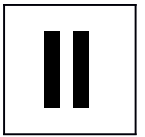


**[Science] Physics O Level Exam Paper
Preliminary Examination Set [II]
Secondary Four Express & Five Normal**



CANDIDATE NAME:

CLASS:

INDEX NUMBER:

Science(Physics)

5076/01

Paper 1 Multiple Choice

5077/01

2024

30 min

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, class and index number 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** or **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.

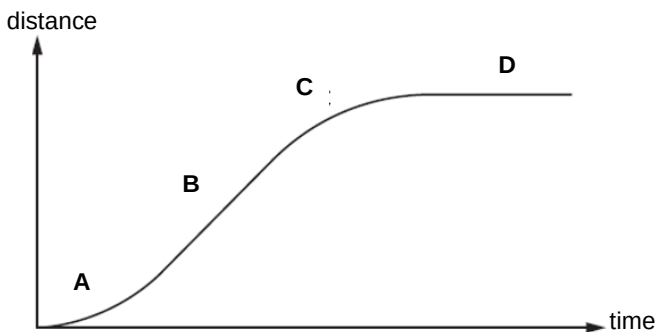
Paper 1 [40 marks]

Answer all questions on the Multiple Choice Answer Sheet.

- 1 What do the quantities of length, temperature and mass all have?
- A magnitude only
 - B magnitude and a unit only
 - C magnitude and direction only
 - D magnitude, direction and a unit
- 2 Which measuring instrument is used to measure the diameter of a thin metal wire?
- A 30 cm rule
 - B measuring tape
 - C metre rule
 - D digital micrometre screw gauge
- 3 What is the order of magnitude of the diameter of the Earth and the diameter of an atom?

	diameter of Earth / m	diameter of atom / m
A	1×10^7	1×10^{-6}
B	1×10^7	1×10^{-7}
C	1×10^9	1×10^{-7}
D	1×10^7	1×10^{-10}

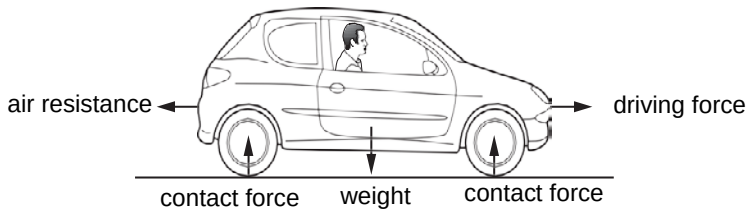
- 4 The graph shows a distance-time graph for a car travelling in a straight line.
- In which region is the car accelerating?



- 5 A motorcycle starts from rest on a straight road and reaches a velocity of 25 m/s after 5 seconds.

What is its average acceleration in that time?

- A 25 m/s²
B 125 m/s²
C 250 m/s²
D 5.0 m/s²
- 6 A car is accelerating along a straight, horizontal road. The diagram shows forces acting on the car.



Which forces are balanced?

- A contact forces and air resistance
B contact forces and weight
C driving force and air resistance
D driving force and weight
- 7 A block of wood has a mass of 2.0 kg and it is being pulled along a horizontal surface.

If the applied horizontal force is 6.0 N and the friction is constant at 2.0 N, what is the acceleration of the block?

- A 2.0 m/s² B 3.0 m/s² C 6.0 m/s² D 12 m/s²

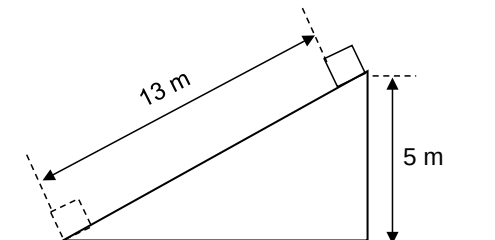
- 8 A baseball player hits a ball with his bat.



The force exerted on the ball by the bat is the action force.

What is the reaction force?

