YUYING SECONDARY SCHOOL
PRELIMINARY EXAMINATION
Secondary 4 Exp/ 5 N(A)/ 4 N(A) 'O'

NAME

CLASS **REG. NO**

SCIENCE (PHYSICS)

5076,5077/1

31 August 2021
30 minutes
Setter: Mdm Tan Soon Lee

Candidates answer on the Multiple Choice Answer Sheet.
Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST
Write your name, class and register number on this question booklet and the separate Answer Sheet.

There are **twenty** questions in this section. 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.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

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 calculator is expected, where appropriate.

For Examiner's Use	
Total	/20

This document consists of **8** printed pages.

Answer **all** the questions in this section on the separate Answer Sheet.

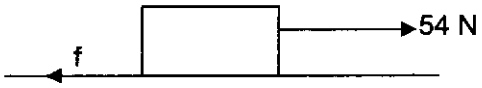
1 A voltage of 2 millivolts is applied across a resistor causing a current of 4 microampere. Which row gives the voltage in volts and the current in ampere?

	voltage / V	current / A
A	0.000002	0.000004
B	0.000002	0.004
C	0.002	0.000004
D	0.002	0.004

2 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 2 km
B 3 km
C 4 km
D 6 km

3 A block of mass 6 kg is pulled across a rough surface by a 54 N force, against frictional force f. The acceleration of the block is 6 m/s^2.
What is the value of f?

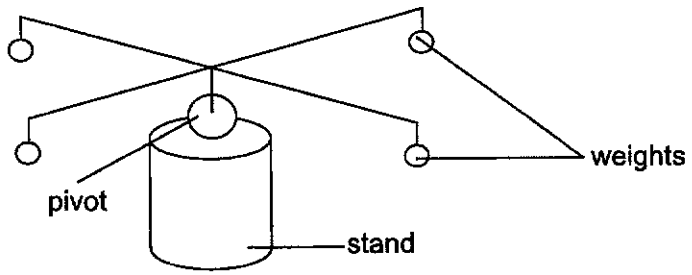


A 9 N
B 18 N
C 36 N
D 54 N

4 In a laboratory on Earth, 2 different balances show that an object has a mass of 2 kg and a weight of 20 N. The same balances and object are then taken to the Moon, where the gravitational field strength is less than on the Earth. Will the mass and weight of the object be the same, or less, than before?

	mass	weight
A	less	less
B	less	same
C	same	less
D	same	same

5 The diagram shows a balancing toy pivoted on a stand. If the toy is tilted slightly, it does not topple, but returns to its original position.



This is because the centre of gravity of the toy is _____.

A between the weight
B exactly at the pivot
C vertically above the pivot
D vertically below the pivot

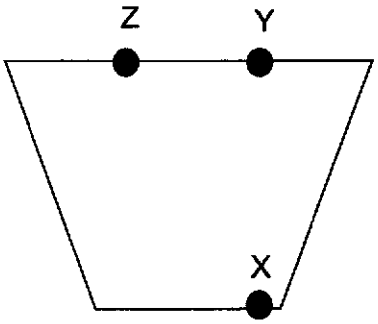
6 A craftsman is preparing a granite worktop for a kitchen. The worktop has dimensions of 2.0 m x 0.8 m x 0.03 m and has a weight of 1300 N. The craftsman rests the worktop on the ground.
What is the maximum pressure that the worktop exerts on the ground?

A 0.81 kPa
B 22 kPa
C 27 kPa
D 54 kPa

7 An electric motor can lift a weight of 2000 N through a height of 10 m in 20 s.
What is the power of the motor?

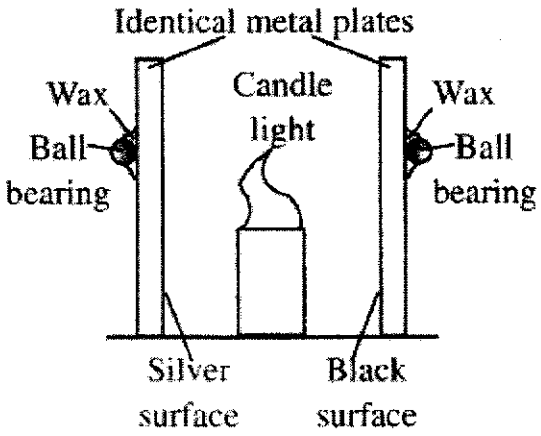
A 10 W
B 1000 W
C 4000 W
D 400 000 W

8 A teacher has a large tank of water in which he wants to set up a convection current. Which of the following actions can set up a convection current?



A cooling at X
B cooling at Y
C heating at Y
D heating at Z

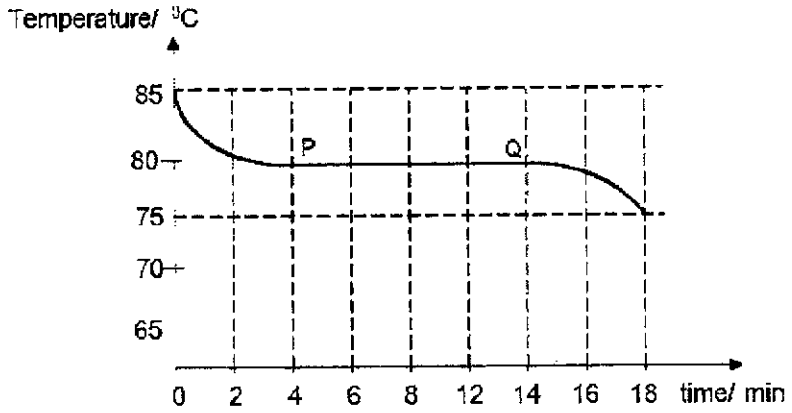
9 Two ball bearings are attached to the outer sides of two metals by wax as shown below. A candle light is placed mid-way between the two identical metal plates. The ball bearing on the right fell first.



Which of the following conclusions is correct?

A Black surface is a better absorber of infra-red radiation than silver surface.
B Black surface is a better emitter of infra-red radiation than silver surface.
C Black surface is a better conductor of infra-red radiation than silver surface.
D Black surface helps the convection of thermal energy.

