Name	Class	Index Number

UNITY SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2019

SECONDARY FOUR EXPRESS

SECONDARY FIVE NORMAL ACADEMIC

SCIENCE (PHYSICS) 5076/01 **30 AUGUST 2019**

PAPER 1 **1 HOUR**

Additional Materials : Optical Answer Sheet

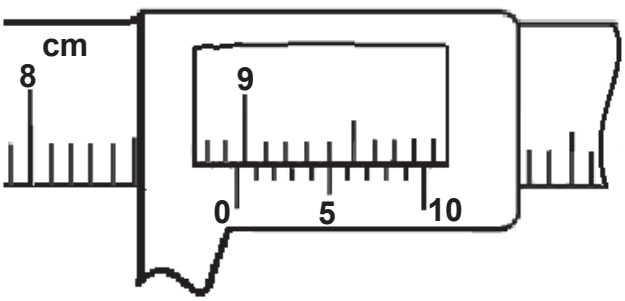
READ THESE INSTRUCTIONS FIRST

1. This paper consists of **20** Multiple Choice Questions.
2. Answer all questions on the Optical Answer Sheet (**OAS**).
3. Write your name, class and shade your register number in the spaces on the **OAS**
4. Do not fold nor use any correction fluid on the **OAS**. Read the instructions on the **OAS** carefully.
5. The total mark for this paper is 20 marks.

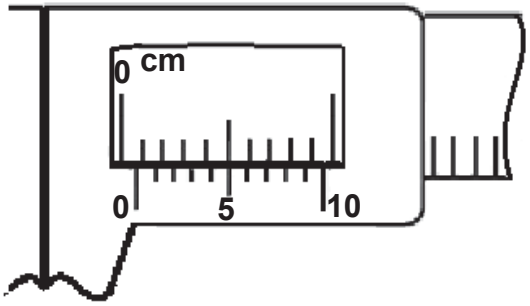
This paper consists of **8** printed pages, including this cover page.

Answer **ALL** the questions in this paper.

1 A student used a pair of vernier calipers to measure the external diameter of a cylindrical glass beaker. The diagrams show the observed reading of the external diameter of the glass beaker and the zero error that is obtained when the jaws are closed.



observed reading



zero error

What is the corrected diameter of the glass beaker?

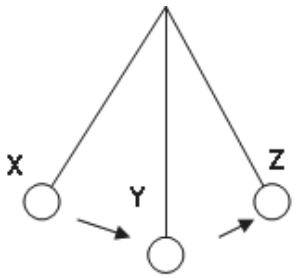
A 8.90 cm

B 8.95 cm

C 9.40 cm

D 9.45 cm

2 A pendulum oscillates between positions **X** and **Z** as shown in the figure below. It takes 0.4 s to go from positions **Y** to **Z** to **Y**.



What is the time taken for 20 oscillations of the pendulum swing?

A 8 s

B 16 s

C 24 s

D 32 s

3 A student constantly jumps up and down on a trampoline during his physical education lesson.

Which of the following statement about the motion of the student is **TRUE**?

A The student has a constant speed throughout his jump.

B The student has a decreasing speed throughout his jump.

C The student has a constant deceleration at the highest height of his jump.

D The student has a decreasing acceleration at the highest height of his jump.

4 Which of the following shows the **CORRECT** free body diagram of an aeroplane cruising forward with a constant speed of 250 m/s?

A

B

C

D

5 The density of an iron block of volume 0.002 m^3 is found to be 7500 kg/m^3. An astronaut transported only 0.01 m^3 of this iron block to the Moon. The gravitational field strength of Moon is given as 1.7 N/kg.

What is the weight of the 0.01 m^3 iron block on the Moon?

A 75 N

B 128 N

C 150 N

D 255 N

6 A SMRT train slows down when it is approaching a train station. A standing man who is not holding to any railings, is observed to fall forward.

Which of the following is **TRUE** for the man to fall forward?

A The inertia of the man tends to resist motion.

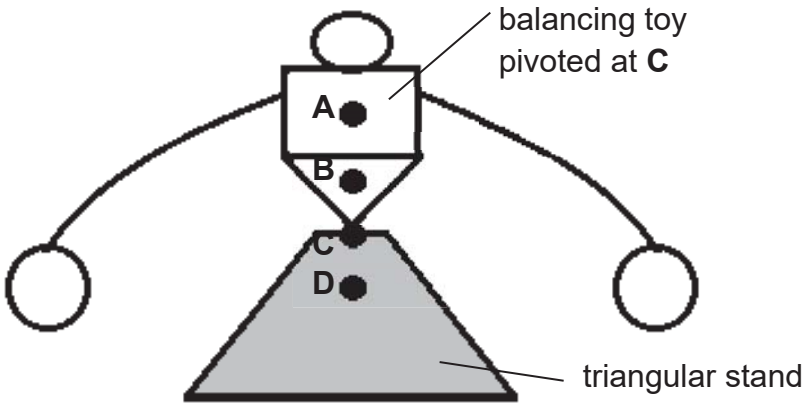
B The standing man's centre of gravity is too high.

C The man is being thrown forward by the slowing SMRT train.

D The friction between the standing man's shoes and the floor is too large.

7 The diagram shows a balancing toy that is pivoted on a triangular stand at **C**. When the toy is tilted slightly, it swings back to its original position.

Where is the centre of gravity of the balancing toy?



8 A man lifts a 15 kg box from the floor to a height of 0.8 m. He then walks forward for 3 m. The gravitational field strength *g* is given as 10 N/kg.

What is the work done by the man on the box?

A 12 J

B 57 J

C 120 J

D 570 J

9 A 45 kg student runs up a flight of stairs to a height of 2 m in 10 s. The gravitational field strength *g* is given as 10 N/kg.

What is the power exerted by the student to run up the flight of stairs.

A 9 W

B 90 W

C 900 W

D 9000 W

10 A piece of ice is heated to water and then to steam.

Which of the following statements is **TRUE**?

A The molecules expand as ice changes to steam.