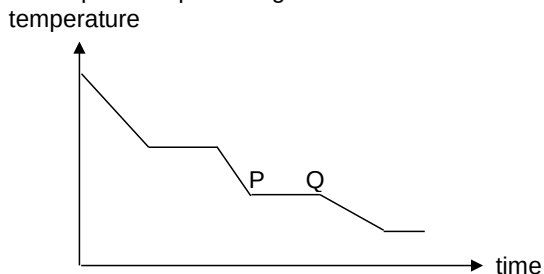
- A the air resistance exerted on the ball
 - B the force exerted on the bat by the ball
 - C the force exerted on the hand of the baseball player
 - D the gravitational force exerted by the ball
- 9 A block of mass 2.0 kg slides from rest through a distance of 13 m down a frictionless slope. The gravitational field strength on Earth is 10 N/kg .



What is the kinetic energy of the block at the bottom of the slope?

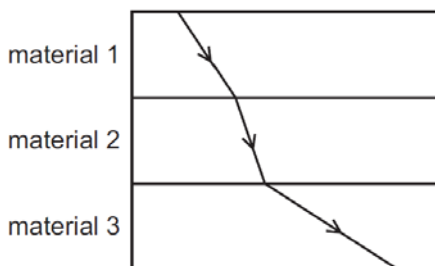
- A 10 J
- B 26 J
- C 100 J
- D 260 J

- 10** A substance in gaseous state was left to cool till it reached room temperature. The temperature of the substance was recorded at regular intervals. The graph below shows the temperature plotted against time.



Which process is taking place at section PQ?

- A** boiling
 - B** condensation
 - C** freezing
 - D** heating
- 11** A composite block is made by joining together three transparent materials. The diagram shows a ray of light passing through the composite block.



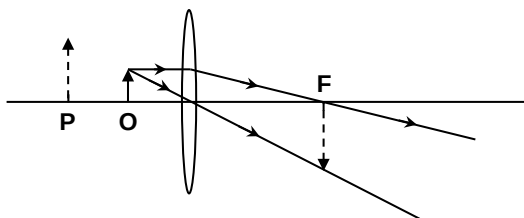
Which list gives the three materials in order of the speeds of light in the materials, from slowest to fastest?

- A** 1 → 2 → 3
- B** 1 → 3 → 2
- C** 2 → 1 → 3
- D** 2 → 3 → 1

- 12 An object is placed 30 cm in front of a plane mirror.

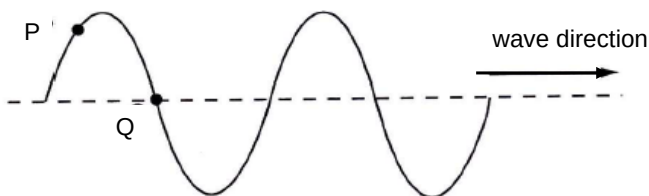
Which statement **correctly** describes the image of the object?

- A The image is the same size and 30 cm from the object.
 - B The image is the same size and 60 cm from the object.
 - C The image is smaller and 30 cm from the object.
 - D The image is smaller and 60 cm from the object.
- 13 A student draws a ray diagram for an object at O, near a thin converging lens. The diagram below shows two possible images, P and F.



Which of the followings is the correct characteristic and position of the image formed?

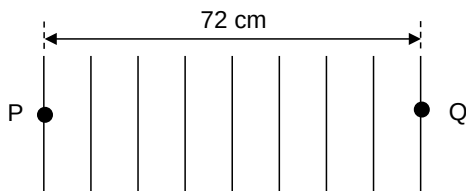
- A real and formed at F
 - B real and formed at P
 - C virtual and formed at F
 - D virtual and formed at P
- 14 The diagram below shows a wave on a string with two points marked P and Q. The wave is moving in the direction shown.



Which of the following statements is **correct** in the next instance in time?

- A P will move to the right.
- B P will move up.
- C Q will remain in the same position.
- D Q will move up.