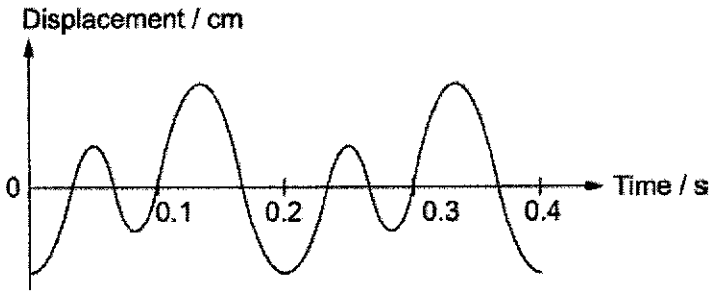
10 Some hot liquid is poured into a test-tube. The graph below shows the temperature of the contents of the test-tube changes with time.



Which row correctly describes the state(s) of matter, energy involved and process in section PQ?

	state(s) of matter	Energy is _____.	process
A	liquid	absorbed	melting
B	liquid and solid	absorbed	freezing
C	liquid and solid	released	freezing
D	solid	released	freezing

11 What is the frequency of the wave shown in the diagram below?

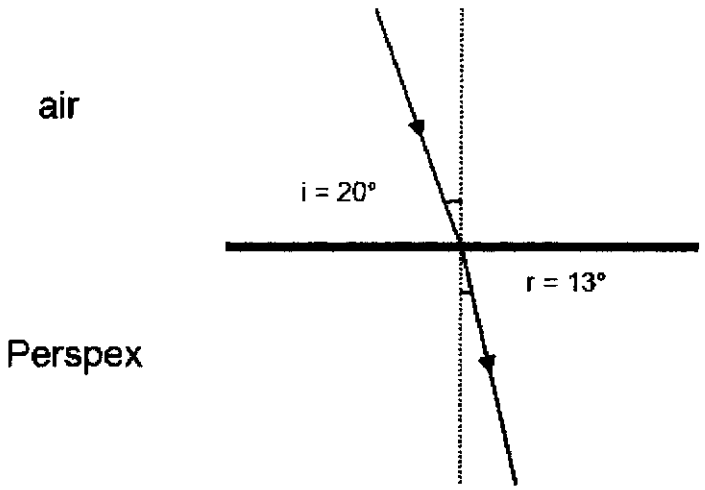


A 0.2 Hz
B 0.5 Hz
C 5 Hz
D 10 Hz

12 Which of the following gives three regions of the electromagnetic spectrum in order of increasing wavelength?

A ultraviolet, infra-red, microwaves
B visible light, gamma rays, radio waves
C gamma rays, microwaves, visible light
D radio waves, ultraviolet, X-rays

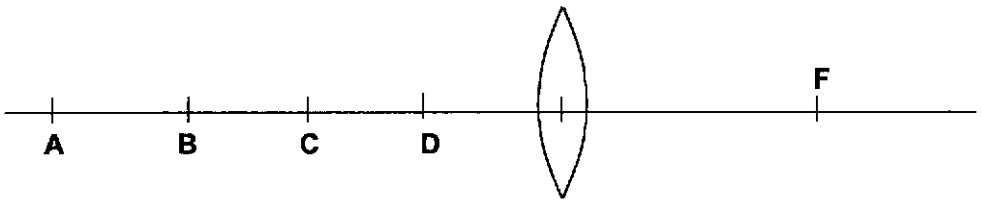
13 The diagram below shows a light ray moving from air entering into a Perspex block. Light travels at 3.0×10^8 m/s in air.



What is the speed of light in the Perspex block?

A 1.95×10^8 m/s
B 1.97×10^8 m/s
C 4.56×10^8 m/s
D 4.62×10^8 m/s

14 The diagram below shows four possible positions, **A**, **B**, **C** and **D** of an object in front of a converging lens with a principal focus at **F**.



In which of the positions, **A**, **B**, **C** or **D** would you place an object to use the lens as a magnifying glass?

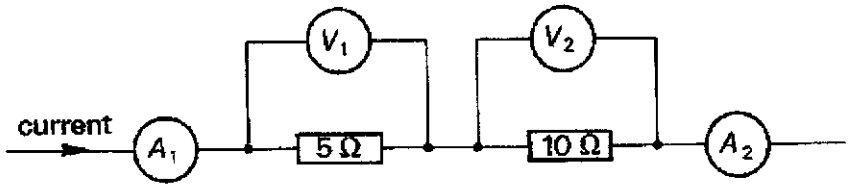
15 A sonic "tape measure' is used to measure the length of a room. It measures a time interval of 0.06 s between transmitting a sound pulse and receiving the echo. The speed of sound in air is 330 m/s.
How far is the reflecting wall from the tape measure?

A 5.5 m
B 9.9 m
C 11 m
D 20 m

16 A current of 300 mA is required to charge the battery of a handphone.
How much charge flows through the circuit during a charging time of 2 hours?

A 0.6 C
B 150 C
C 600 C
D 2160 C

17 Current flows in two resistors connected in series as shown in the diagram below. A_1 and A_2 are the readings on the ammeters. V_1 and V_2 are the readings on the voltmeters.



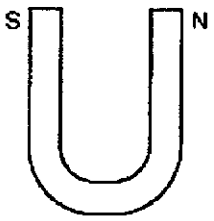
Which of the following correctly describes the ammeter and voltmeter readings?

	ammeter readings	voltmeter readings
A	A_1 is equal to A_2	V_1 is equal to V_2
B	A_1 is equal to A_2	V_1 is less than V_2
C	A_1 is greater than A_2	V_1 is equal to V_2
D	A_1 is less than A_2	V_1 is less than V_2

18 The energy absorbed by a solar panel is used to charge a battery. During the day, the battery stores 1.6 J of energy each second. At night, the battery is used to light a 1.2 W lamp for 18 000 s.
What is the minimum time for which the battery must be charged during the day?

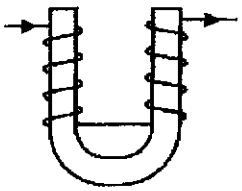
A 9375 s
B 13 500 s
C 24 000 s
D 34 560 s

19 It is desired to produce a magnet as shown below.

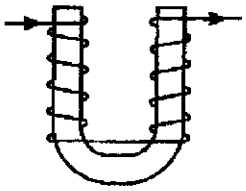


Which of the following windings would give the desired magnetic poles?