B The molecules move closer to one another as ice changes to steam.

C The molecules move slower as ice changes to steam.

D The intermolecular force of attraction decreases as ice changes to steam.

11 The rate of energy transfer by heat radiation is affected by the colour and texture of the surface of an object.

Which of the following surfaces is the best absorber and the best emitter of heat radiation?

	Best absorber	**Best emitter**
A	dull black	dull black
B	dull black	shiny white
C	shiny white	dull black
D	shiny white	shiny white

12 Which of the following statements is **INCORRECT** about the processes of evaporation and boiling?

A Evaporation is a slow process but boiling is a fast process.

B Evaporation takes place at the surface of the liquid but boiling takes place throughout the whole of the liquid.

C Evaporation takes place at all temperatures but boiling takes place at 100 °C.

D Bubbles are formed throughout the liquid during boiling but not during evaporation.

13 Which of the following statements is **TRUE** of all electromagnetic waves?

A They travel at 3×10^8 m/s.

B They require a medium to travel.

C They carry electric charges.

D They carry energy.

14 A sound wave travels from air into water.

How does the frequency, the wavelength and the speed of the sound change?

	Frequency	Wavelength	Speed
A	remains the same	increases	increases
B	increases	decreases	increases
C	decreases	increases	decreases
D	remains the same	decreases	decreases

15 Which of the following about electric field is/are **CORRECT**?

I An electron experiences a force when it is placed in an eletric field.

II Field lines cannot intersect each other.

III Field lines flow from positively charged object to negatively charged object.

A **I** and **II**

B **II** and **III**

C **I** and **III**

D **I**, **II** and **III**

16 A mobile charging device which contains 120 C of charges is connected to a circuit to charge a mobile phone.

What is the time taken to discharge the device completely if the charging current in the circuit is 3 A?

A 0.025 s

B 0.67 s

C 40 s

D 6 min

17 An electricity supplier charges a household $0.25 per unit of electricity.

How much does it cost for a household to operate an air-conditioner rated at 2500 W, 250 V for 5 hours daily in 30 days?

A $ 3.13

B $ 93.80

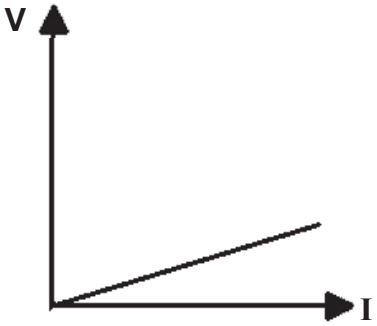
C $ 188

D $ 3130

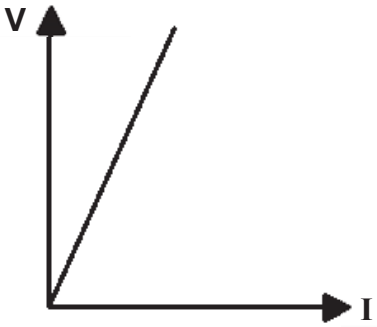
18 The V-I graphs of 4 resistors are shown.

Which of these V-I graphs shows a resistor with increasing resistance?

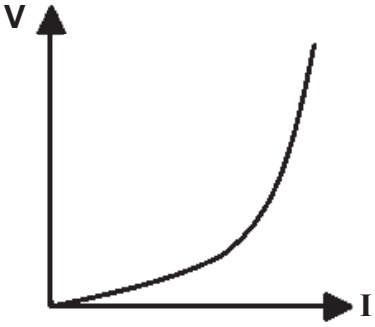
A



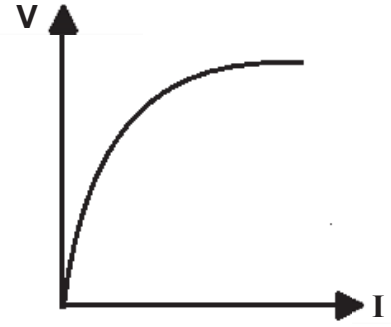
B



C



D



19 Which of the following is the correct sequence to effectively demagnetize a steel bar using the electrical method?

1 Insert the steel bar into a solenoid.

2 Connect direct current to a solenoid.

3 Connect an alternating current to a solenoid.

4 Pull the steel bar slowly out of the solenoid.

5 Switch off the current supply.

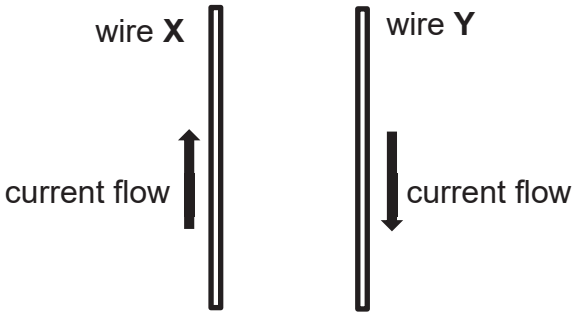
A **1, 2, 4, 5**

B **2, 1, 4, 5**

C **3, 1, 4, 5**

D **1, 3, 5, 4**

20 Two current carrying wires are arranged in parallel as shown.



What is the direction of the electromagnetic force on each wire?

	Wire X	**Wire Y**
A	to the left	to the left
B	to the left	to the right
C	to the right	to the left
D	to the right	to the right

***** END OF PAPER *****

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SCIENCE PHYSICS 5076/02 **30 AUGUST 2019**

PAPER 2 **1 HOUR 15 MINUTES**

Additional Materials : NIL

READ THESE INSTRUCTIONS FIRST

1. Answer **ALL** questions in Section **A** on the question paper.
2. Answer any **TWO** questions in Section **B** on the lined pages provided.
3. All workings and constructions must be shown clearly. Omission of essential working will result in loss of marks.
4. The number of marks is given in brackets [ ] at the end of each question or part question.
5. You are expected to use an electronic calculator to evaluate explicit numerical expression.
6. The total mark for this paper is 65 marks.

This paper consists of **16** printed pages, including this cover page.