- 15 The diagram below shows plane water waves produced in a ripple tank. The dipper dips into the water 5 times per second. Points P and Q are 72 cm apart.



What are the values of period and wavelength for this wave?

	period / s	wavelength / cm
A	0.20	8.0
B	0.20	9.0
C	5.0	8.0
D	5.0	9.0

- 16 The diagram shows the various regions in the electromagnetic spectrum.

J	microwaves	K	L	ultra-violet radiation	M	N
---	------------	---	---	------------------------	---	---

Which of the followings is **correct** about the electromagnetic waves?

- A J has the highest frequency while N has the longest wavelength.
- B K is visible light wave in the spectrum.
- C M is used to scan luggage for hazardous materials in the airport.
- D Overexposure to M can cause sun burns.

- 17** A wire of length L has a resistance of $3.0\ \Omega$. When connected to a cell, the current in the wire is 5.0 A .

The wire is now replaced by a wire of the same material and cross-sectional area but length $2L$.

What is the resistance of the wire and current through it?

	resistance	current
A	$1.5\ \Omega$	2.5 A
B	$1.5\ \Omega$	10 A
C	$6.0\ \Omega$	2.5 A
D	$6.0\ \Omega$	10 A

- 18** If 50 C of charge flows through a point in an electric circuit in 10 s , what is the current passing through that point?

A 0.2 A **B** 5 A **C** 60 A **D** 500 A

- 19** An electric heater takes a current of 5 A from a 240 V supply when operating normally.

How long would it take for the heater to convert 4.8 MJ of electrical energy?

A 400 s
B 1000 s
C 4000 s
D $100\ 000\text{ s}$

- 20** Diagram 1 shows a small compass needle with its poles marked. It is not near any magnetic materials.

Diagram 2 shows a bar magnet with its poles marked. The compass needle is placed at point P.

diagram 1

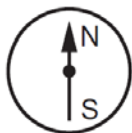


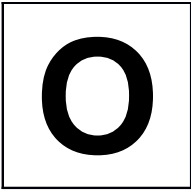
diagram 2



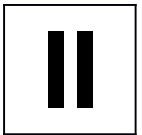
• P

In which direction will the N pole of the compass needle point?

- A** to the left
- B** to the right
- C** down the page
- D** up the page



[Science] Physics O Level Exam Paper
Preliminary Examination Set [II]
Secondary Four Express & Five Normal



CANDIDATE NAME:

CLASS:

INDEX NUMBER:

Science(Physics)

Paper 2 Theory

5076/03

2024

5078/03

1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid/tape.

Section A

Answer **all** questions.

Section B

Answer **all** questions. Question 11 has a choice of parts to answer.

Candidates are reminded that **all** quantitative answers should include appropriate units.
The use of an approved scientific calculator is expected, where appropriate.
Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [] at the end of each question or part question.

Section A	
Section B	
Total	

Section A [55 marks]

Answer **all** questions in this section.

Write your answers in the spaces provided.

- 1** A student records the mass and volume of two irregular objects, one made of iron and the other of copper. The student uses the apparatus shown in Fig. 1.1.

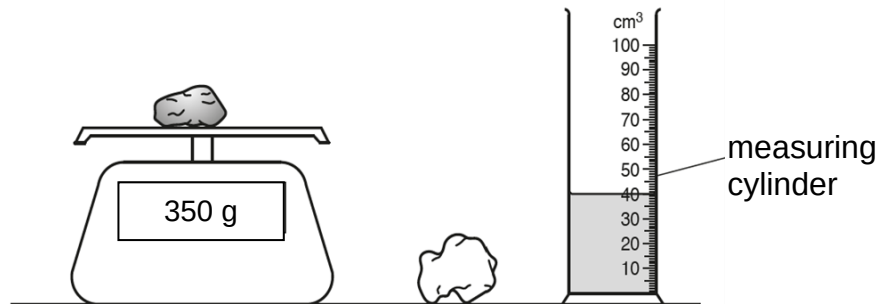


Fig. 1.1

Fig. 1.2 shows the results obtained.

	mass / g	volume / cm ³
iron	400	51
copper	350	39

Fig. 1.2

- (a)** Describe how the volume of an irregular object can be determined using the measuring cylinder.