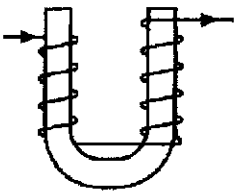
A



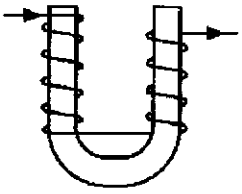
B



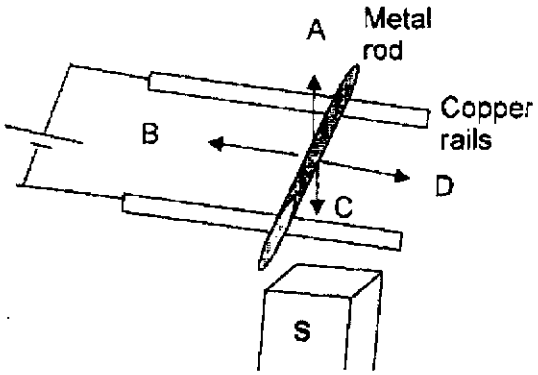
C



D



20 The diagram below shows a metal rod resting on two copper rails which are connected to a battery. The south pole of the magnet is placed beneath the rails.
In which direction will the metal rod move?



END OF PAPER

YUYING SECONDARY SCHOOL
PRELIMINARY EXAMINATION
Secondary 4 Exp/ 5 N(A)/ 4 N(A) 'O'

NAME _____

CLASS _____ **REG. NO** _____

SCIENCE (PHYSICS) 5076/2

25th Aug 2021
1 hour 15 minutes
Setter: Mr Desmond Ong

Candidates answer on the Question Paper.
Additional Materials: Nil

READ THESE INSTRUCTIONS FIRST
Write your name, class and register number on this question booklet and the separate Answer Sheet.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions in the spaces provided.

Section B
Answer any **two** questions.
Write your answers in the spaces provided on the Question Paper.

The number of marks is given in brackets [ ] at the end of each question or part question.
The use of an approved calculator is expected, where appropriate.

For Examiner's Use	
Total	/65

This document consists of **18** printed pages.

Section A

Answer **all** the questions in this paper.
The total mark for this section is 45.

1 A beaker can hold 200 cm^3 of liquid.
When it is filled with paraffin (density 0.90 g/cm^3), the total weight is 2.6 N.

(a) Calculate the mass of the filled beaker. [1]

mass = _____ kg

(b) Calculate the mass of paraffin in the beaker. State clearly the formula. [2]

mass = _____ kg

(c) The paraffin is poured into a 300 cm^3 flask and a cube of mass 20 g is brought to the centre of the paraffin and released, it remains at its location, and does not rise or fall as shown in Fig.1.1.

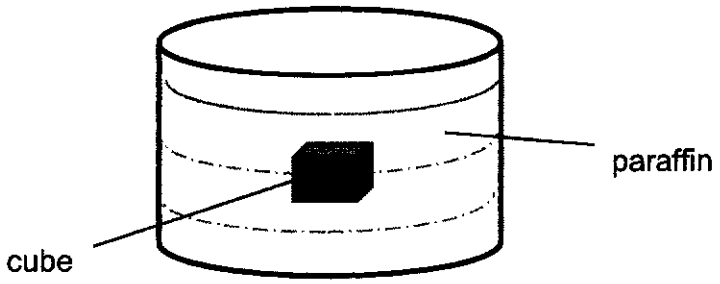


Fig 1.1

(i) Explain why the cube remains at the centre of the liquid. [1]

_____

_____

(ii) The cube is cut into 4 equal pieces and one piece is put back into the paraffin. State and explain the position of the smaller cube. [1]

2 Fig. 2.1 shows the speed-time graph of a car moving along a straight track for 30 seconds.

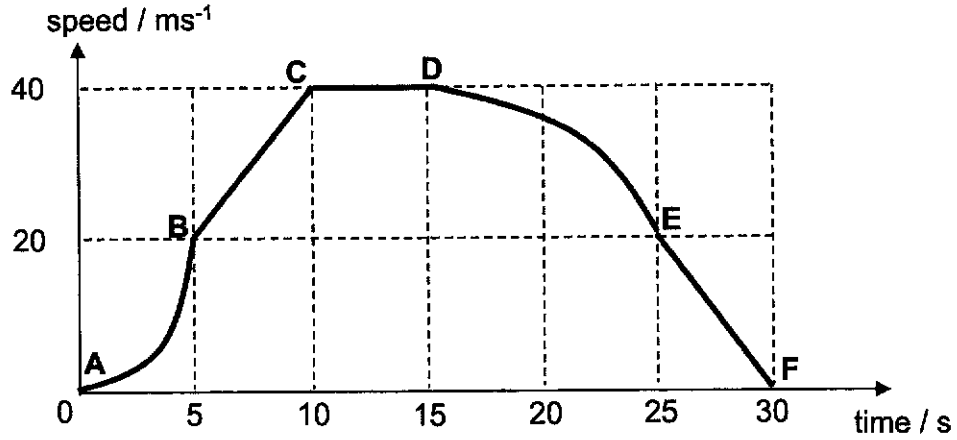


Fig 2.1

(a) Calculate the acceleration of the car between points **B** and **C**. [2]

acceleration : _____ m/s^2

(b) Describe the motion of the car between points **C** and **E**. [2]

3 (a) State what is meant by a *vector* quantity. [1]

_____

_____

(b) Fig. 3.1 shows a cart being towed by two ropes, which exert forces of 300 N and 200 N. The angle between the two ropes is 60°.

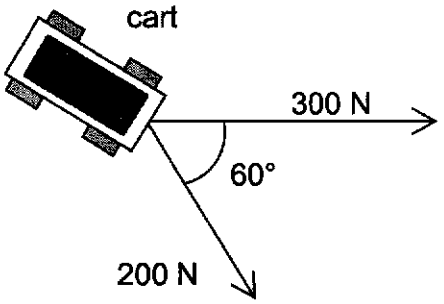


Fig 3.1

Draw a suitable scale diagram to determine the resultant force that the ropes exert on the cart. [4]

scale: _____

resultant force = _____ N

4 Fig. 4.1 shows a uniform plank AB, 2.5 m long, of mass 50 kg, resting on a knife's edge 0.50 m from B. A vertical spring balance represented by tension T supports the end such that AB is horizontal. The gravitational field strength is 10 N / kg.

