NAME		INDEX NO.		CLASS	

NORTHLAND SECONDARY SCHOOL
PRELIMINARY EXAMINATION
Secondary 4 Express

PHYSICS **6091/01**

Paper 1 Multiple Choice **22 September 2020**

Additional materials: Multiple Choice Answer Sheet **1 hour**

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
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** 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.

Setter: Mdm Nor Rasidah

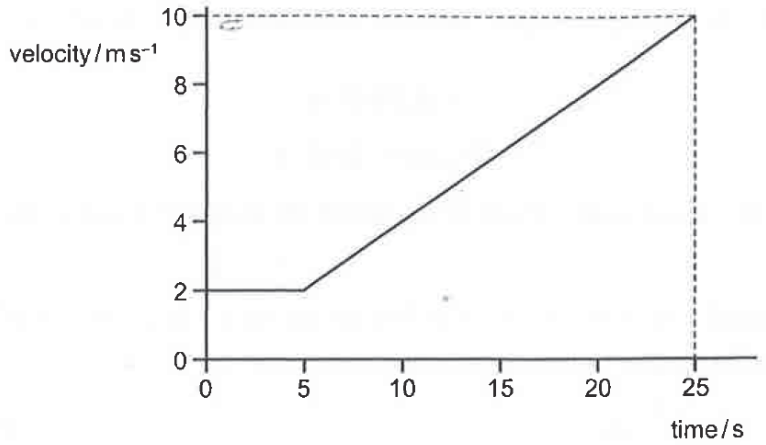
Vetter: Mdm Lim Mei Teng

1 A student needs to measure a distance of about 2 cm to a precision of 0.001 cm.

Which measuring instrument should be used?

A metre rule
B micrometer
C measuring tape
D vernier calipers

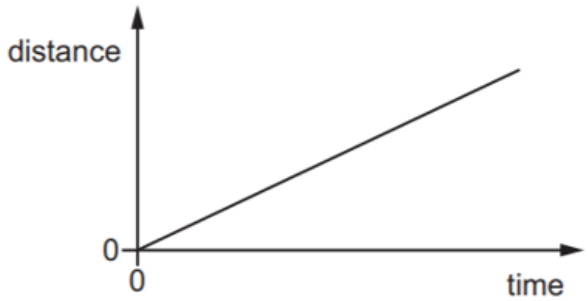
2 The diagram shows a velocity- time graph for an object travelling along a straight line.



What is the displacement of the object for the 25 s?

A 90 m
B 120 m
C 130 m
D 150 m

3 The diagram shows the distance-time graph of a car.

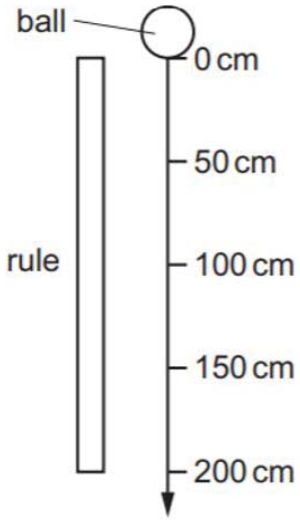


The car is travelling along a straight road up a hill.

Which quantity for the car is constant and greater than zero?

A acceleration
B gravitational potential energy
C kinetic energy
D resultant force

4 In a laboratory, a ball is dropped in a vacuum and falls 200 cm.



Which statement describes the acceleration of the ball?

A It is greater at 10 cm than at 200 cm.
B It is greatest at 200 cm.
C It is smaller at 50 cm than at 100 cm.
D It is the same value at 50 cm as at 150 cm.

5 The acceleration of free fall on Pluto is 0.66 m s^{-2}.

An object weighs 6.0 N on Earth.

What would this object weigh on Pluto?

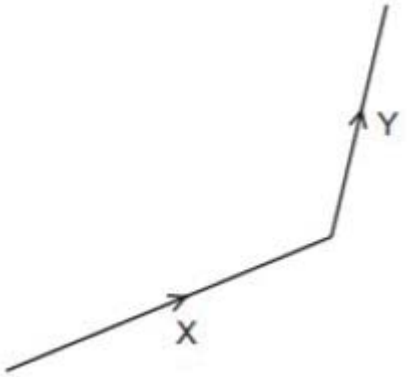
A 0.40 N
B 0.93 N
C 4.0 N
D 39 N

6 Solid **R** of mass 15 g was immersed in a measuring cylinder filled with water. It displaces the same volume of water as solid **S** of mass 5 g.

What can be deduced about the densities of solid **R** and **S**?

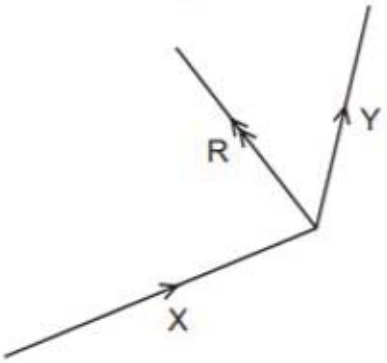
A Both **R** and **S** have the same density.
B The density of **R** is 3 times lesser than the density of **S**.
C The density of **S** is 3 times lesser than the density of **R**.
D The density of **R** is 1.5 times more than the density of **S**.

7 Two forces **X** and **Y** act as shown.

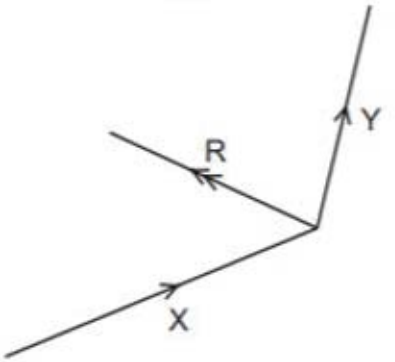


Which diagram shows the resultant force of **X** and **Y**?

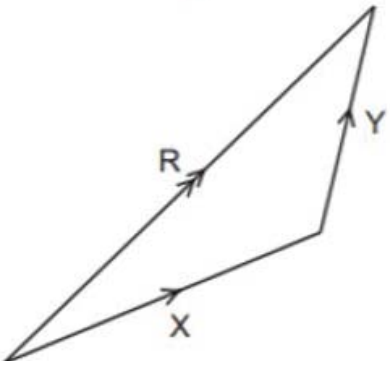
A



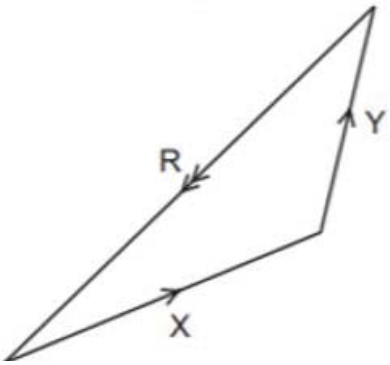
B



C



D



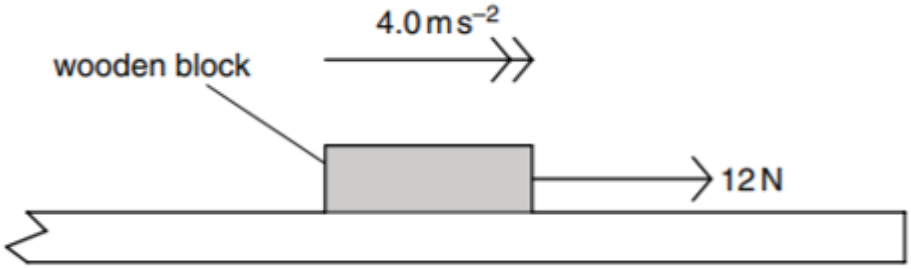
8 A man with an open parachute falls to Earth at constant speed.
The following forces act on different bodies:

P the upward force of the parachute on the man
Q the upward force of the man on the Earth
R the downward force of the Earth on the parachute
S the downward force of the man on the parachute

Which two forces are action-reaction force pair?