.....

.....

.....

.....[2]

- (b)** Calculate the density of iron.

density =g/cm³ [2]

- (c)** A third object, which is also made of copper, has the same volume as the iron object.

Calculate the mass of this copper object.

mass =g [2]

- (d)** State and explain what happens to the density of the iron object when it is heated.

.....

.....

.....[2]

- 2 Fig. 2.1 shows the speed-time graphs of two falling balls. One of them is a rubber ball and the other is a plastic ball with a small parachute attached to it.

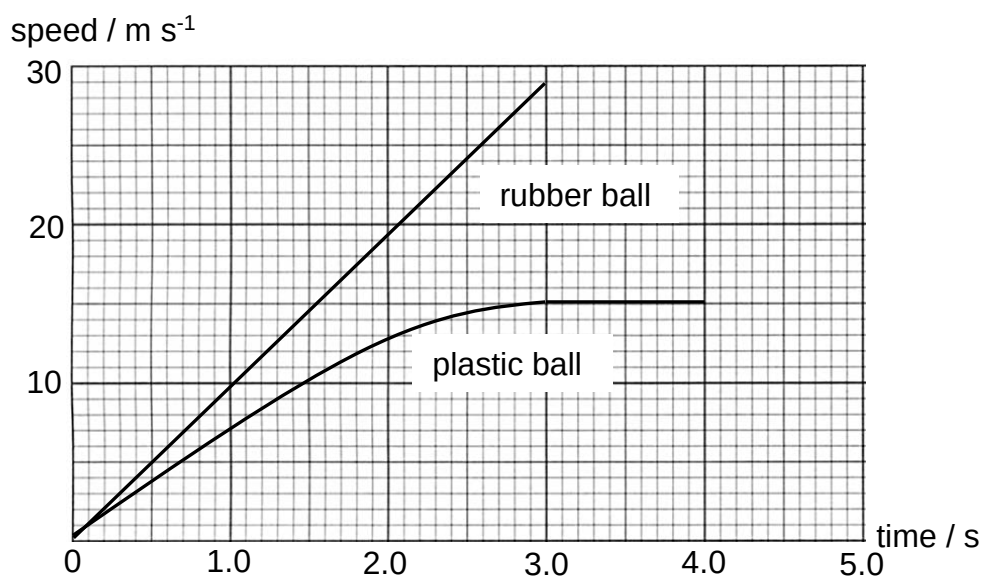


Fig. 2.1

- (a) Calculate the acceleration of the falling rubber ball during the first 3.0 s.

acceleration =m/s² [2]

- (b) Calculate the distance travelled by the rubber ball during the first 3.0 s.

distance = m [2]

- (c) Explain in terms of forces acting on the plastic ball why the plastic ball eventually reaches constant speed.

.....

.....

.....[2]

- 3 Fig. 3.1 shows a model of the human arm. The rubber band represents the muscle that moves part of the arm XY up.

A mass is suspended from XY as shown in Fig. 3.2. The weight of section XY is negligible and the model is at rest.