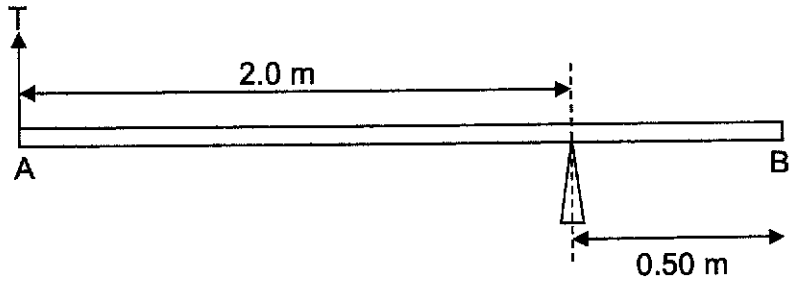


Fig 4.1

(a) On Fig. 4.1,

(i) mark the position of the centre of gravity of the plank with a cross (x) and label it as C.G. [1]

(ii) draw an arrow to represent the weight of the plank. Label it as W. [1]

(b) Calculate the weight of the plank. [1]

weight, W = _____ N

(c) Hence, find the tension T in the string. [2]

tension, T = _____ N

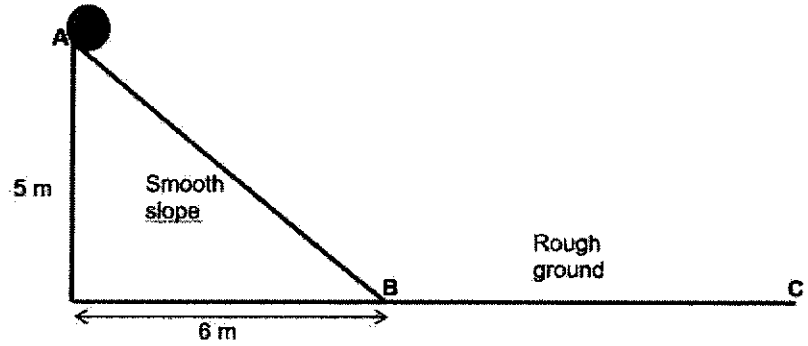
(d) Explain what happens to tension T when the pivot is shifted towards B. [1]

_____

_____

_____

5 A wooden barrel, of mass 15.0 kg, is released from rest at point **A**. It rolls down the smooth slope towards point **B** and then rolls across the horizontal rough ground from point **B** to point **C**. At point **C**, it comes to a complete stop.



(a) State the principle of conservation of energy. [2]

_____

_____

_____

(b) Taking the gravitational field strength to be 10 m / s^2 on earth, calculate the gravitational potential energy of the wooden barrel at **A**. [2]

gravitational potential energy = _____ J

(c) Calculate the speed of the wooden barrel at point **B**. [2]

speed of the ball = _____ m / s

(d) Given that the frictional force of the rough floor is 50 N. Calculate the distance **BC** travelled by the wooden barrel. [2]

distance travelled = _____ m

6 (a) Ice is placed into a glass of cola to cool it as shown in Fig 6.1.

Fig 6.1

Name and describe the process that causes all the cola in the cup to be cooled by the ice. [3]

(b) Fig. 6.2 shows a slab of ice-cream dipped in flour dough (which is a mixture of dough with bicarbonate of soda). This slab of ice-cream is then dipped into a pot of hot oil for a short while to make "fried ice-cream".

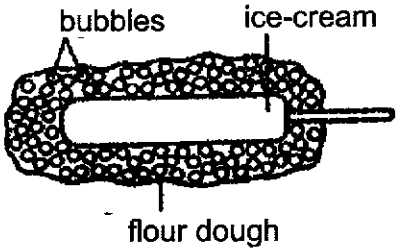


Fig 6.2

The "fried ice-cream" is cooked when the stick is dipped in the hot oil but the ice-cream in the middle does not melt. Explain why this is possible. [2]

7 Fig.7.1 shows components of the electromagnetic spectrum in order of increasing frequency.

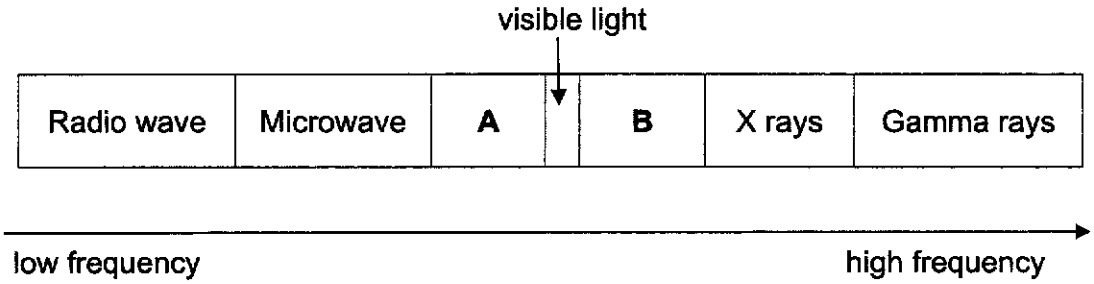


Fig 7.1

(a) State the component **A** and component **B**. [1]

_____

(b) State one property of the electromagnetic wave. [1]

_____

_____

(c) Given the wavelength of a radio wave is 500 m, calculate the frequency of this radio wave. The speed of radio wave is 3.0×10^8 m / s. [2]

frequency of radio wave = _____ Hz

8 John records the power rating of some electrical appliances and the length of time for which the appliances are switched on for one day, as given in Fig. 8.1.

appliance	power rating	time	energy used in kWh
air conditioner	2000 W	8.0 hours	
lights	0.10 kW	420 minutes	
water heater	3000 W	0.50 hours	

Fig 8.1

(a) Complete Fig. 8.1 by calculating the energy consumed by each appliance. [2]

(b) If one unit of electricity costs $0.20, calculate the cost of switching on all the appliances for one day. [1]

cost = $_____

(c) Explain why it is necessary to use a thicker wire to supply electricity to the water heater than those supplying current to the lights. [1]

_____

_____

(d) Fig. 8.2 below shows an electric circuit connected to a battery, a bulb and two resistors. A switch is connected to the 6 Ω resistor.