A **P** and **Q**
B **P** and **R**
C **P** and **S**
D **Q** and **R**

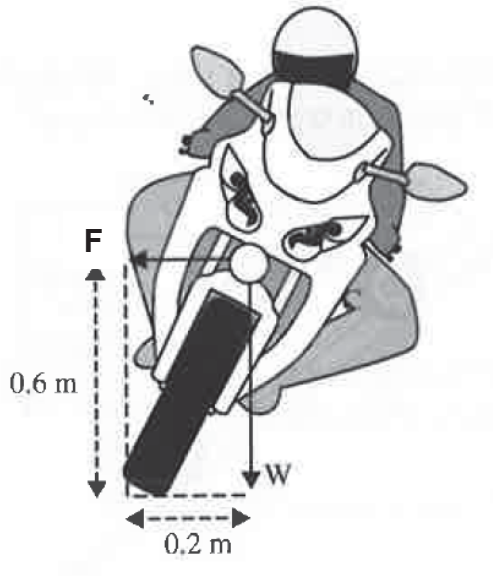
9 A wooden block of mass 0.60 kg is on a rough horizontal surface. A force of 12 N is applied to the block and it accelerates at 4.0 m/s^2.



What is the magnitude of the frictional force acting on the block?

A 2.4 N
B 9.6 N
C 14 N
D 16 N

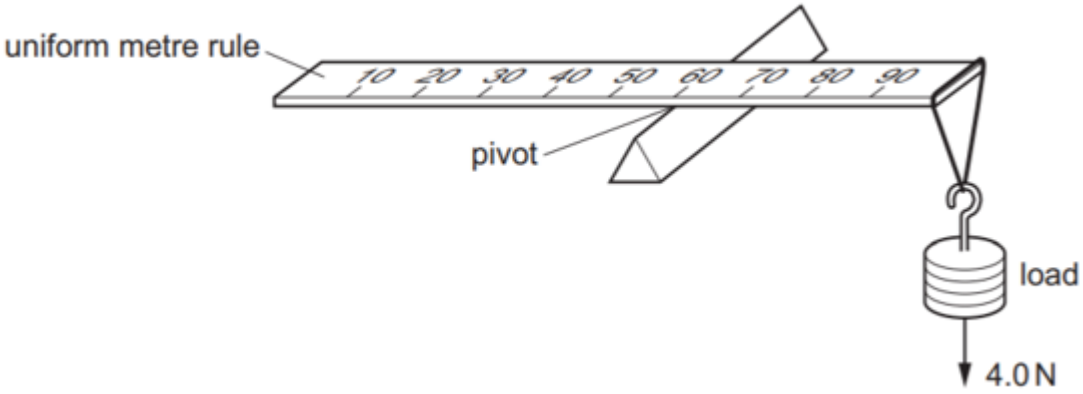
10 A motorcyclist is turning a corner. The combined mass of the motorcyclist and the motorcycle is 240 kg.



What is the magnitude of the force **F** that prevents the motorcyclist from falling over?

A 480 N
B 720 N
C 800 N
D 2400 N

11 A uniform metre rule of weight 2.0 N is pivoted at the 60 cm mark. A 4.0 N load is suspended from one end, causing the rule to rotate about the pivot.



Based on the diagram above, what is the resultant moment about the pivot?

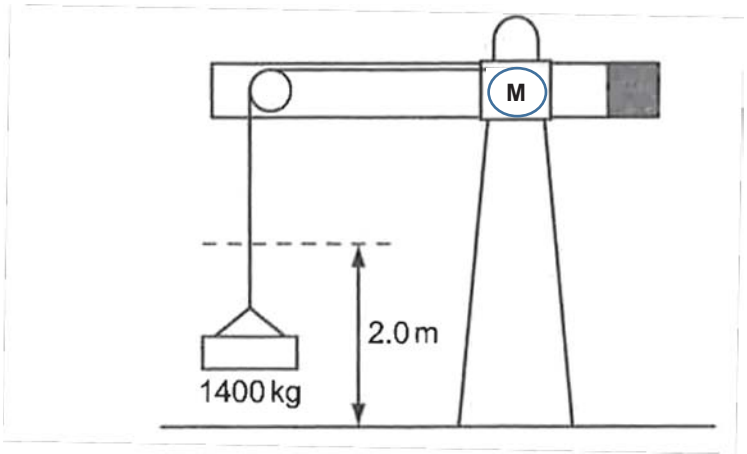
A 0.0 Nm
B 1.4 Nm
C 1.6 Nm
D 1.8 Nm

12 A force of 90 N is applied on an object. It starts moving from rest and accelerates constantly at 1.2 m/s^2 for 8.0 seconds.

What is the work done on the object during the 8.0 seconds?

A 720 J
B 864 J
C 3 456 J
D 6 912 J

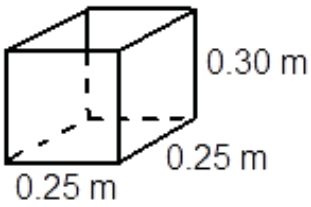
13 The motor **M** in a crane is used to lift a total mass of 1400 kg through a height of 2.0 m in 1.40 s. The motor is 20 % efficient.



What is the minimum input power to the motor **M**?

A 10 kW
B 20 kW
C 100 kW
D 120 kW

14 Six bags of flour, each of mass 2.5 kg, are used to fill up a box as shown below. The box measures 0.30 m × 0.25 m × 0.25 m and has a mass of 0.5 kg.



What is the average pressure of the full box of flour on the floor?

A $\frac{15.0}{0.30\times0.25}$ Pa

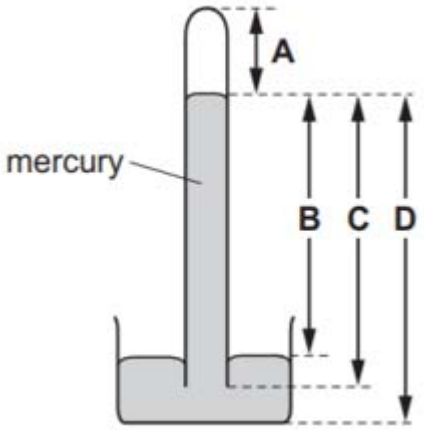
B $\frac{15.5\times10}{0.25\times0.25}$ Pa

C $\frac{15.0\times10}{0.30\times0.25\times0.25}$ Pa

D $\frac{15.5}{0.30\times0.25\times0.25}$ Pa

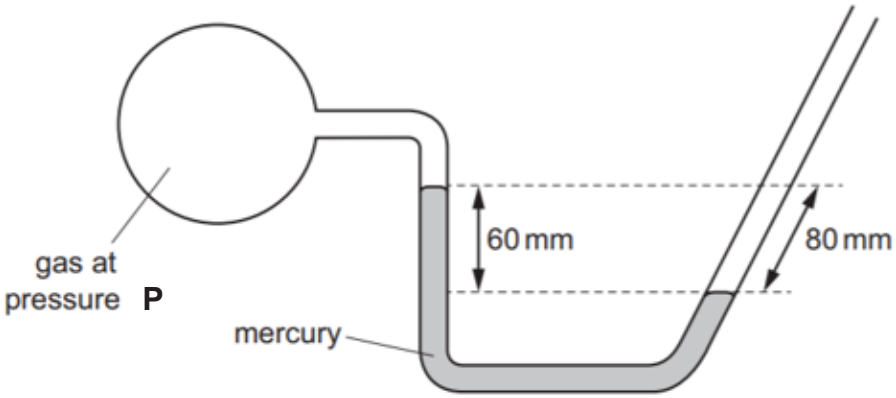
15 The diagram shows a simple mercury barometer.

Which labelled length is measured when finding atmospheric pressure?



16 The diagram shows a mercury manometer. The tube is open to the atmosphere on the right-hand side.

The left-hand side is connected to a container containing a gas at pressure **P**.

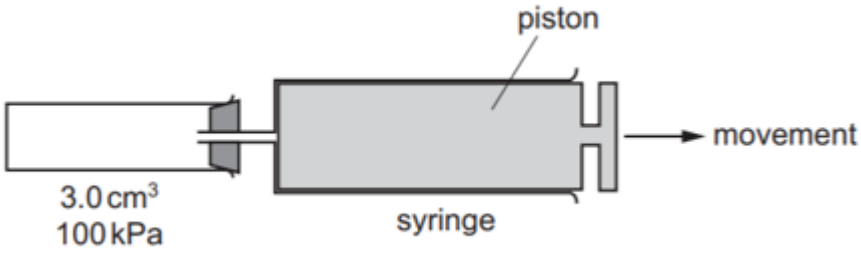


The atmospheric pressure is 760 mmHg.