Section A [45 Marks]

Answer **ALL** the questions in this section. Write your answers in the spaces provided on the question paper.

1 Fig. 1.1 below shows the distance-time graph of a school van travelling towards the school.

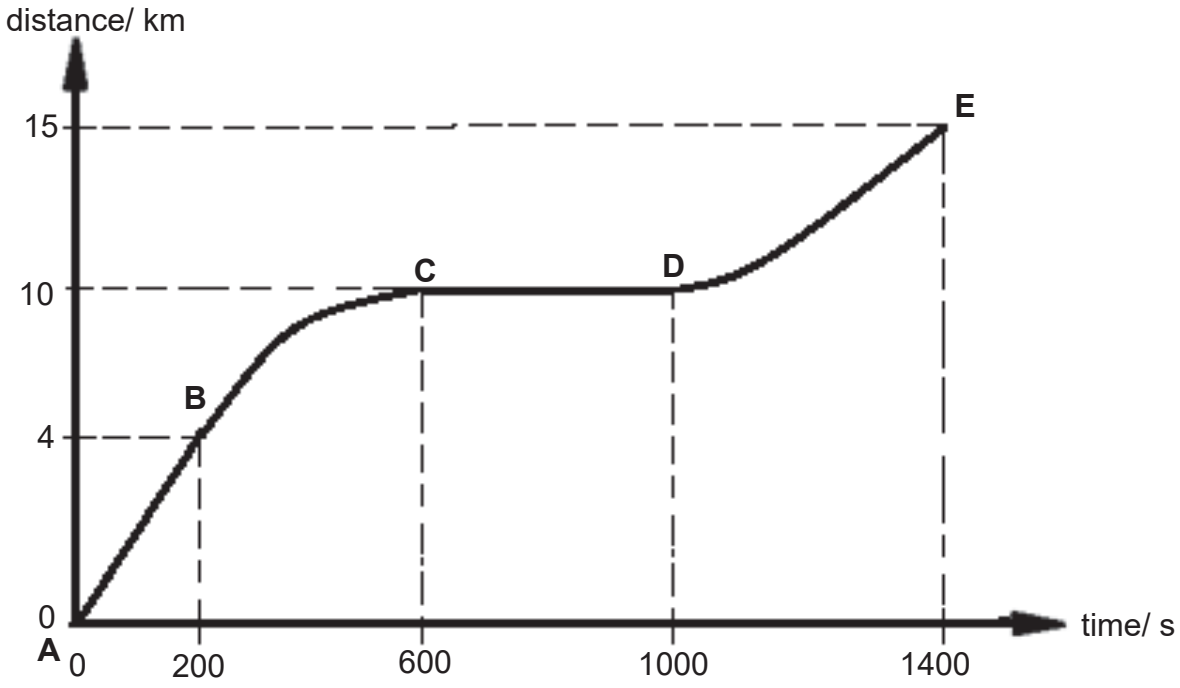


Fig. 1.1

(a) Use the graph to determine which of the marked section(s) (**AB**, **BC**, **CD** and/or **DE**) describes the motion of the school van when

(i) the school van is travelling at a constant speed; ……..…… [1]

(ii) the school van picks up students along its journey. ……..... [1]

(b) Determine the average speed travelled by the school van between t = 600 s to t = 1400 s.

average speed = ... m/s [2]

2 **(a)** A uniform metre rule is pivoted at the 35 cm mark shown in Fig. 2.1. A weight of 8 N is suspended from the 10 cm mark. A weight of 4 N is suspended from the 80 cm mark so that the rule is balanced horizontally.

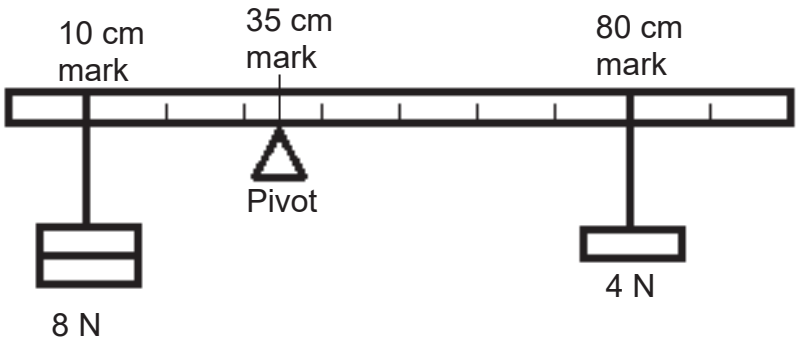


Fig. 2.1

(i) On Fig. 2.1, draw an arrow to represent the weight of the metre rule. [1]

(ii) Calculate the weight of the metre rule.

weight = ... [2]

(b) The pivot is now shifted from 35 cm mark to 30 cm mark and the position of the 8 N weight remains the same at the 10 cm mark.

Using the principle of moments, state and explain where the 4 N weight should be shifted to so that the rule can be balanced horizontally.

.....

.....

..... [2]

3 Fig. 3.1 shows a concrete block with dimensions of 0.3 m x 0.6 m x 0.2 m resting on a horizontal surface. The density of the concrete block is 25 kg/m^3.

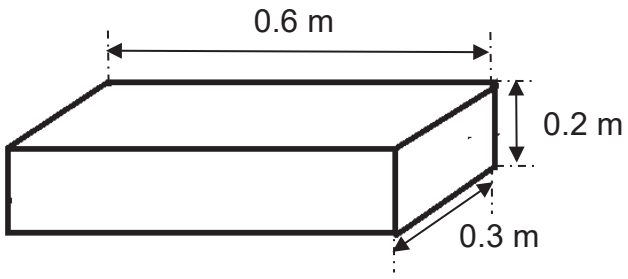


Fig. 3.1

(a) Calculate the mass of the concrete block.

mass = ... [2]

(b) The concrete block can be turned so that any one of the faces is in contact with the horizontal surface. The gravitational constant, *g* is given as 10 N/kg.