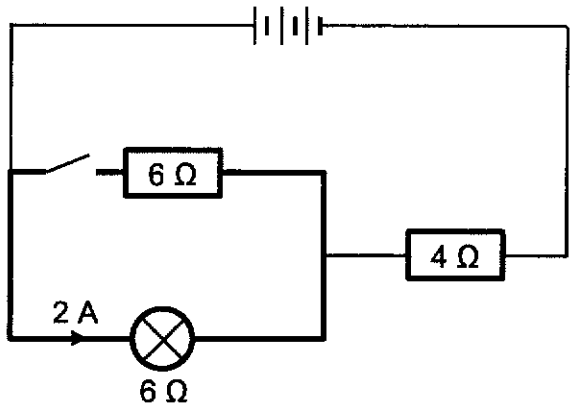


Fig 8.2

(i) When the switch is open, a current of 2 A flows through the bulb. Calculate the electromotive force of the battery. [2]

electromotive force = _____ V

(ii) When the switch is closed, calculate the effective resistance of the whole circuit. [2]

effective resistance = _____ Ω

Section B

Answer any **two** questions in this section in the spaces provided.
The total mark for this section is 20.

9 Fig. 9.1 shows a ray of light passing through the edge of a converging lens.

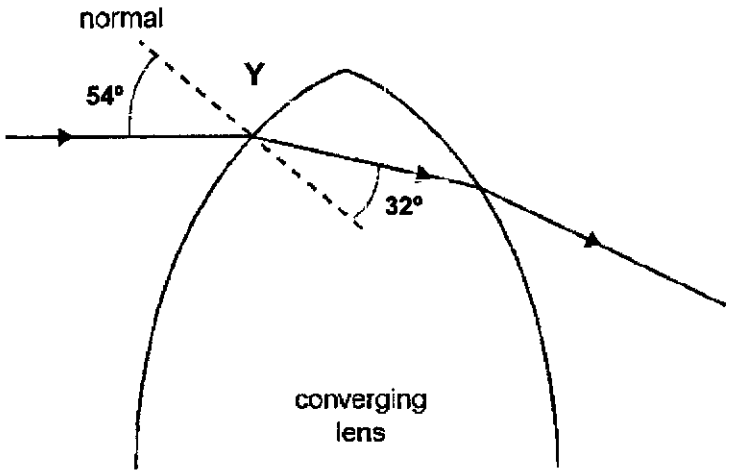


Fig 9.1

(a) Explain why the ray of light follows the path as shown in Fig. 9.1 when it enters the lens at point **Y**. [1]

_____

_____

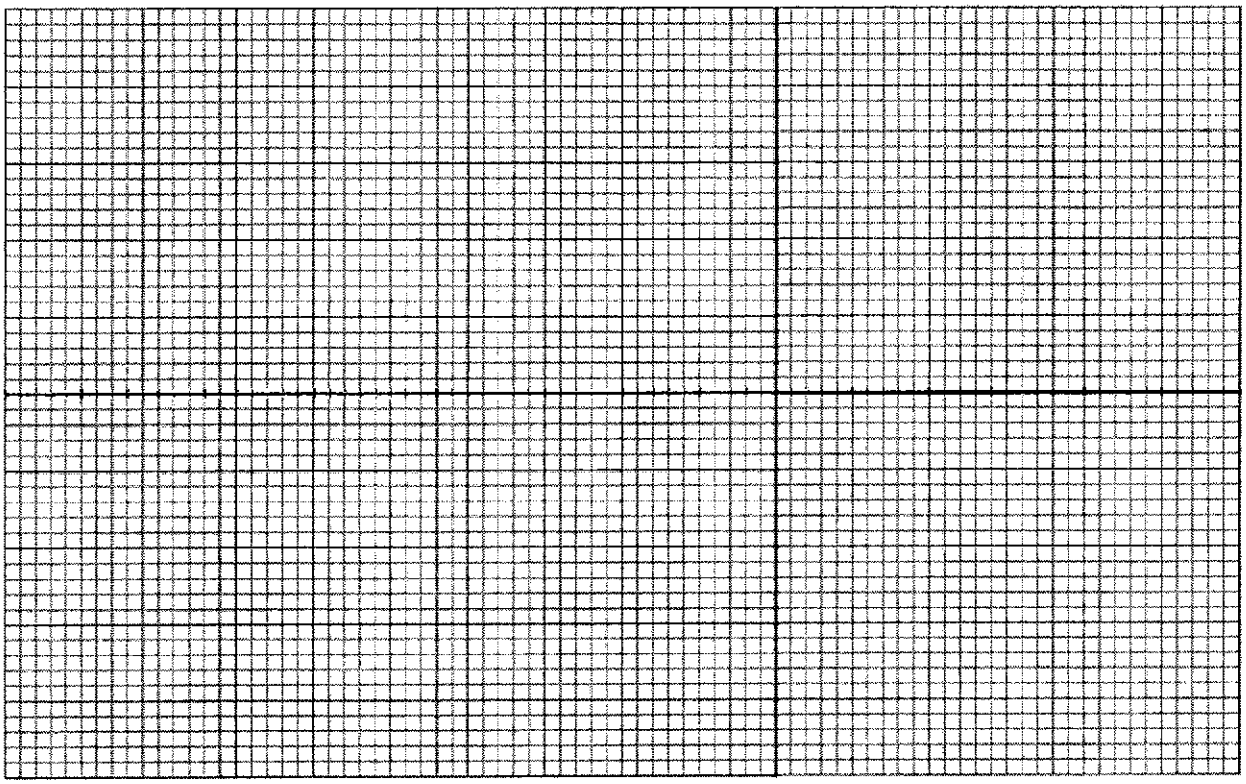
(b) Calculate the refractive index of the converging lens. [2]

refractive index = _____

(c) Calculate the critical angle of the converging lens. [2]

critical angle = _____°

(d) The focal length of the converging lens is 8 cm. An object of height 4 cm is placed at a distance of 4 cm away from the lens and an image is formed. Using a suitable scale, draw a ray diagram to locate the image. [4]



(e) State a suitable application for this lens arrangement. [1]

_____

10 (a) Sound from a flute travels through the air as a longitudinal wave.

Fig. 10.1 shows the variation of pressure in the wave produced by this flute with time.