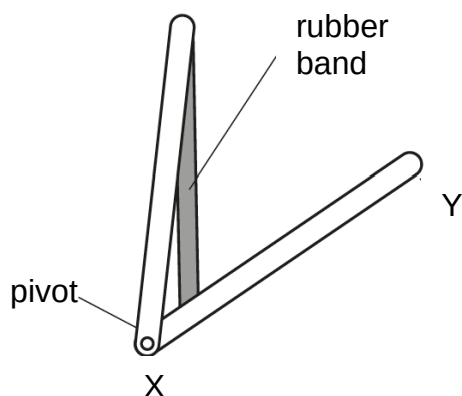


Fig. 3.1

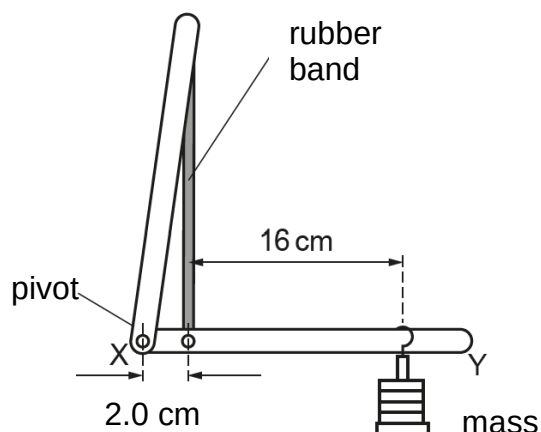


Fig. 3.2

- (a) Explain why the force that the rubber band exerts on section XY is larger than the weight of the mass.

.....

[1]

- (b) The mass suspended from section XY in Fig. 3.2 has a weight of 4.0 N.
 Calculate the force that the rubber band exerts on section XY.

force = N [2]

- (c) Explain how your answer will be different from part (b) if the weight of section XY is not negligible.

.....

[2]

- 4 Fig. 4.1 shows the bottom section of an old bicycle tyre. The tyre exerts pressure on the ground.

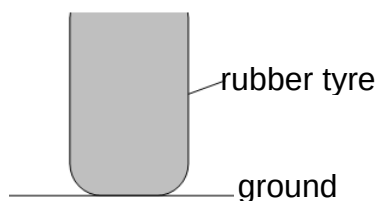


Fig. 4.1

The total mass of the rider and bicycle is 60 kg. The total area of the tyres in contact with the ground is $2.4 \times 10^{-3} \text{ m}^2$. The gravitational field strength on Earth is 10 N/kg.

- (a) Calculate the pressure exerted on the ground.

pressure =Pa [3]

- (b) One of the rubber tyres goes over a small stone as shown in Fig. 4.2.

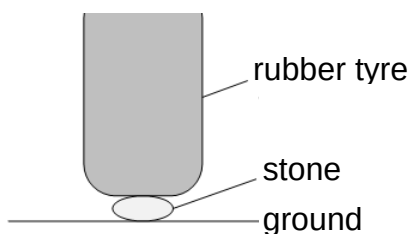


Fig. 4.2

State and explain how the pressure exerted on the ground changes.

.....

[2]

5 Fig. 5.1 shows a rider on an electric scooter.



Fig. 5.1

The scooter contains a battery and a motor to drive the back wheel. The battery is marked 'energy capacity 0.35 kWh.'

- (a) (i) Describe the main energy changes from the energy store in the battery to the energy store of the scooter.

.....
.....[1]

- (ii) The total mass of the scooter and the rider is 70 kg.

Calculate the total kinetic energy of the rider and scooter when the scooter has a speed of 4.0 m/s.

kinetic energy = J [2]

- (b)** **(i)** The scooter stops working because the battery is totally flat. This means that there is no more energy stored in the battery. The battery is then recharged using a 70 W power supply.

Calculate the time taken to fully recharge the battery.

time =h [2]

- (ii)** Singapore Power charges 29 cents for each kWh.

Calculate the cost of using the scooter till the battery is totally flat.

cost = cents [1]

- 6 Fig. 6.1 shows three wires, 1, 2 and 3, from an electric kettle as well as a 3-pin plug with terminals P, Q and R.