Calculate the maximum amount of pressure that the concrete block can exert on the horizontal surface.

pressure = ... [2]

4 An immersion heater is placed in the water in a water tank as shown in Fig. 4.1. Two temperature sensors **P** and **Q** are placed in the water.

Sensor **P** is near the surface of water and Sensor **Q** is at the bottom of the water tank. The temperature change registered by Sensor **P** is significantly higher than the temperature change registered by Sensor **Q**.

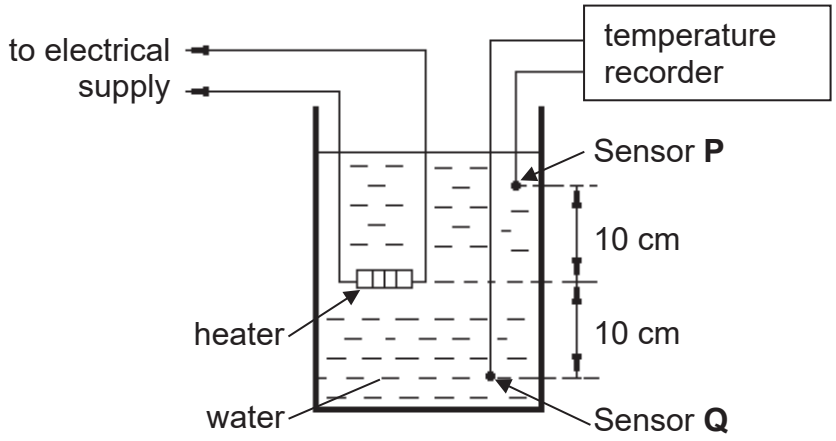


Fig. 4.1

(a) Explain why the temperature change registered by Sensor **Q** is so much lower than Sensor **P** although the immersion heater has the same distance from sensors **P** and **Q**.

……

……

……

…… [2]

(b) Suggest, with reason, a new position for the immersion heater so that both sensors **P** and **Q** can record approximately the same temperature.

……

……

……

…… [2]

5 Fig. 5.1 shows how the temperature of a pure substance changes with time when it is heated at a constant rate.

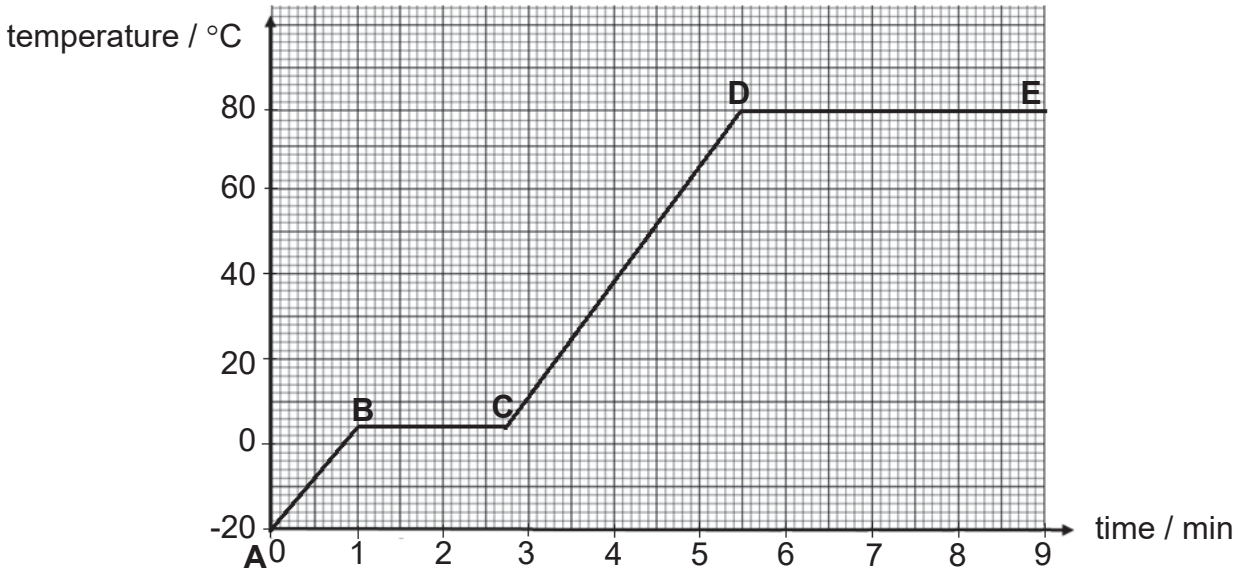


Fig. 5.1

At point **E**, all the substance has changed to vapour.

(a) State and explain, in molecular terms, the changes to the substance between points **D** and **E**.

……

……

……

…… [3]

(b) Describe the movement and the arrangement of the molecules of the substance at the temperature of 40 °C.

……

……

……

…… [2]

6 Fig. 6.1 shows an object **AB** is placed in front of a converging lens. The focal points of the converging lens are indicated on the principal axis at points **F**.