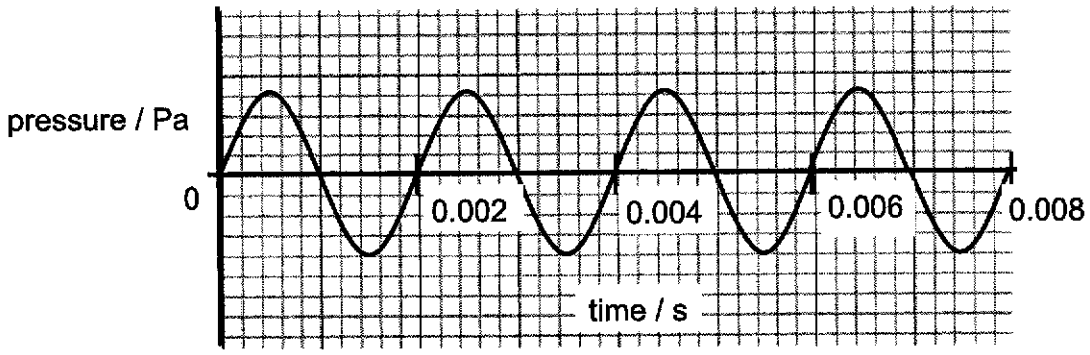


Fig. 10.1

(i) State what is meant by a *longitudinal wave*. [1]

_____

_____

(ii) Deduce the frequency of the sound wave produced. [2]

frequency = _____ Hz

(iii) If the wave travels with a speed of 330 m/s in air, calculate the wavelength of this wave. [2]

wavelength = _____ m

(b) A group of students on board a ship was charting out the depth of the sea. This was done by constantly sending pulses of high frequency ultrasound from the ship to the seabed, and detecting the echoes, as seen in Fig. 10.2. Readings were taken as the ship moves along to the left.

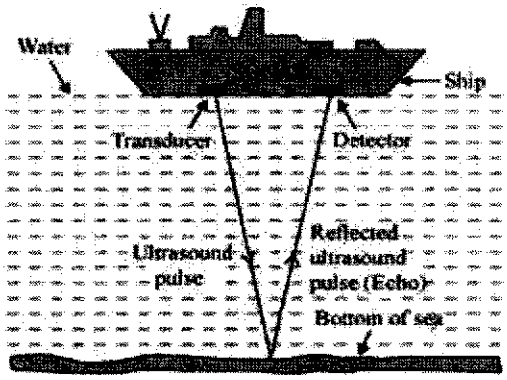


Fig 10.2

The speed of ultrasound in seawater is 1550 m/s. The time taken by the echo to be detected by the ship is 6.2 s after the sound was emitted.

(i) Calculate the depth between the ship and the seabed. [2]

depth = _____ m

(ii) The time taken for the echoes to reach the ship got longer as the ship travelled to the left.

What does this suggest about the depth of the sea as the ship travelled to the left? [1]

_____

_____

(iii) Assuming that the high frequency ultrasounds have sufficient energy to travel large distances, explain why this method cannot be used to measure the distance between the Earth and the Moon. [2]

11 (a) A magnet is placed on a bench, as shown in Fig. 11.1a. End P of a rod is held above each end of the magnet in turn, as shown in Fig. 11.1b and in Fig. 11.1c. One end of the magnet is lifted off the bench in both cases.

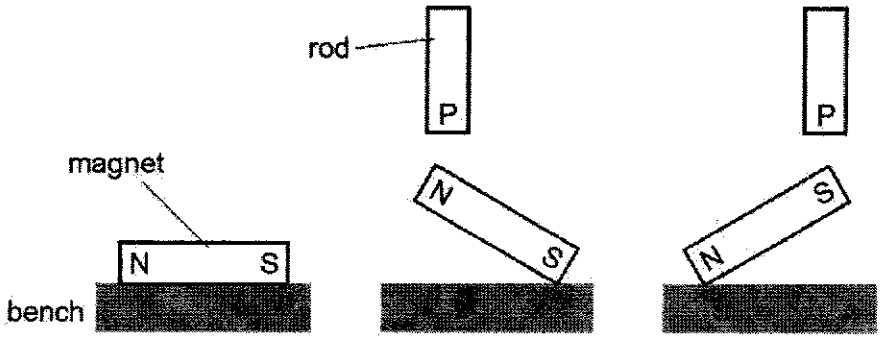


Fig 11.1a Fig 11.1b Fig 11.1c

(i) Suggest what material the rod is made from. [1]

(ii) Explain how the rod lifts each end of the magnet off the bench. [3]

(b) Fig. 11.2 shows the structure of a circuit-breaker that uses an electromagnet. The circuit-breaker operates when the current is 13 A.

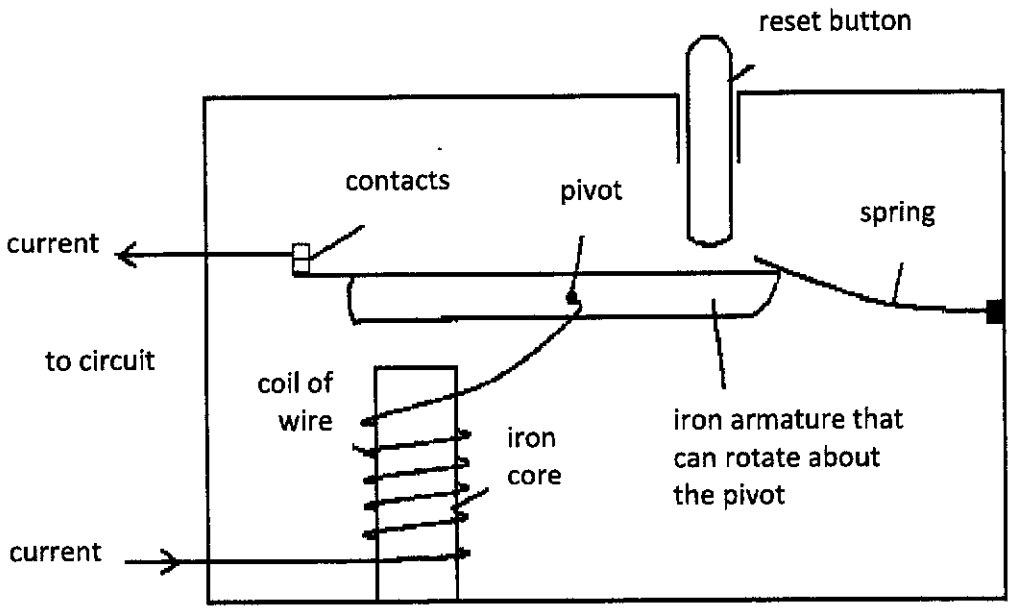


Fig 11.2

(i) On Fig. 11.2, mark with an arrow the force on the iron armature caused by the electromagnet. [1]

(ii) Suggest one reason why the iron bar does not move when the current is less than 13 A. [1]

_____

_____

(iii) When the current is greater than 13 A, the circuit-breaker stops the current.