What is the pressure of gas **P**?

A 680 mmHg
B 700 mmHg
C 820 mmHg
D 840 mmHg

17 A small vessel of volume 3.0 cm^3 contains air pressure of 100 kPa. The small vessel is connected to a syringe. The piston is fully inserted into the syringe.

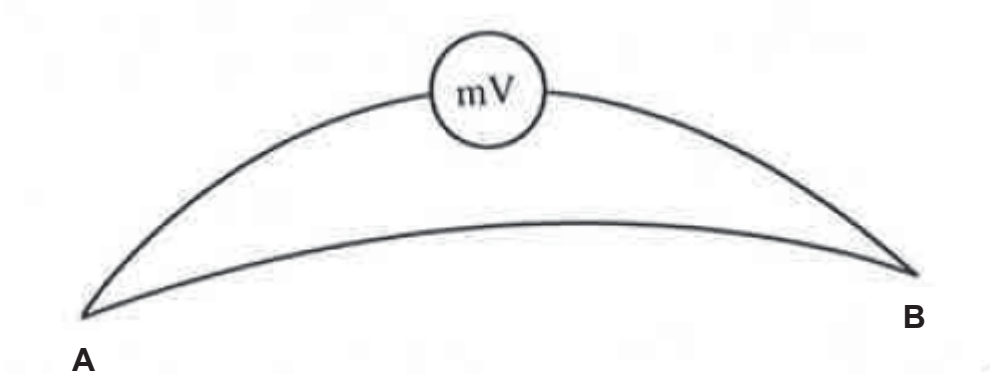


The piston is moved slowly to the right so that the air in the syringe has a volume of 12 cm^3. The temperature of the air does **not** change.

What is the pressure of the air in the syringe?

A 20 kPa
B 25 kPa
C 80 kPa
D 100 kPa

18 The diagram shows a thermocouple with two junctions **A** and **B**. Junction **A** is placed in pure melting ice and junction **B** is placed in a pot of boiling water. The e.m.f. reading registered by the voltmeter is 5.8 mV.



Junction **A** is then placed in a liquid of an unknown temperature while junction **B** is being immersed in water at a temperature of 70°C. The new e.m.f. shown on the voltmeter is now 7.0 mV.

What is the temperature of the liquid?

A -121 °C
B -51 °C
C 121 °C
D 191 °C

19 Thermal energy is used to turn water at 100 °C to steam at 100 °C.
Which of the following occurs?

1. The forces between the molecules decreases.
2. The kinetic energy of the molecules increases.
3. The potential energy of the molecules decreases.
4. The separation of the molecules increases.

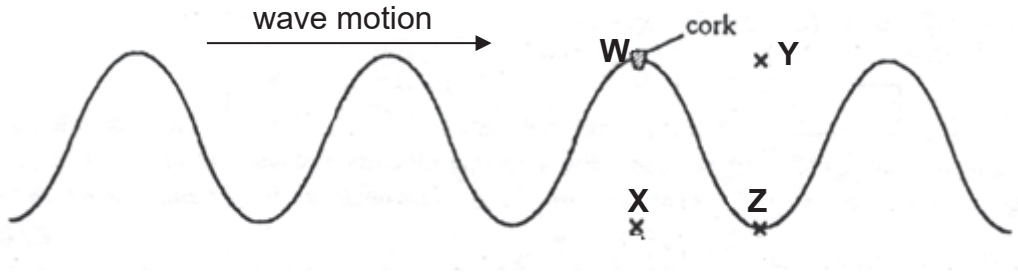
A 1 and 4 only
B 2 and 3 only
C 1, 2 and 3 only
D 2, 3 and 4 only

20 In an experiment to find the specific heat capacity of a metal, it is found that 5200 J is needed to raise the temperature of a 2 kg block by 20 °C.

What is the specific heat capacity of the block?

A 130 J/ (K °C)
B 520 J/ (K °C)
C 52 000 J/ (K °C)
D 104 000 J/ (K °C)

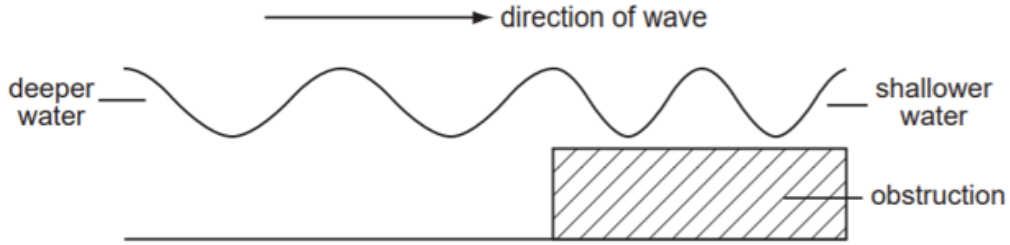
21 A ripple tank is used to observe the ripples made by a straight vibrator. One crest is produced in every 0.2 second. The cross-section of the water ripples with a cork at **W** is shown in the diagram. The wave is moving to the right.



Where is the position of the cork after 0.1 second?

A **W**
B **X**
C **Y**
D **Z**

22 The diagram shows a wave moving into shallow water.

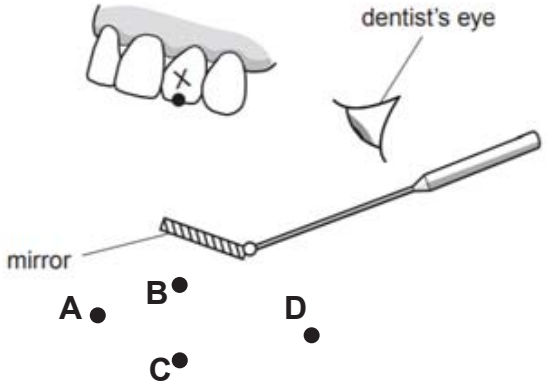


What causes the wavelength of the waves to decrease?

A Both the frequency and the speed of the wave decrease.
B Both the frequency and the speed of the wave increase.
C Only the frequency of the wave increases.
D Only the speed of the wave decreases.

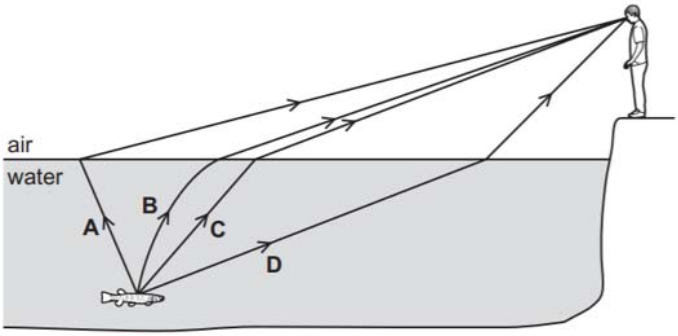
23 The diagram shows a plane mirror used by the dentist to see the point labelled **X** on the tooth.

Which point shows the position of the image of point **X**?

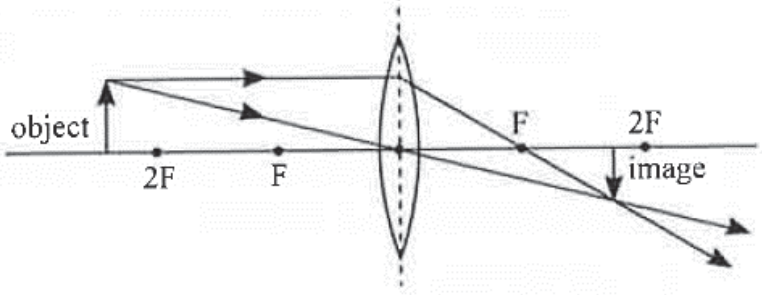


24 A boy sees a fish in a lake.

Which labelled path is taken by the light travelling from the fish to the boy's eye?



25 The diagram shows how an image is formed with a converging lens. A screen is placed at the image position to capture it.