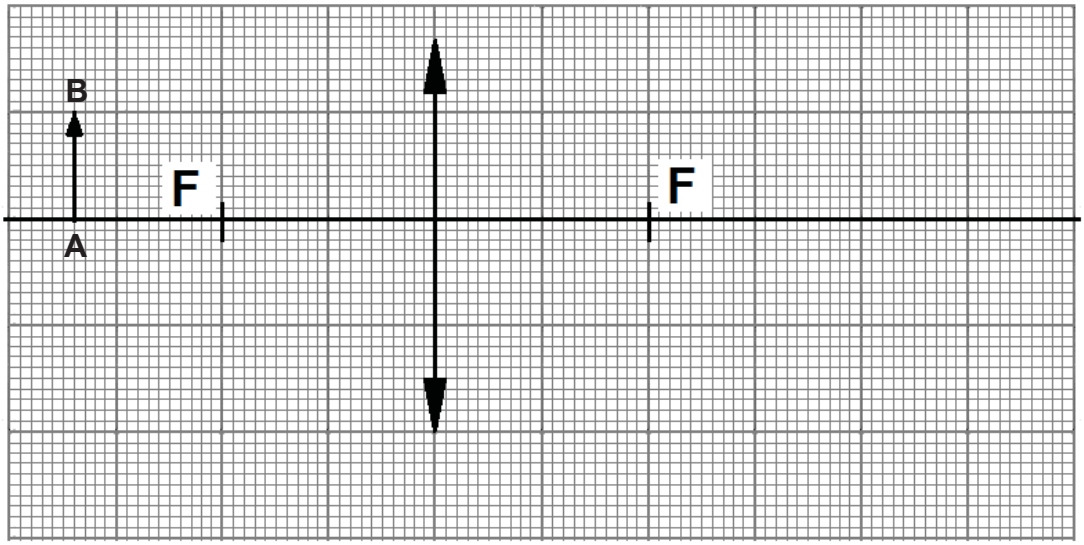


Fig. 6.1

On Fig. 6.1,

(a) draw two suitable light rays to locate the position of the image and label it **I**. [3]

(b) state the three characteristics of the image formed.

……..… [2]

(c) state an application of the converging lens for the situation shown in Fig. 6.1.

……..….. [1]

7 Fig. 7.1 shows an arrangement that is used to remove dust particles from the exhaust in an industrial chimney.

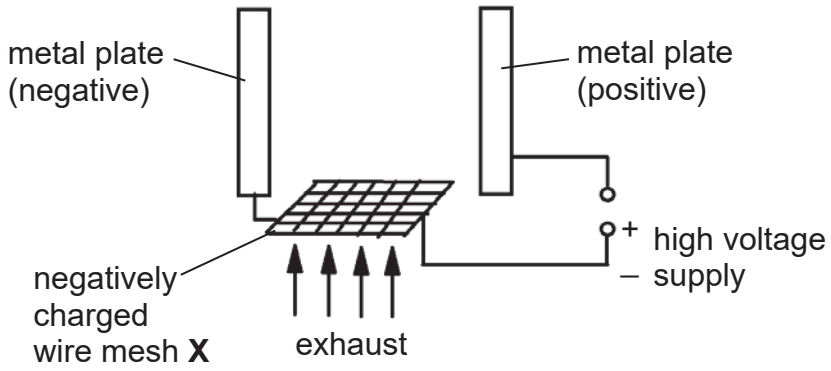


Fig. 7.1

When the exhaust passes through the wire mesh **X**, the dust particles are given a negative charge.

(a) Explain why the dust particles becomes negatively charged when they pass through the wire mesh **X**.

……

……

…… [1]

(b) State and explain what will happen to the dust particles when they pass through the electric field.

……

……

…… [2]

(c) The dust particles repel each other before they enter the electric field.

In Fig. 7.2, draw to show the electric field between these two dust particles. [1]

Fig. 7.2

8 In a satellite communication system, microwaves are transmitted from transmitter **A** to a satellite as shown in Fig. 8.1. The satellite then transmits the signal to receiver **B**. The satellite is 36000 km from transmitter **A** and 44000 km from receiver **B** respectively.

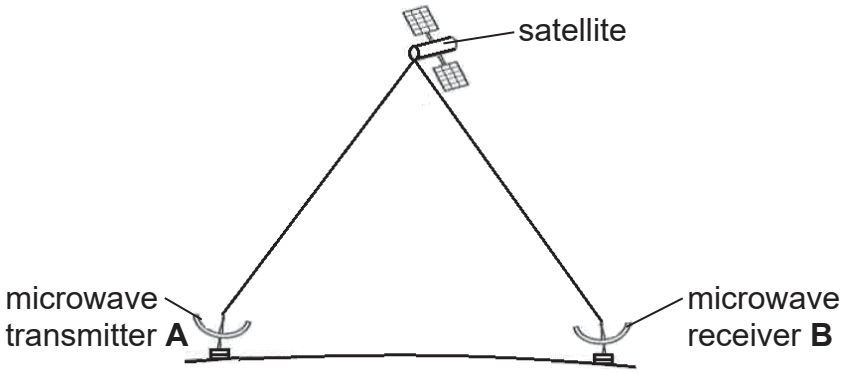


Fig. 8.1

The microwaves have a frequency of 8000 MHz and a wavelength of 0.04 m

(a) Calculate the speed of the microwaves.

speed = ... [2]

(b) Calculate the time taken for the microwaves to travel from transmitter **A** to the satellite and to receiver **B**.

time = ... [2]

(c) Explain why microwaves are used in satellite communications.

.....

..... [1]

9 Fig 9.1 shows how the pressure changes with time, at a person's ear, for two different sound waves **A** and **B**. The sounds are produced by two different sources.

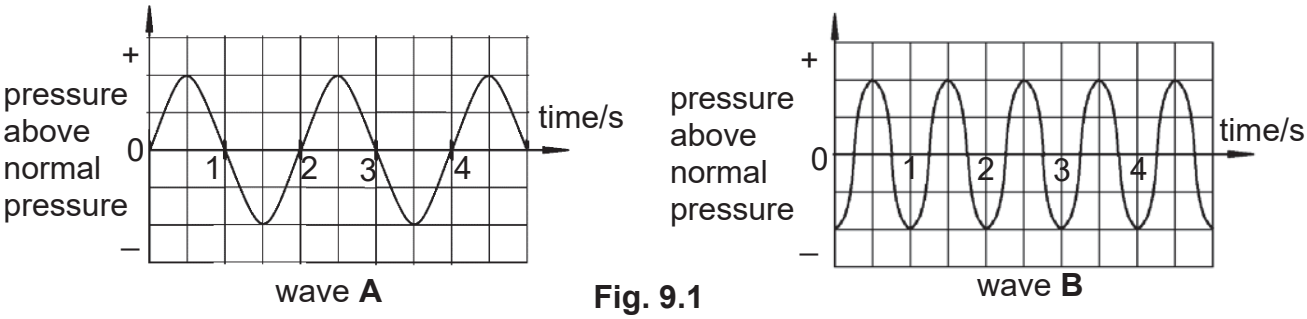


Fig. 9.1

(a) State and explain one difference between the 2 sounds.