Explain what happens in the circuit-breaker when this occurs.[3]

_____

_____

_____

_____

_____

_____

(iv) State how the electromagnet can be altered so that the circuit-breaker stops the current at less than 13 A. [1]

END OF PAPER

MARKING SCHEME (4 E / 5 NA SCI PHY) PRELIM EXAM P1 (2021)

(20 MARKS)

1	2	3	4	5
C	B	B	C	D
6	7	8	9	10
D	B	B	A	C
11	12	13	14	15
C	A	B	D	B
16	17	18	19	20
D	B	B	C	D

4e5n_sciphy_prelimP1/marking scheme/01

Paper 2 Answer:

1 a) W=mg

m = 2.6/10
= 0.26kg [A1]

b) m = D x V
= 0.9 x 200 [M1]
= 180 g
= 0.18 kg [A1]

c) i) It has the same density as paraffin. [1]
ii) It will stay where it is placed.[0.5] Density is the same [0.5]

2 a) a = (v – u)/ t
= (40 – 20)/ 5 [M1]
= 4m/s^2 [A1]

b) CD: the car moves with constant speed/ zero acceleration. [1]
DE: the car moves with increasing deceleration. [1]

3 a) It is a quantity that has both magnitude and direction. [1]

b) scale: 1 cm : 50N [1]
resultant force = 430N to 440N [1]

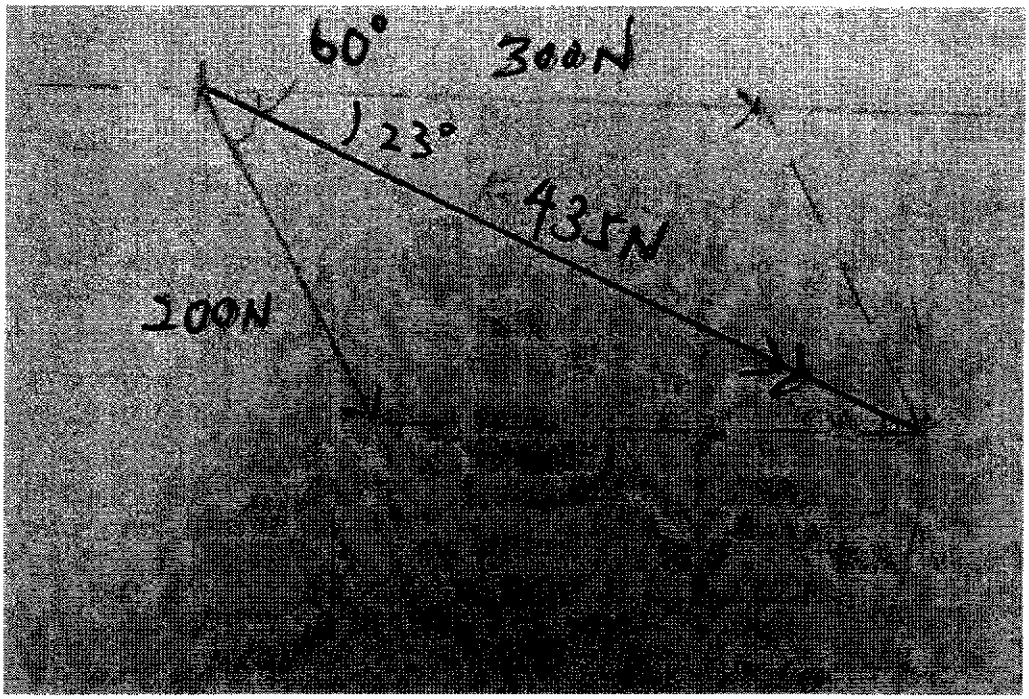
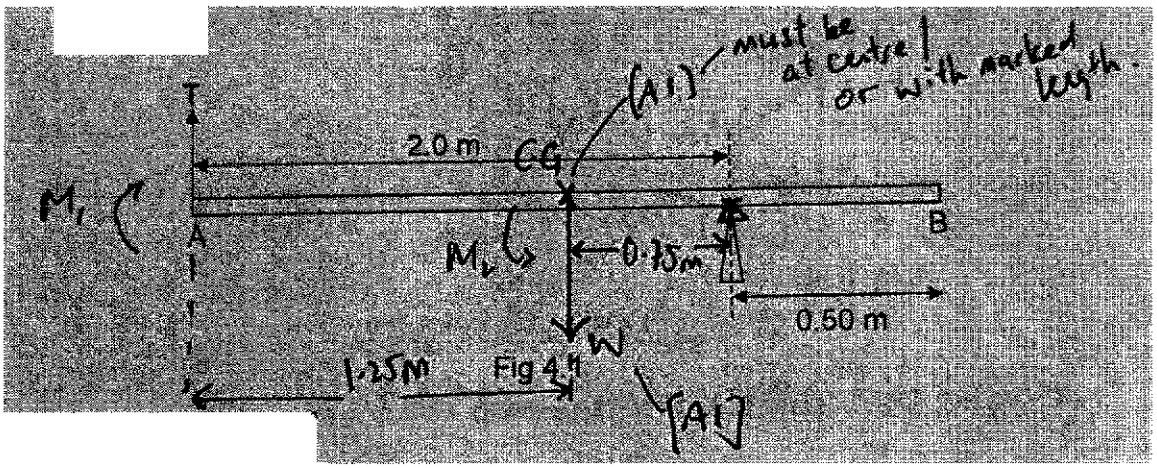


Diagram [2]
Minus 0.5 marks for missing arrows
Minus 0.5 marks for hard lines, dotted lines.