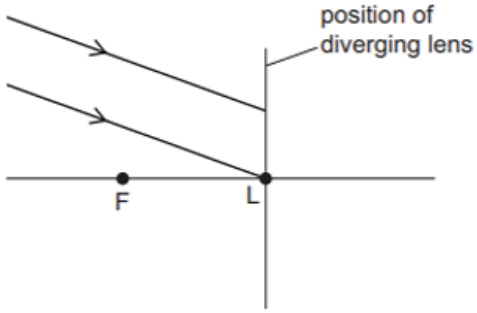


Adam moves the screen to the right, further away from the lens and the image is now blurred.

Which measure can be taken to obtain a sharp image once again?

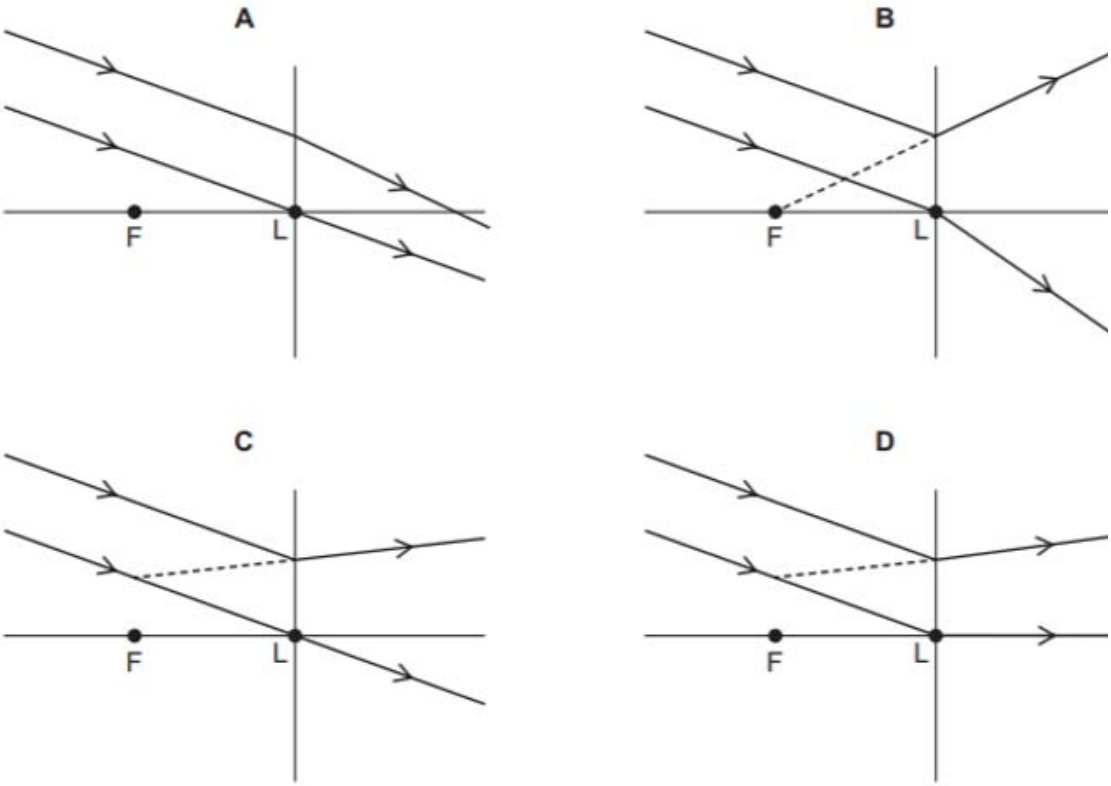
A Shift the lens towards the left, away from the screen.
B Shift the object towards the right, closer to the lens.
C Shift the object towards the left, further away from the lens.
D Change the lens into one with smaller focal length.

26 A parallel beam of light is incident on a thin diverging lens.



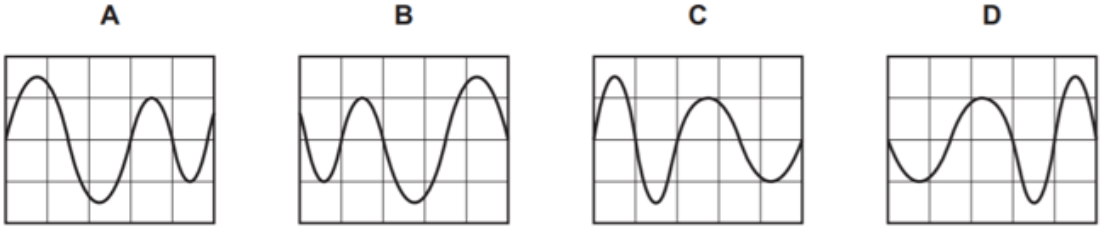
The focal length of the lens is **FL**, as shown in the diagram.

Which ray diagram shows the beam after it has passed through the lens?



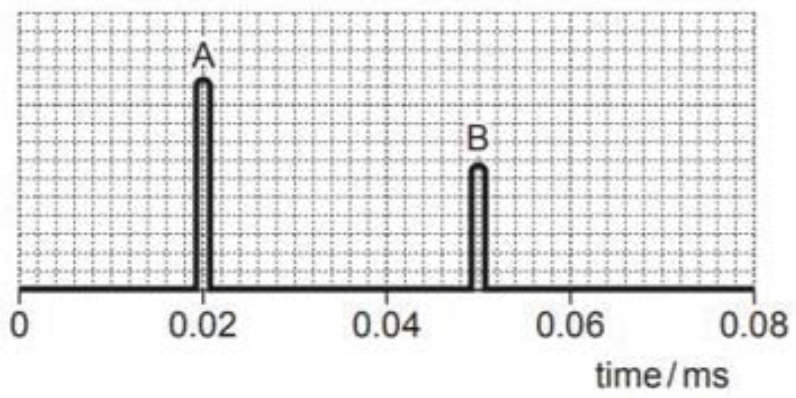
27 Four sound waves are displayed on the screen of a cathode-ray oscilloscope.

Which sound wave gets louder and has a pitch that decreases?



28 To produce the image of an unborn child, an ultrasound emitter and receiver are placed close together on the mother's skin.

The diagram shows pulses detected by the receiver.



Pulse **A** is the emitted pulse and pulse **B** is the first pulse that returns from the unborn child.

The average speed of ultrasound in human tissue is 1500 m/s.

What is the distance between the emitter and the child?

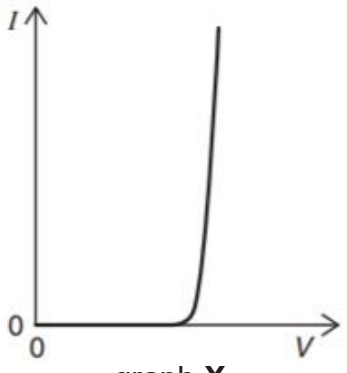
A 22.5 mm
B 45.0 mm
C 37.5 mm
D 75.0 mm

29 An ultraviolet wave has a wavelength of 10 nm.

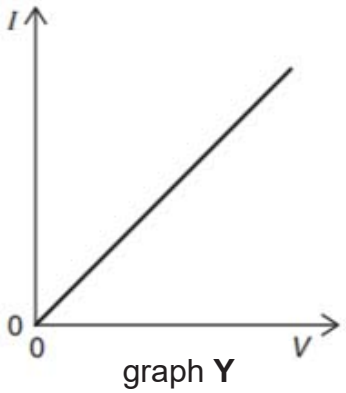
What is the frequency of the wave when it is travelling through vacuum?

A 3.0 Hz
B 3.0×10^{10} Hz
C 3.0×10^{13} Hz
D 3.0×10^{16} Hz

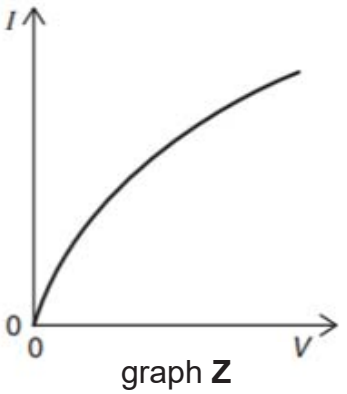
30 The graphs show the variation with potential difference ***V*** of the current ***I*** for three circuit elements.



graph **X**



graph **Y**



graph **Z**

The three circuit elements are a metal wire at constant temperature, a semiconductor diode and a filament lamp.