.....

..... [2]

(b) State and explain one similarity between the 2 sounds.

.....

..... [2]

10 A coil is wound on an iron core. It is placed near a permanent magnet as show in Fig. 10.1.

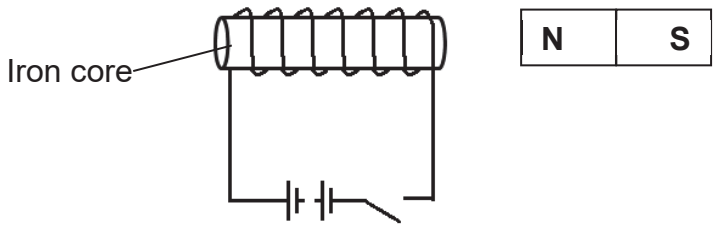


Fig. 10.1

The switch is closed.

(a) Explain why the permanent magnet moves away from the iron core.

.....

.....

..... [2]

(b) The switch is opened and the permanent magnet is replaced by an iron rod.

State and explain what will happen to the iron rod when the switch is closed.

.....

.....

..... [2]

Section B [20 Marks]

Answer any **TWO** questions. Write your answers in the spaces provided on the question paper.

11 Fig. 11.1 shows a rectangular glass block of refractive index 1.42. The light ray enters the glass block at an angle of 60 ° from the surface **AB** of the block.

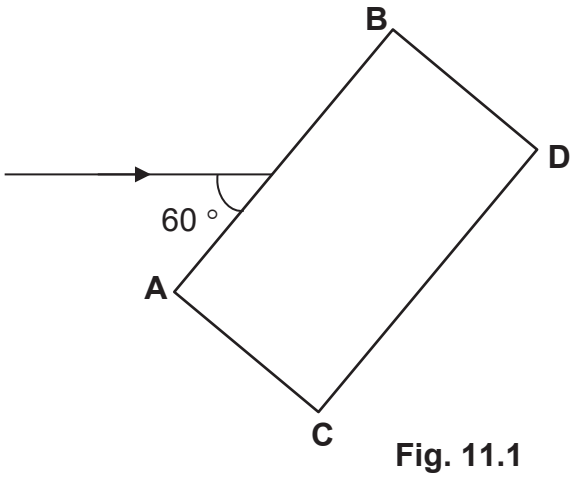


Fig. 11.1

(a) Define critical angle.

……

…… [1]

(b) Calculate the critical angle of the glass block.

critical angle = ... [2]

(c) Determine the angle of refraction of the light ray.

angle = ... [2]

(d) On Fig 11.1, draw the light ray as it passes through surface **AB** and emerges from surface **CD**. [2]

(e) State what is meant by total internal reflection.

……

…… [1]

(f) Explain why a ray of light that strikes surface **CD** cannot be totally internally reflected at surface **CD**.

……..……

……..……

……..……

…….. [2]

12 Fig. 12.1 shows a circuit consisting of three fixed resistors. The potential difference measured by the voltmeter across the 18 Ω resistor is 6 V.

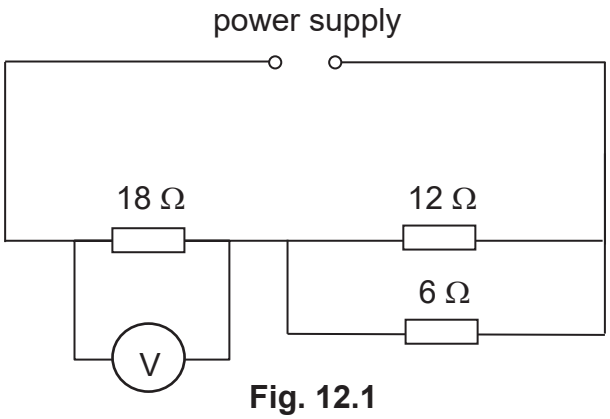


Fig. 12.1

(a) State the name given to the arrangement of the 12 Ω and the 6 Ω resistors.

..... [1]

(b) Determine the effective resistance of the 12 Ω and the 6 Ω resistors.

effective resistance = ... [2]

(c) Determine the e.m.f. of the power supply.

e.m.f. = ... [3]

(d) Calculate the current flowing through the 12 Ω resistor.

current = ... [2]

(e) The 6 Ω resistor in the circuit consists of a nichrome wire of length 0.3 m and cross-sectional area of 0.02 m^2.

Explain what will happen to the overall resistance of the circuit when this resistor is replaced by a nichrome wire of length 0.6 m and cross-sectional area of 0.01 m^2.

……..……

……..……

……..……

……..… [2]

13 A man connects three electric blowers each rated “240 V 600 W” in his house. He makes a domestic wiring as shown in the Fig.13.1 below. The mains supply is at 240 V and **L**, **N** and **E** denote the live, neutral and earth wire respectively.

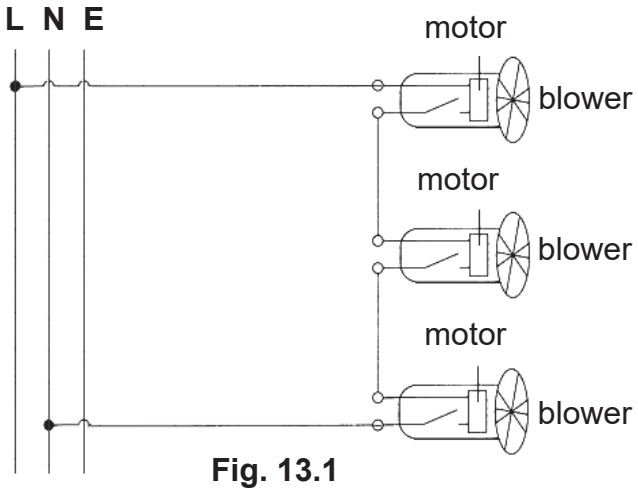


Fig. 13.1

(a) State the **THREE** mistakes that the man has made in this electrical wiring.

