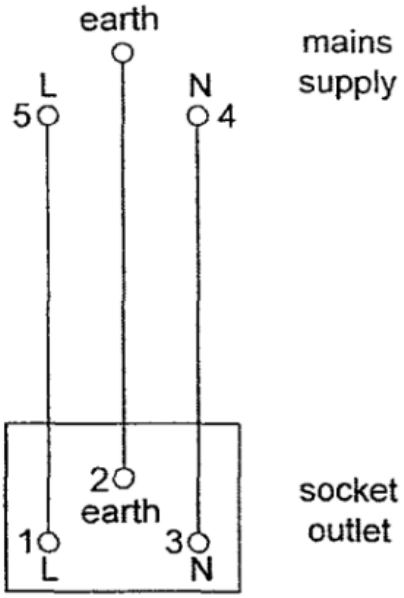
32 An electrical cable contains three wires: live, neutral and earth. The cable is correctly wired to a plug which contains a 3 A fuse. The cable insulation becomes damaged and the bare metal wires are exposed. Five possible events may occur:

- A person touches the earth wire.
- A person touches the neutral wire.
- A person touches the live wire.
- The live wire touches the neutral wire.
- The live wire touches the earth wire.

How many of these events will cause the fuse in the plug to blow?

A 2
B 3
C 4
D 5

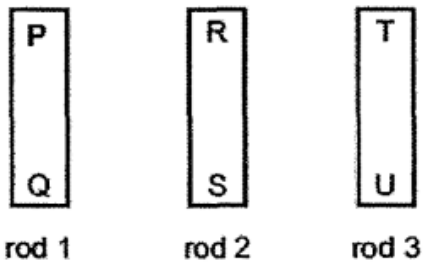
33 The wiring from a 240 V mains supply to a socket outlet in a house is shown below in the diagram.



To measure the voltage at the socket outlet, where should the voltmeter be connected?

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

34 A student conducts an experiment to find out whether there is/are magnet(s) among the metal rods 1, 2 and 3 shown below, by placing the ends of the rods close to other ends of the other rods.

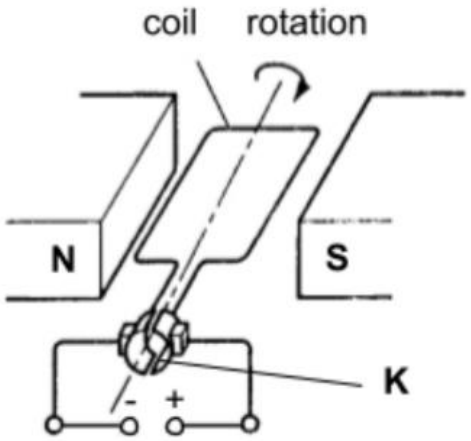


	end R	**end S**	**end T**	**end U**
end P	No observation	No observation	Attraction	Attraction

Which of the following statements is definitely correct?

A None of the rods are magnets.
B Rod 3 is a magnet.
C Rods 1 and 3 are magnets.
D The results obtained are inconclusive.

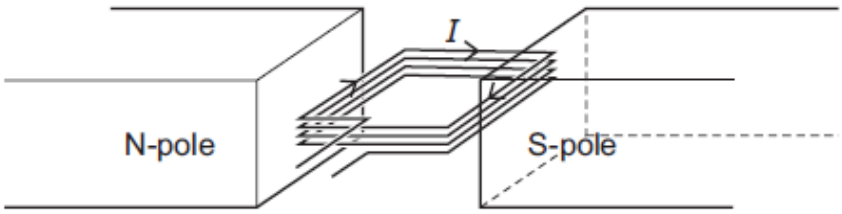
35 The diagram below shows a simple d.c. motor.



What is the main function of K?

A It acts as a contact between the coil and the connecting wires.
B It increases the strength of the magnetic flux experienced by the coil.
C It induces an e.m.f. in the coil and causes it to rotate.
D It reverses the direction of the current in the coil every half a cycle.

36 A coil P of N turns is made from a length L of wire. The coil carries a current I when between two magnetic poles.

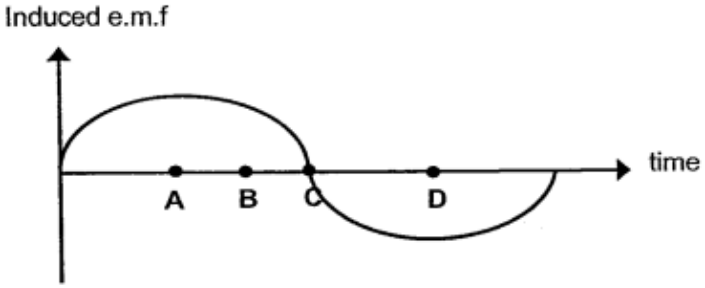


A similar coil Q of $2N$ turns is made from a length $2L$ of identical wire. It also carries the same current I when between the two magnetic poles.

Which coil has the greater resistance and which coil experiences the greater turning effect?

	greater resistance	greater turning effect
A	P	P
B	P	Q
C	Q	P
D	Q	Q

37 When an a.c. generator is rotating in a magnetic field, the induced e.m.f. changes due to the position of the coil.



Which point on the graph shows that the plane of the coil is at an angle of 45 degrees to the direction of the magnetic field?

38 A transformer has 500 turns on the primary coil and 1 500 turns on the secondary coil. The primary coil draws a current of 0.5 A from a 230 V a.c. supply. The current in the secondary coil is 0.15 A.

What is the efficiency of the transformer?

A 9%
B 10%
C 90%
D 91%

39 Three different radioactive nuclides P, Q and R each decay by three different successive emissions.

P emits α, α, β
Q emits α, β, β
R emits β, β, β

Which nuclide produces a final nucleus that has the same proton number as its starting nucleus, and which nuclide produces the same nucleon number as its starting nucleus?

	same proton number	same nucleon number
A	P	Q
B	P	R
C	Q	P
D	Q	R

40 When a nucleus of uranium-235 absorbs a neutron in a nuclear reactor it undergoes fission to form various products and release further neutrons.

In one nuclear reaction involving the fission of uranium-235, barium-144 and another element, Z are products. Two neutrons are also released when these products are formed. The reaction is shown in the equation.

$$^{235}_{92}\mathrm{U} + \mathrm{n} \rightarrow {}^{144}_{56}\mathrm{Ba} + \mathrm{Z} + 2\,\mathrm{n}$$

How many neutrons are there in the nucleus of Z?

A 34 **B** 36 **C** 53 **D** 54

END OF PAPER