Which row of the table correctly identifies these graphs?

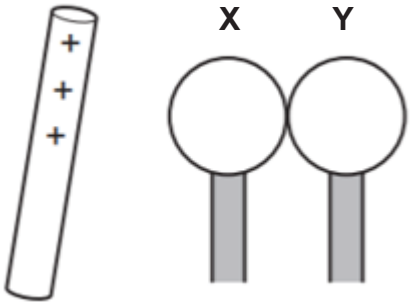
	metal wire at constant temperature	a semiconductor diode	a filament lamp
A	**X**	**Y**	**Z**
B	**Y**	**X**	**Z**
C	**Y**	**Z**	**X**
D	**Z**	**X**	**Y**

31 A stationary negative charge in an electric field experiences an electric force in the direction shown.

What is the direction of the electric field?

A To the left
B To the right
C Down the page
D Up the page

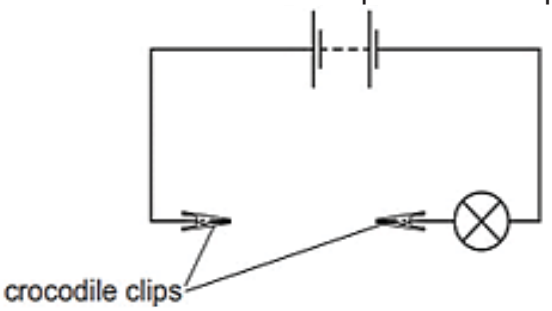
32 Two insulated and uncharged metal spheres **X** and **Y** are touching. A positively charged rod is held near **X** and then the spheres are moved apart.



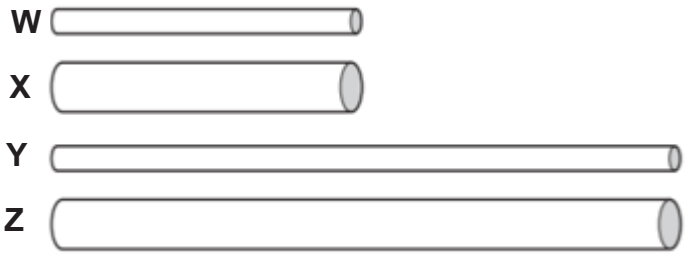
What is the charge on **Y**?

A Negative and smaller than that on **X**.
B Negative and the same size as that on **X**.
C Positive and smaller than that on **X**.
D Positive and the same size as that on **X**.

33 A battery is connected to two crocodile clips and a lamp.



There is a gap between the crocodile clips.



Four cylinders **W**, **X**, **Y** and **Z** are made of the same metal but have different dimensions. The cylinders are connected in turn, by their ends, between the crocodile clips. The diagrams of the cylinders are all drawn to the same scale.

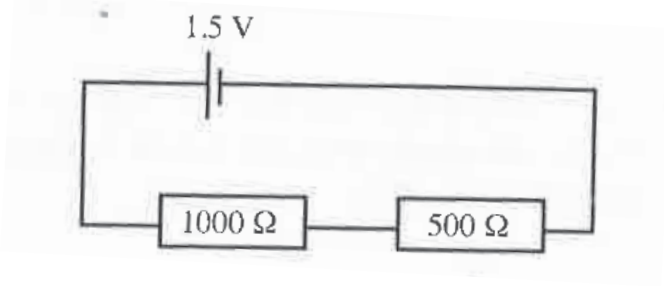
Which cylinder makes the lamp glow most brightly and which cylinder makes the lamp glow least brightly?

	most brightly	least brightly
A	**W**	**Y**
B	**W**	**Z**
C	**X**	**Y**
D	**X**	**Z**

34 Which of the following is the same as one volt?

A one coulomb per ampere
B one coulomb per joule
C one joule per ampere
D one joule per coulomb

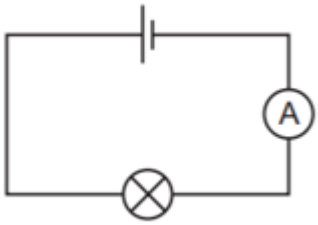
35 The circuit shows two resistors connected to a 1.5 V cell.



What is the total energy supplied to the 1000 Ω resistor in 10 minutes?

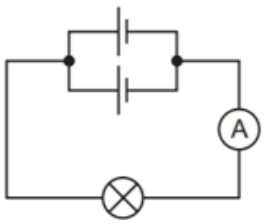
A 0.0010 J
B 0.0015 J
C 0.60 J
D 1.35 J

36 A cell is connected in series with an ammeter and a lamp. The current is 1 A.

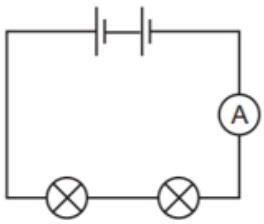


In which circuit, using identical cells, lamps and ammeters, is the current 2 A?

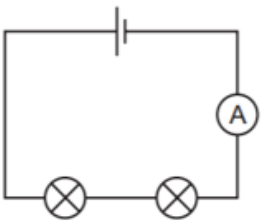
A



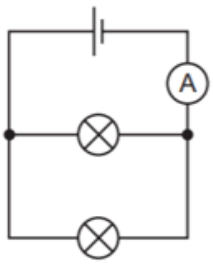
B



C

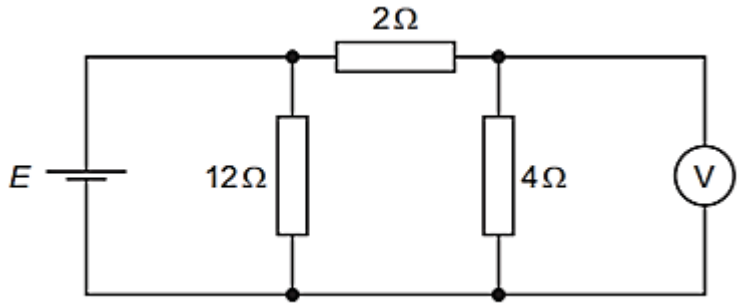


D



37 A cell of electromotive force ***E*** is connected in a circuit as shown.

The voltmeter reads a potential difference V_{out}.



What is the ratio $\frac{V_{out}}{E}$?

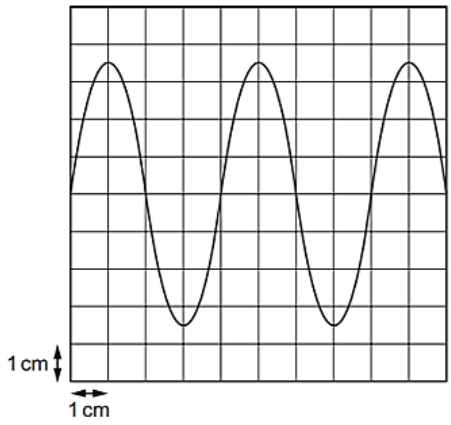
A $\frac{1}{6}$

B $\frac{1}{3}$

C $\frac{1}{2}$

D $\frac{2}{3}$

38 A cathode-ray oscilloscope (c.r.o.) is connected to an alternating voltage. The following trace is produced on the screen.

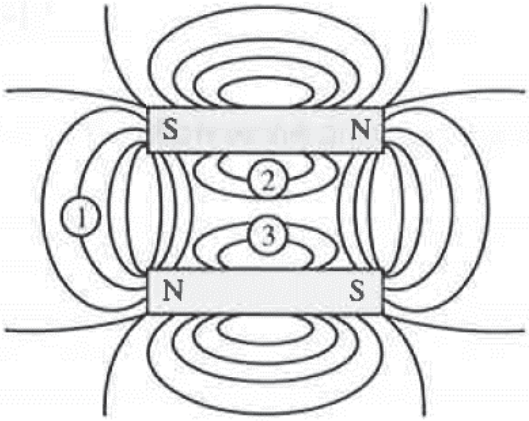


The time-base setting is 0.5 ms cm^{-1} and the Y-plate sensitivity is 2 V cm^{-1}.

Which statement about the alternating voltage is correct?

A The frequency is 0.5 kHz.
B The peak voltage is 3.5 V.
C The period is 1 ms.
D The wavelength is 4 cm.