Mistake 1: .....

.....

Mistake 2: .....

.....

Mistake 3: .....

..... [3]

(b) Complete Fig. 13.2 to show the correct wiring of the blowers. [3]

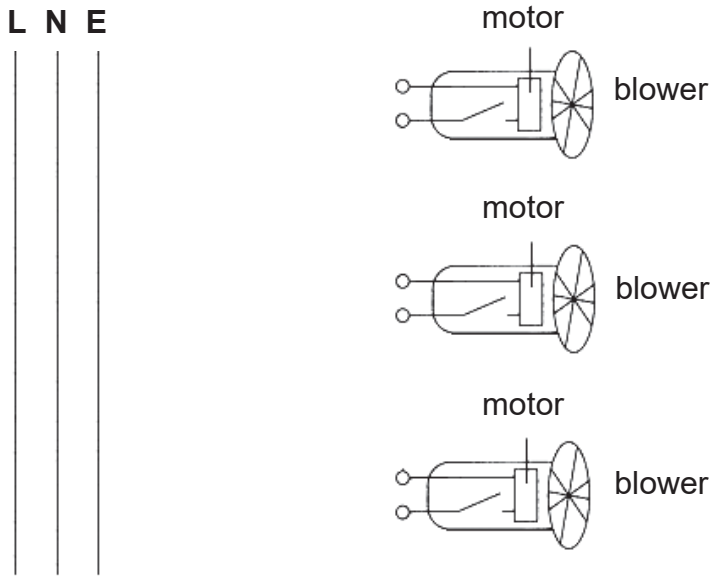


Fig. 13.2

(c) After correcting the mistakes, calculate the total current drawn from the mains supply when all the blowers are switched on.

total current = ... [2]

(d) There is an electric component missing inside the blower. Name the missing component and state its function.

.....

.....

.....

..... [2]

*****End of Paper*****

Sec 4E5N Express Sc(Physics) Prelim Exam Marking Scheme 2019

Paper 1 MCQ:

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

Paper 2 Section A:

1(a) **(i) AB [A1] (ii)CD [A1]**

1(b) average speed $=\frac{(15-10)km}{(1400-600)s}$ $[\boldsymbol{M1}] = \frac{5000}{800} = 6.25\ m/s$ **[A1]**

2(a) **(i)** W (with arrow) is at the centre of the rule exactly at the 50 cm mark **[A1]**

2(a) **(ii)** Using Principle of moments (50-35) x W+(80-35) x 4 = (35-10) x 8 **[M1]**
15W = 200-180 =20, W=1.33 N [**A1**]

2(b) moment arm of 4N must reduce OR move 4N towards pivot OR 0.4N position less than 80 cm mark.(any value given that is smaller) **[A1]**
As the moment arm of 0.8 N is shorter, anticlockwise moment is smaller **OR** clockwise moment caused by weight is increased, Clockwise moment of 4N must be reduced.

3(a) Volume = 0.6x0.3x0.2 = 0.036 m^3, mass = 0.036 x 25 **[M1]** = 0.9 kg **[A1]**

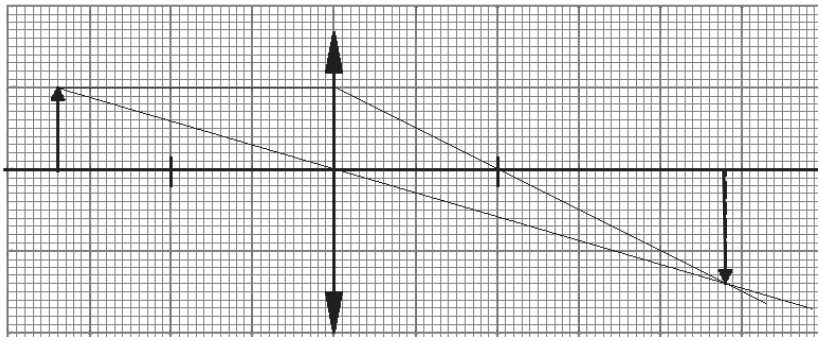
3(b) Weight = 0.9 x 10 = 9, Pressure (max) = 9/(0.3 x 0.2) **[M1]** =150 Pa **[A1]**

4(a) Water is a poor conductor of heat/ insulator so the heat cannot conduct easily from heater to Sensor Q by conduction. **[A1]**
Little convection occurs below heater at Sensor Q as heated, less dense water from heater rises above it **[A1]** while cold, more dense water replaces the risen water.
By just mentioning about convection current affecting P and Q will not get any marks.

4(b) Lower the heater down 10cm /same level as Sensor **Q** OR bottom of the beaker **[A1]**
Now heated, less dense water from heater rises above it while cold, more dense water replaces the risen water, setting up convection current **[A1]**

5(a) Molecules sliding over one another **[A1]**
Molecules gain energy and overcome intermolecular forces **[A1]**
Molecules moved further apart **[A1]**

5(b) From graph, substance is liquid at 40 °C.
The molecules are arranged in a disorderly manner/ randomly **[A1]**
The molecules can slide past one another **[A1] No mark if moving randomly.**



6(a) **(i)** image, label I [**A1**] (No mark if no label)
Connect object through optical centre lens to image **[A1]**
Connect object to lens, from lens to image [**A1**],
Note: Subtract only 1 mark for missing arrows or dotted rays or both.