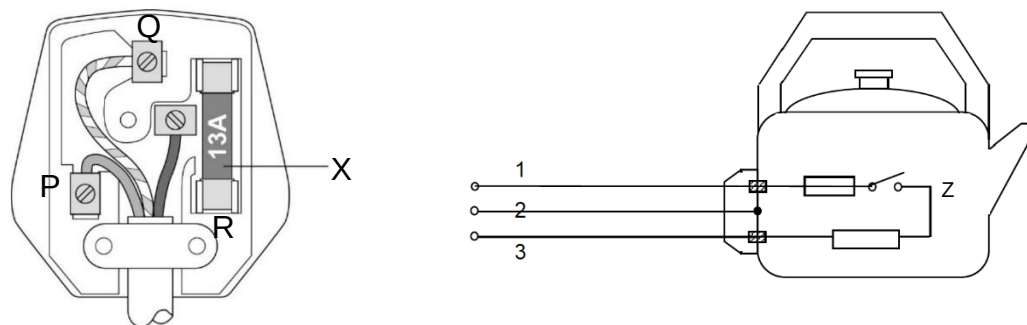


Fig. 6.1

- (a) Wire 1 is connected to terminal R.

Fill in the blanks using the letters P, Q or R to show which wire is connected to which terminal.

Wire 2 is connected to terminal and Wire 3 is connected to terminal [1]

- (b) State the name of component X in the three-pin plug and describe its function as a safety device.

.....

[3]

- 7 Fig. 7.1 shows an ultrasound scan taking place. It is a technique used in the medical field to obtain information about the internal structure of the human body without the need for surgery.

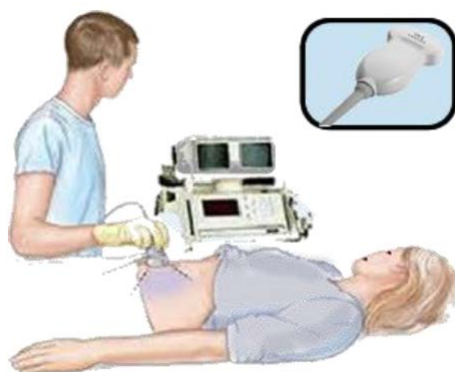


Fig. 7.1

Ultrasound of 3.0 MHz is beamed into the body from a transmitter placed on the surface of the body. Ultrasound is reflected at the boundaries between different tissues of the body. The time taken for the reflected ultrasound to return to the transmitter is measured.

- (a)** The average speed of ultrasound in the body is 1500 m/s.

Calculate the wavelength of the ultrasound travelling in the body.

wavelength = m [2]

- (b)** When a short pulse of the ultrasound is beamed into the body, a reflected pulse is received by the transmitter 2.5×10^{-4} s later.

Calculate the distance from the surface of the body to the layer that produced the reflection.

distance = cm [2]

- 8 Fig. 8.1 shows an electrical circuit containing a 12 V power supply and a number of resistors.

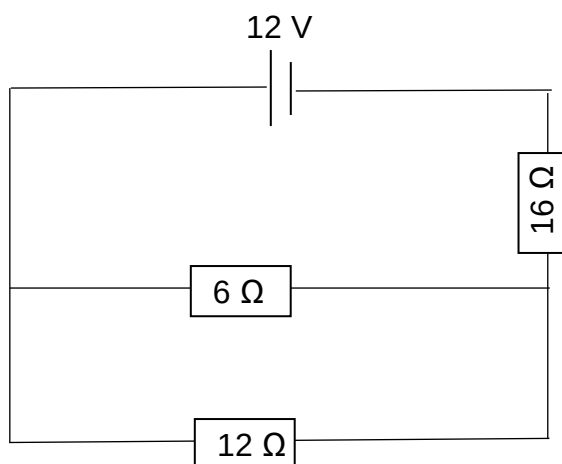


Fig. 8.1

- (a)** Calculate the effective resistance of the circuit.

resistance = Ω [2]

- (b)** Calculate the current in the $16\ \Omega$ resistor.

current = A [1]

- (c)** Calculate the potential difference across the $16\ \Omega$ resistor.

potential difference = V [1]

- (d)** Calculate the potential difference across the $12\ \Omega$ resistor.

potential difference = V [1]

- (e)** Calculate the current in the $6\ \Omega$ resistor.

current = A [2]

- 9 A model of a circuit breaker made by a student consisting of a solenoid with an unmagnetised iron core is shown in Fig. 9.1.