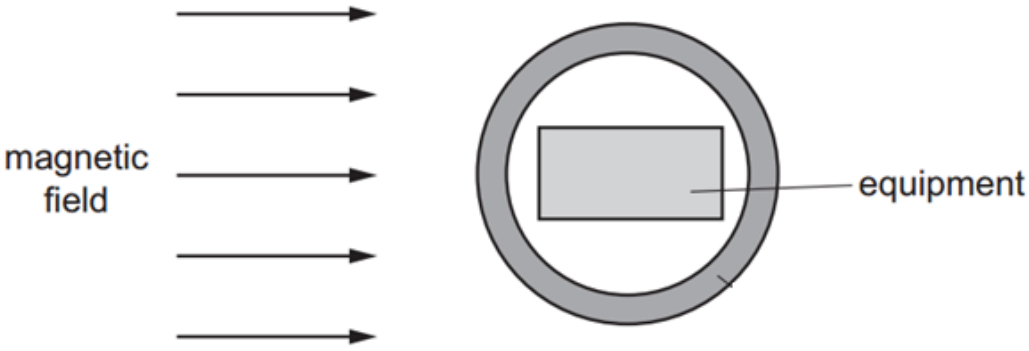
39 The resultant magnetic field of two magnets is shown below. Three plotting compasses are placed as shown.



In what directions do the compass needles point?

A **B** **C** **D**

40 A circular ring screens a piece of equipment from a magnetic field.



Which material should be used for the ring in order to protect the equipment?

A Copper
B Iron
C Silver
D Wood

[End of Paper]

NAME		INDEX NO.		CLASS	

NORTHLAND SECONDARY SCHOOL
PRELIMINARY EXAMINATION
Secondary 4 Express

PHYSICS **6091/02**

Paper 2 Theory **17 September 2020**

Additional materials: NIL **1 hour 45 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.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A (50 marks)
Answer **all** questions.

Section B (30 marks)
Answer **all** questions. Question 13 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.

For Examiner's Use	
SECTION A	
SECTION B	
TOTAL	/80

Setter: Mdm Nor Rasidah

Vetter: Mrs Phua Mei Teng

Section A

Answer **all** questions.

1 Fig. 1.1 shows a parachutist with a total weight of 600 N falling vertically towards the ground. The gravitational field strength is 10 N/kg.

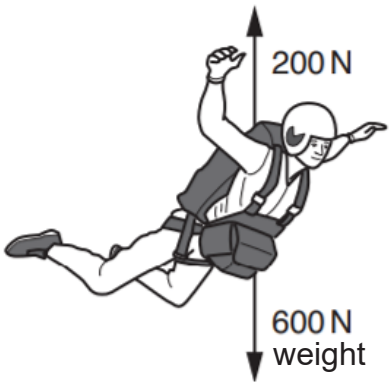


Fig. 1.1

(a) Define *gravitational field strength*.

……..…….[1]

(b) Calculate the acceleration of the parachutist when the air resistance is 200 N.

acceleration = ... [2]

(c) Fig. 1.2 shows how air resistance acting on the parachutist changes with his speed.

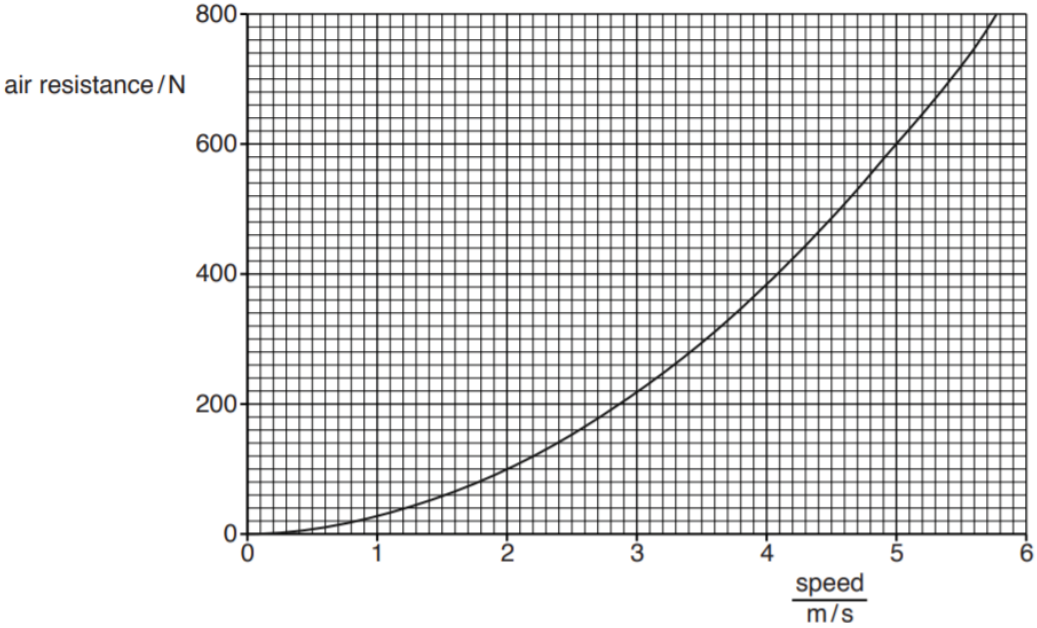


Fig. 1.2.

The parachutist falls from rest at time $t = 0$. He reaches terminal velocity at t_1 and the parachute opens at t_2.

On Fig. 1.3, draw the speed–time graph for the parachutist from 0 s to t_2. [3]

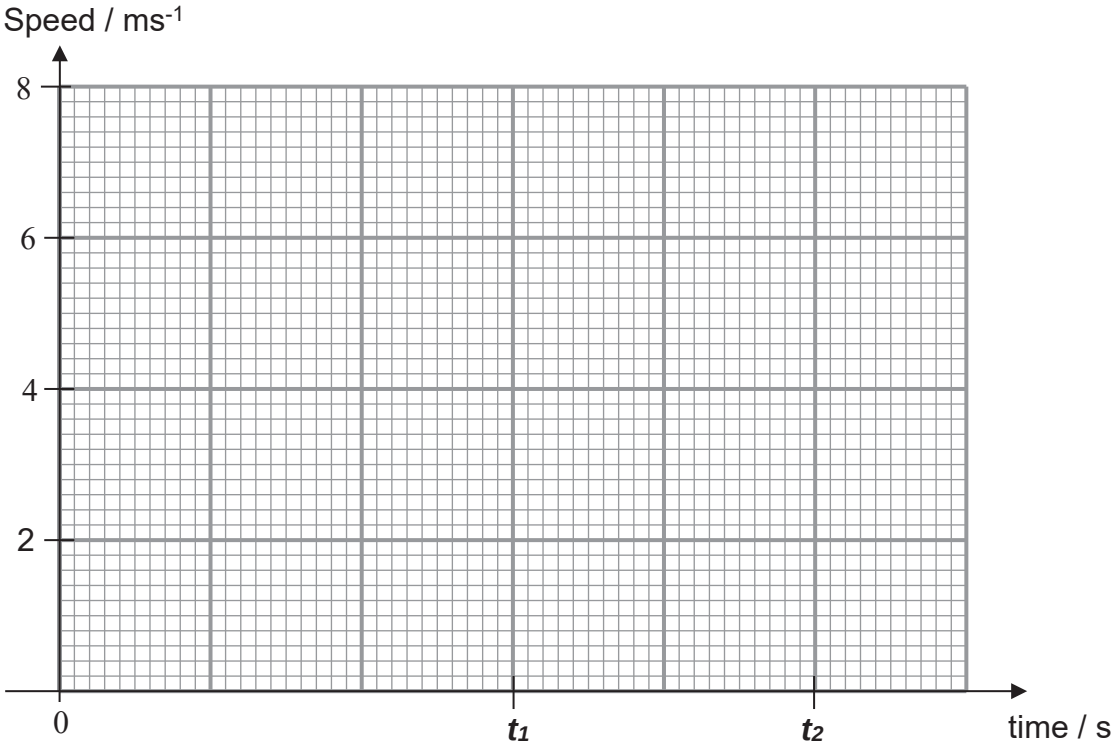


Fig. 1.3

2 **(a)** Fig. 2.1 shows a boat that has been lifted out of a river. The boat is suspended by two ropes. It is stationary. The weight of the boat, acting at the centre of mass, is 24 kN. The tensions in the ropes are T_1 and T_2.