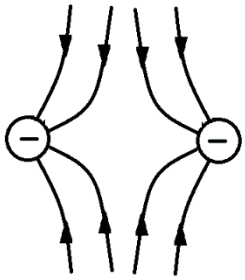
6(a) **(ii)** inverted, magnified or enlarged, real [**2 ans** correct for **A1**, 3 for **A2**]

6(a) **(ii)** projector [**A1**]

7(a) The dust particles gain electrons from the wire mesh and becomes negatively charged. **[A1]**

7(b) The negatively charged dust particles are attracted towards the positively charged metal plate.**[A1]** Like charges repel **[A1] OR** The negatively charged dust particles are repelled away from the negatively charged metal plate.**[A1]** Unlike charges repel **[A1]**

7(c) pattern must symmetrical with the neutral zone and arrow directions correct**[A1]**



8(a) v= fλ, Speed = 8000 000 x 0.04 **[M1]** = 320 000 000 m/s **[A1]**

8(b) time = (36000+44000)x 1000/320 000 000 **[M1]** ecf 8a= 0.25 s **[A1] ecf 8a**

8(c) Transmission of microwaves not affected/obstructed by cloud cover/water droplets and need no medium (in space) to transmit. **[A1]**

9(a) Pitch of Wave B higher **[A1]** than Wave A. Frequency of Wave B higher **[A1]** than Wave A, giving higher pitch

9(b) Loudness of Wave B is the same **[A1]** as Wave A. Amplitude of Wave B same **[A1]** as Wave A, giving same loudness

10(a) When current is switched on. The iron core becomes an electromagnet**[A1]**. Based on the Right hand grip, North pole is induced by the electric current flowing in the coils of wire onto the right side of the iron core **[A1]** and like poles repel.
By saying that it is North pole on the right of iron core with no reason and mentioning like poles repel will not get any mark.

10(b) The iron rod will be attracted to the iron core **[A1]** when current in turned on. Based on the Right hand grip, North pole is induced on the right hand side of the iron core which will induce an opposite pole onto the magnetic iron rod. **[A1]** Unlike poles attract.

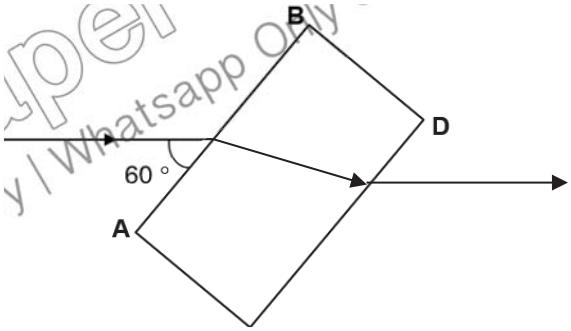
11(a) Critical angle is the angle of incidence in the optically denser medium when the angle of refraction in the optically less dense medium is 90 ° (*no optical word will be marked wrong)

11(b) Critical angle = $\sin^{-1}(1/1.42)$ **[M1]** = 44.8° **[A1]**

11(c) Angle of incidence = 90° – 60° = 30°

n of glass block = $\frac{\sin i}{\sin r} = \frac{\sin 30}{\sin r}$ = 1.42 **[M1]**, r = 20.6 ° **[A1]**

11(d) Refracted ray bend towards normal **[A1]**
Emergent ray must be // incident ray**[A1]**



11(e) When the angle of incidence in the optically* dense medium exceeds the critical angle, the light ray will no longer be refracted into the optically less dense medium and total internal reflection occurs. **[A1]** *Do not award marks if optical is missing

11(f) As the angle of incidence in the optically* dense medium does not exceed the critical angle **OR** all the incident light rays on surface AB does nto exceed 90 ° **[A1],** the light ray will always be refracted **[A1]** into the optically less dense medium and no total internal reflection occurs. *Do not award marks if optical is missing

12(a) parallel **[A1]**

12(b) $1/R_{eff}$ **=** 1/6 + 1/12 **[A1]** = 1/4 => R_{eff} = 4 Ω **[A1]**

12(c) Total Current = 6/18 = 0.333 A **[M1]**

Total resistance = 18 + 4 , emf = 0.333 x 22 **[M1]** = 7.33 V **[A1] ecf 12b,c**

12(d) potential difference = total EMF- $V_{18\ \Omega}$ = 7.33 - 6 [M1] = 1.33 V**[A1]**

Current across 12 Ω = 1.33/12 = 0.111 A **[A1] ecf 12c**

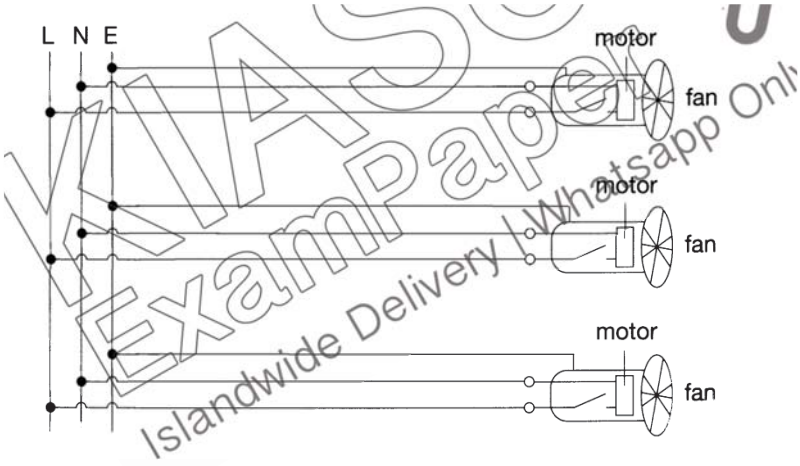
12(e) Increase Length of wire 2x doubles the resistance of wire. Reduce diameter/cross sectional area/ thinner wire by half doubles the resistance.**[A1].** For the parallel circuit, the effective resistance is calculated to be higher, thereby increasing overall resistance **[A1]** of the whole circuit.

13(a) Series connection instead of parallel connection **[A1]**

Switch is connected to neutral instead of live wire **[A1]**

The casing is not earthed/ connected to earth wire **[A1]**

13(b)



[A3]

13(c) Current for 1 fan = Power / Potential Difference

= 600 W / 200 V = 3 A **[M1]**

Current for 3 fan = 3 x 3 A = 9 A **[A1]**

13(d) Fuse **[A1]**

When the current in the circuit exceeds the current rating of the fuse, the fuse will melt or break**[A1]**, thus preventing overheating/ fire. No mark if voltage is mentioned instead.