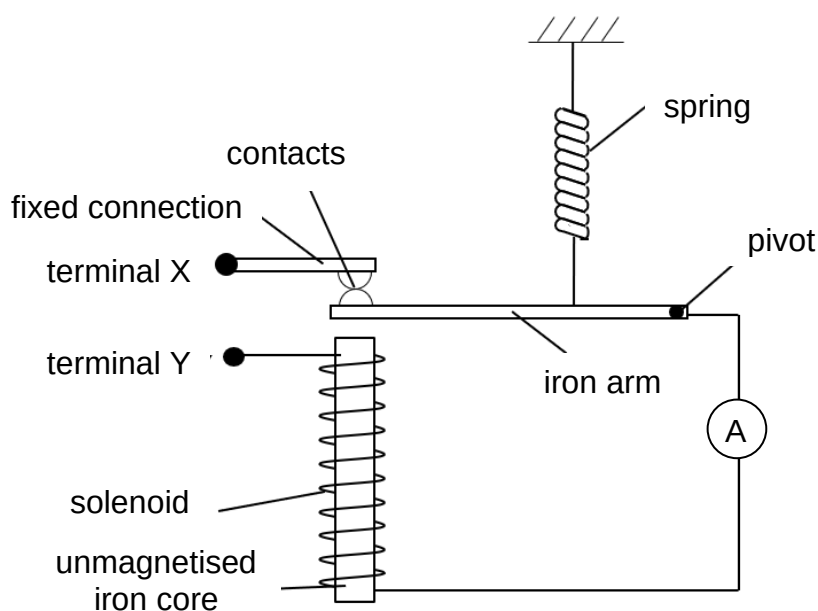


Fig. 9.1

- (a) It is observed that currents up to 0.60 A has no effect on the circuit, but when the circuit exceeds 0.60 A, the contacts open.

Explain why.

.....
.....
.....[2]

- (b) When the ammeter reading is more than 0.60 A, it is observed that the iron arm moves up and down causing the contacts to open and close repeatedly.

Explain why.

.....
.....
.....
.....[2]

- (c) (i) State one modification which can be made to allow the circuit breaker to break the contacts at a higher current of 0.80 A instead of 0.60 A.

.....

.....[1]

- (ii) Explain your answer.

.....

.....[1]

- (d) Fig. 9.2 shows an apparatus used to demonstrate the motor effect. P is a short length of copper rod resting on two other bare copper wires.

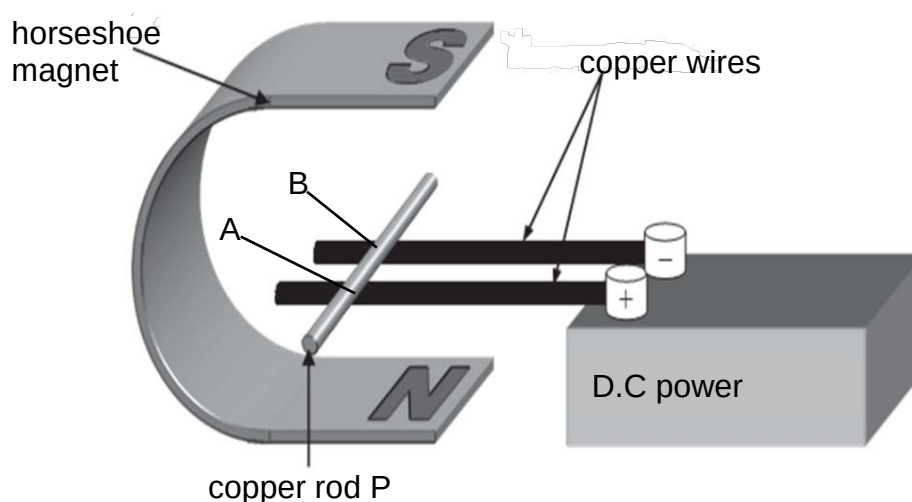


Fig. 9.2

- (i) Tick the correct answer to show the direction of the conventional current flows through copper rod P.