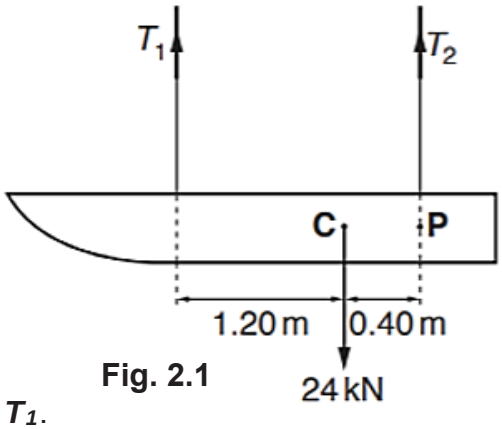


Fig. 2.1

Calculate the tension T_1.

tension = ... [2]

(b) Fig. 2.2 shows a student sitting on a chair. Fig. 2.3 shows the same student with his chair tilted backwards slightly.

Fig. 2.2

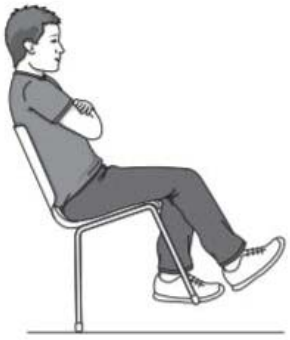


Fig. 2.3

(i) State and explain how the pressure of the chair on the floor differs in the two positions.

.....

.....[1]

(ii) If the chair is tilted backwards more than in Fig. 2.3, the chair and the student will fall to the ground. Explain why.

.....

.....

.....[2]

3 Fig. 3.1 shows an apparatus that is used to demonstrate some effects of heat transfer. The heater glows red when switched on. The heater is at the same distance from each bulb.

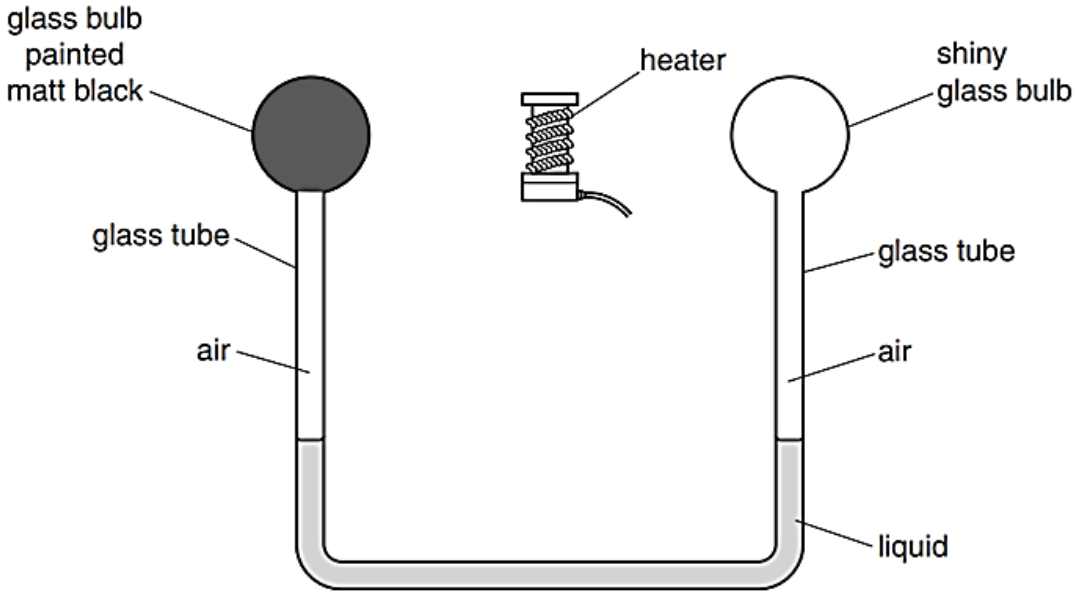


Fig. 3.1

One of the glass bulb is painted matt black while the other is a shiny glass bulb. The spaces above the liquid in the tubes contain air.

(a) State the two components of the electromagnetic spectrum that are emitted by the heater.

……..…….[1]

(b) Before the heater is switched on, the liquid levels in the two columns of glass tube are the same.

(i) State and explain the difference in the liquid levels in the two columns after the heater had been switched on for an hour.

……

…...……[2]

(ii) Using ideas about molecules, explain how the air particles causes the liquid in the two columns to move which results in the observation in **part b(i)**.

……

……

……

…...……[3]

(iii) The density of the liquid in the glass tubes is 12600 kg m^{-3}.

Calculate the height difference between the liquid columns if the pressure difference between the two columns is 1.2 x 10^4 Pa.

height difference = …….. [1]

4 Fig.4.1 shows a wave travelling along a rope at time $t = 0$.

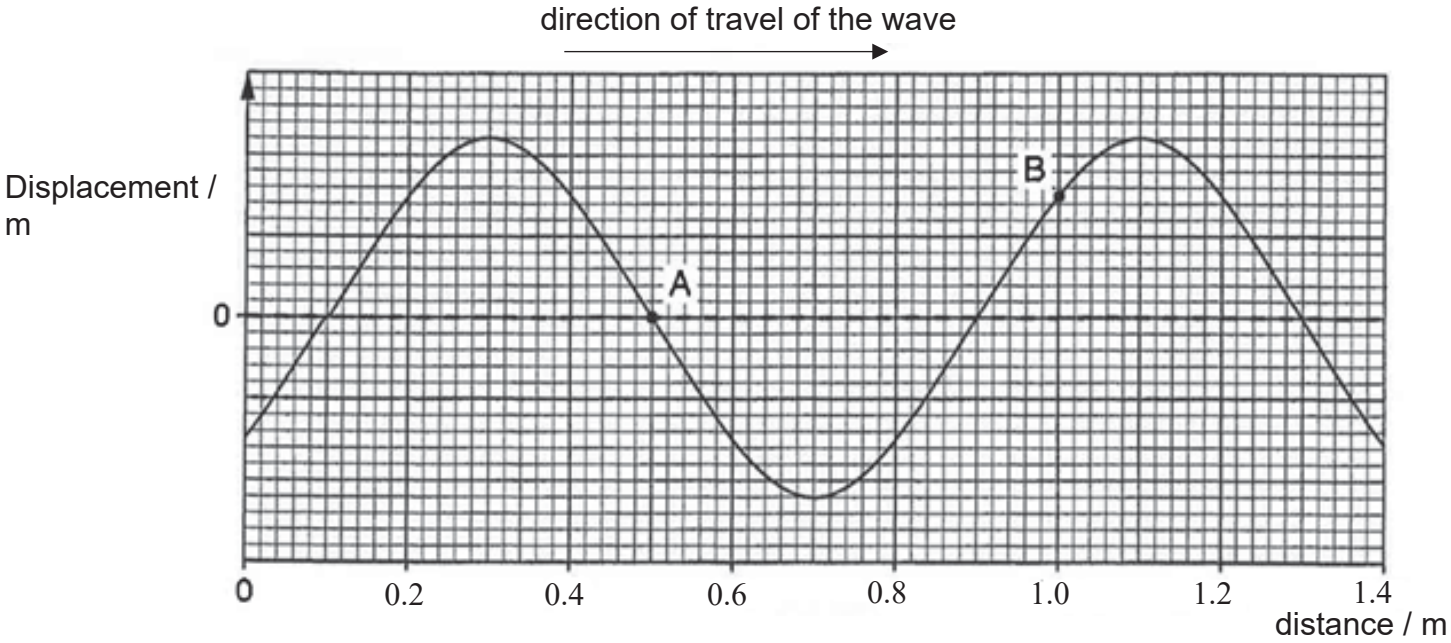


Fig. 4.1

Two points **A** and **B** on the rope are marked.

(a) Determine the wavelength of the wave.

wavelength = ... [1]

(b) The speed of the wave is 1.8 m/s.
Calculate the period of the wave.

period = ... [2]

(c) **(i)** Describe the movement of **A** for one complete cycle, starting from time $t = 0$.