4 a) i) ii)



b) W = mg
= 50 x 10
= 500 N [A1]

c) In equilibrium,

Total clockwise moment = total anticlockwise moment

(T x 2) = (500 x 0.75) [M1]
T = 187.5 N [A1]

d) When pivot shift towards R. Tension T increases. [1]

5 a) Energy cannot be created or destroyed but it can change from one form to another. [1]
Total energy remains the same. [1]

b) GPE = mgh
= 15 x 10 x 5 [M1]
= 750 J [A1]

c) KE = GPE
$0.5 \times 15 \times v^2 = 750$ [M1]
v = 10 m/s [A1]

d) work done = F x d
750 = 50 x d [M1]
d = 15 m [A1]

6 a) Convection [1]. The cola at the top is cooled by the ice. Cooler denser[0.5] Cola sinks[0.5]. Warmer less dense[0.5] cola rises [0.5] to replace. Convection current is setup.

b) Air[1] bubbles are formed. Air is a bad conductor of heat.[1]

7. a) A – infra-red [0.5]
B – ultraviolet [0.5]

b) 1. Transverse wave
2. speed = 3×10^8 m/s
3. Can travel in vacuum [Any 2]

c) f = v / λ
$= 3 \times 10^8 / 500$ [M1]
= 600000Hz [A1]

8 a)

appliance	power rating	time	energy used in kWh
air conditioner	2000 W	8.0 hours	**16**
lights	0.10 kW	420 minutes	**0.7**
water heater	3000 W	0.50 hours	**1.5**

[any mistake -1]

b) E = 16 + 0.7 + 1.5
= 18.2 kWh

Cost = 18.2 x 0.20
= $3.64 [A1]

c) Higher power rating will have higher current.[0.5]
Higher current with thin wire may cause electric fire. [0.5]

d) i) emf = [2 x 6] + [2 x 4] [M1]
= 12 +8
= 20 V [A1]

ii) 1 / R = 1/6 +1/6
R = 3Ω [M1]

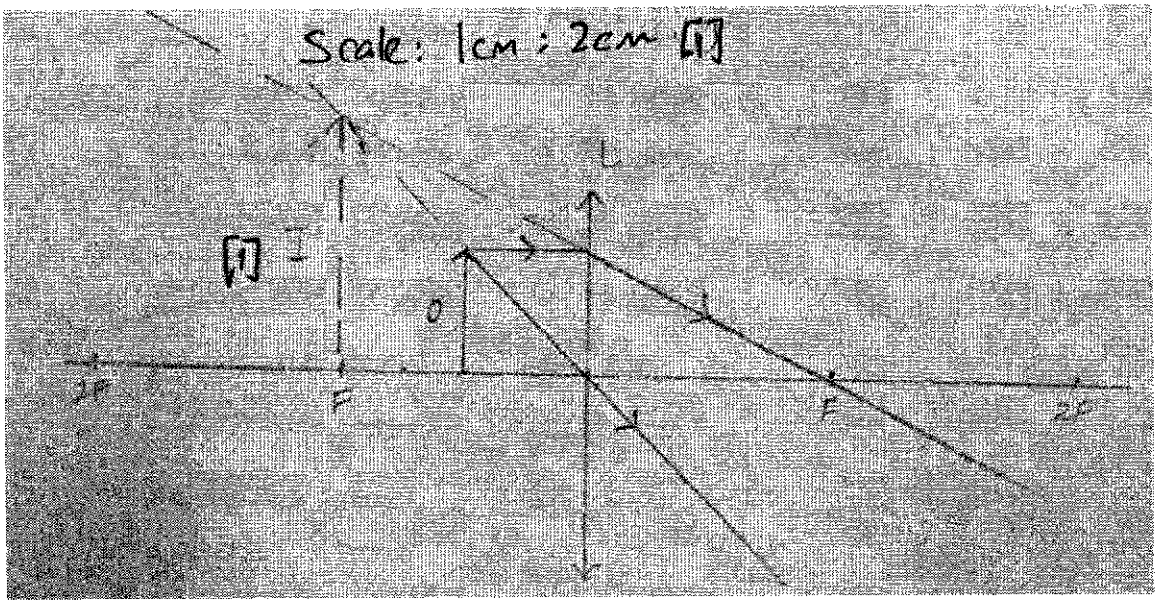
RT = 3 +4 = 7Ω [A1]

9 a) When light travels to a optically denser medium, speed of light slows[0.5] and it bends towards the normal. [0.5]

b) refractive index = sin 54° / sin 32° [M1]
= 1.53 [A1]

c) η = 1 / sin c [M1]
c = 40.9° [A1]

d)



scale [1]
Image [1]
Minus 0.5 marks for missing arrow
Minus 0.5 marks for hard lines, dotted lines.

e) Magnifying glass

10 a) i) Wave in which the direction of vibration of the medium is parallel to the direction of the wave motion. [1]

ii) T = 0.002 s

f = 1 / T [M1]
= 1/0.002 = 500 Hz [A1]

iii) V = f λ
λ = 330/ 500 [M1]
= 0.66 m [A1]

b) i) s = 2d / t
1550 = 2 d / 6.2 [M1]
d = 4805 m [A1]

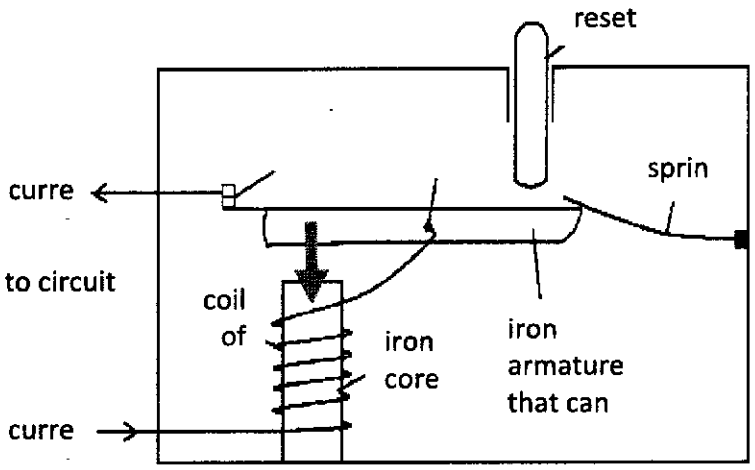
ii) The depth is deeper to the left. [1]

iii) It needs to travel from earth to moon in vacuum. [1]
It requires a medium to transmit. [1]

11 a) i) Iron, nickel, steel, cobalt [Any 1]

ii) The rod is a magnetic material and becomes an induced magnet.[1]
The end of the rod nearer to the permanent magnet has an opposite pole. [1]
Attraction occurs as unlike poles attracts. [1]

b) i)



ii) The magnetic force of the electromagnet is not big enough to attract the iron armature. [1]

iii) When the current is greater than 13A, the electromagnetic force is strong enough to attract the iron armature. [1]
The armature turns anticlockwise and the spring goes below the Armature and the contact is broken.
The current stops flowing due to the incomplete circuit. [1]

iv) 1. Increase the number of turns.
2. reduce the distance between the coil and the iron armature.
3. Use a longer armature.
[Any one]