Conventional current flows from

☐ A to B

☐ B to A.

[1]

- (ii) On Fig. 9.2, draw an arrow to show the direction copper rod P would roll when the D.C. power supply is switched on.

[1]

- (iii) Explain why the copper rod P moves.

.....

.....

.....[2]

Section B [10 marks]

Answer **one** question in this section.

- 10** Hot drink vending machines are manufactured by a company. The company wants to determine the type of cups dispensed by the machines that will keep the drinks hot for a longer period of time.

The company conducts experiments to find out:

- which type of material is best for making the cup
- the effect of adding a lid on the cup

Fig. 10.1 shows the temperature drop over twelve minutes for different cups filled with 200 g of hot tea.

	cup made from paper pulp		cup made from polystyrene	
	without lid	with lid	without lid	with lid
time / min	temperature /°C	temperature /°C	temperature /°C	temperature /°C
0	100	100	100	100
2	85	85	88	88
4	75	76	79	80
6	66	67	71	73
8	54	56	64	66
10	50	53	59	63
12	48	51	57	61

Fig. 10.1

- (a)** State why all the tests must start at the same temperature.

.....[1]

- (b)** By considering the experimental data in Fig. 10.1, state and explain whether changing the type of material used or adding a lid is more effective to keep drinks hot for a longer period of time.

.....

.....

.....[2]

- (c)** Explain how the lid keeps the tea hot for a longer period of time.

.....

.....

.....[2]

- (d)** Suggest a reason to explain why the temperature drop for the polystyrene cup is less than the temperature drop of the paper pulp cup over 12 minutes.

.....

.....

.....[2]

- (e) (i)** Which colour, black or white should the polystyrene cup be painted in order to keep the tea hot for a longer period of time?

.....[1]

- (ii)** Explain your answer in part **(i)**.

.....

.....[2]

- 11 (a) Fig. 11.1 describes four nuclides.

name of nuclide	plutonium-238	thorium-234	uranium-235	uranium-238
nuclide notation	$^{238}_{94}\text{Pu}$	$^{234}_{90}\text{Th}$	$^{235}_{92}\text{U}$	$^{238}_{92}\text{U}$

Fig. 11.1

- (i) State which **two** nuclides have the same number of protons.
[1]
- (ii) State which **two** nuclides have the same number of nucleons.
[1]
- (iii) State which **one** of the four nuclides has the most electrons orbiting when it is in a neutral atom.
[1]

- (b) Thorium-234 has a half-life of 24 days. A sample of radioactive material contains 40 mg of thorium-234.

Calculate the mass of thorium-234 remaining after 72 days.

mass of thorium-234 remaining = mg [2]

- (c) Fig. 11.2 shows details of seven different nuclides.

nuclide	radiation emitted	half-life
hydrogen - 3	beta	12 years
iridium - 192	gamma	74 days
phosphorus - 32	beta	14 days
radon - 222	alpha	4 days
technetium - 99	gamma	6 hours

Fig. 11.2

One of the sources in Fig. 11.2 is used in a medical procedure to detect unusual bone structures. It is injected into a patient and the radiation emitted is detected outside the body.

- (i) State which source in Fig. 11.2 is most suitable for this type of medical use.

.....[1]

- (ii) State **two** reasons for your choice in part (c)(i).

.....

.....

.....[2]

- (d) Radon gas is one natural source of background radiation. Some causes of background radiation are man-made, for example, X-rays.

- (i) State **one** other **natural** source of background radiation.

.....[1]

- (ii) State **one** harmful effect of background radiation.

.....[1]

End of Paper