.....

.....

.....[2]

(ii) Fig. 4.1 shows the displacement of particles **A** and **B**.
Calculate the time taken for particle **A** to move to the same displacement as of particle **B** as shown in Fig. 4.1.

time = ... [1]

5 **(a)** Explain what is meant by *critical angle*.

……..

……..[2]

(b) Diamonds are attractive because of their ability to reflect light. The critical angle for diamond is 24°.

Calculate the refractive index of diamond.

refractive index = …….. [1]

(c) Fig. 5.1 and Fig. 5.2 shows two diamonds of different shapes. A ray of light enters each diamond, as shown.

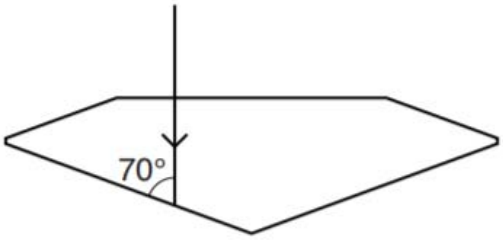


Fig. 5.1

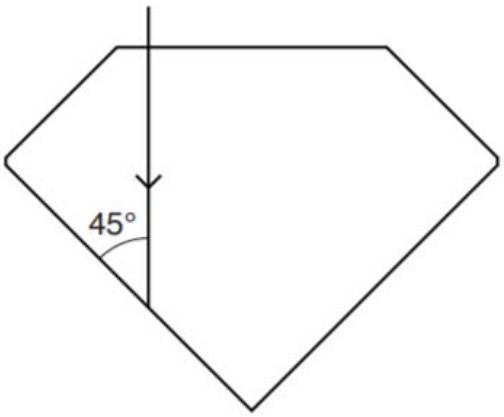


Fig. 5.2

(i) Explain why the light is **not** refracted when entering both diamonds.

……..

…….. [1]

(ii) On Fig. 5.1 and 5.2,

(1) continue the path of each ray of light until it emerges into air, [2]

(2) calculate and indicate the angles of reflection or refraction where applicable. [2]

6 An electrostatic generator is used to produce sparks, as shown in Fig. 6.1.

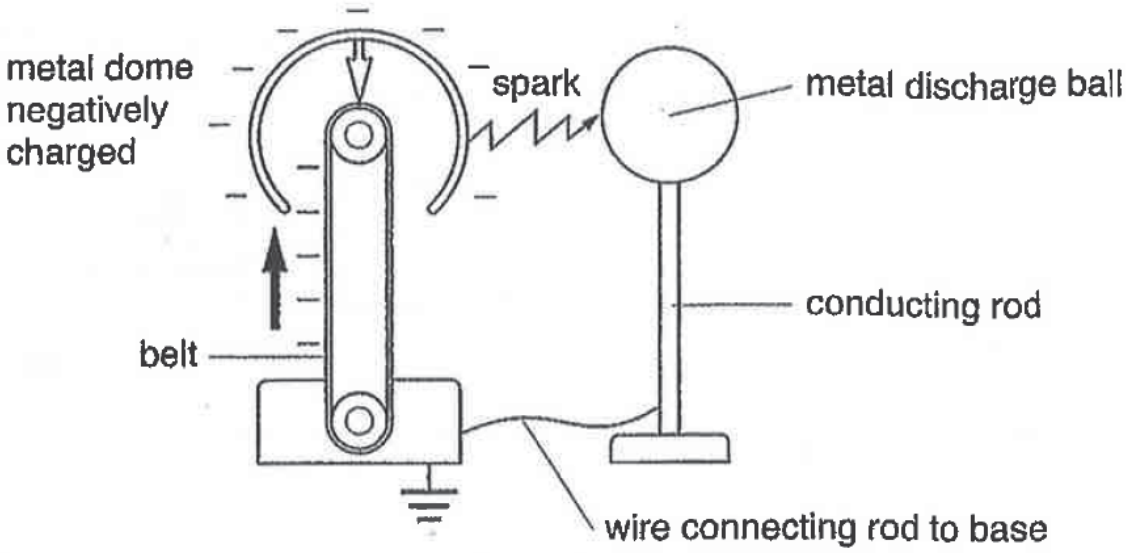


Fig. 6.1

The belt carries negative charge to the dome, making it negatively charged.

(a) Before a spark is produced, the discharge ball becomes positively charged. Describe and explain why the metal discharge ball becomes charged.

……..

……. [2]

(b) On Fig. 6.1, mark an **X** to show where the most positive charge on the discharge ball is. [1]

(c) When there is enough negative charge on the dome, a spark jumps between the dome and the discharge ball resulting a current of 0.3 mA for 0.0015 s.

Calculate the amount of charge that jumped between the dome and the discharge ball.

amount of charge = ……[2]

7 Fig. 7.1 shows a simple design of a hair dryer. Switch **S** can be connected to either contact **P** or **Q**.

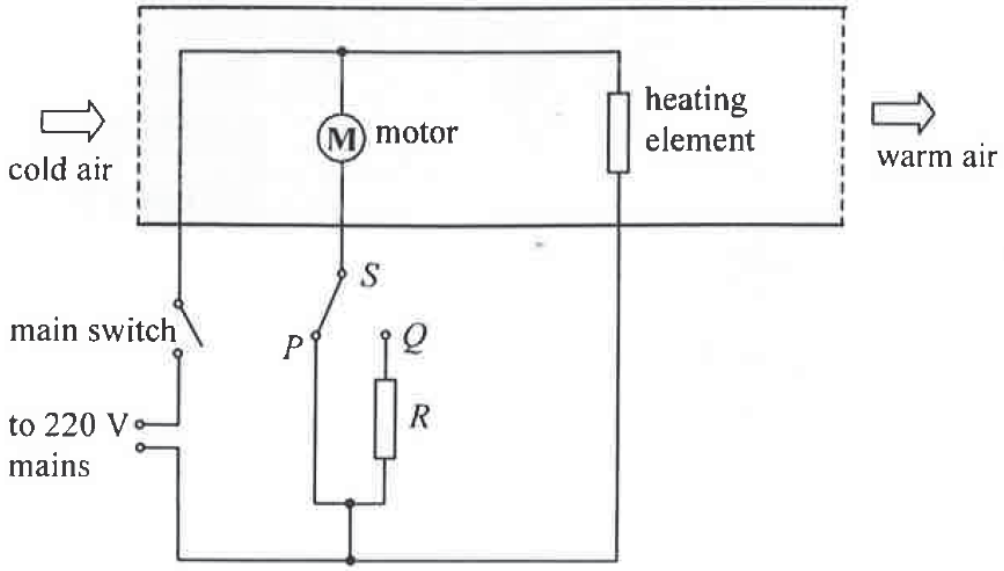


Fig. 7.1

The switch **S** is connected to contact **P**. The information for the hair dryer is as follows:

Resistance of heating element = 60.0 Ω
Rate of air flowing through the dryer = 0.040 kgs^{-1}
Temperature of air flowing into the dryer = 28.7 °C
Specific heat capacity of air = 1000 J kg^{-1} $°C^{-1}$

(a) Calculate

(i) the power of the heating element,

power = …….. [2]

(ii) the temperature of the air flowing out of the dryer.

temperature = ……[2]

(b) If switch **S** is connected to contact **Q** instead, state and explain the effect on the air flowing out of the dryer.

……

……

……[2]

8 **(a)** Fig. 8.1 shows a beaker is filled with mercury. L_1 and L_2 are conducting wires. Current flows through the resistor when the circuit is switched on.

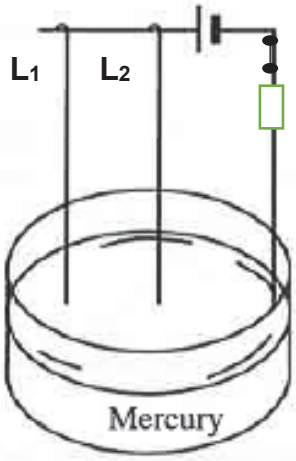


Fig. 8.1

With the aid of a diagram, explain the forces acting between the wires L_1 and L_2.

……

……

……[3]

(b) Fig. 8.2 shows a coil in a magnetic field.

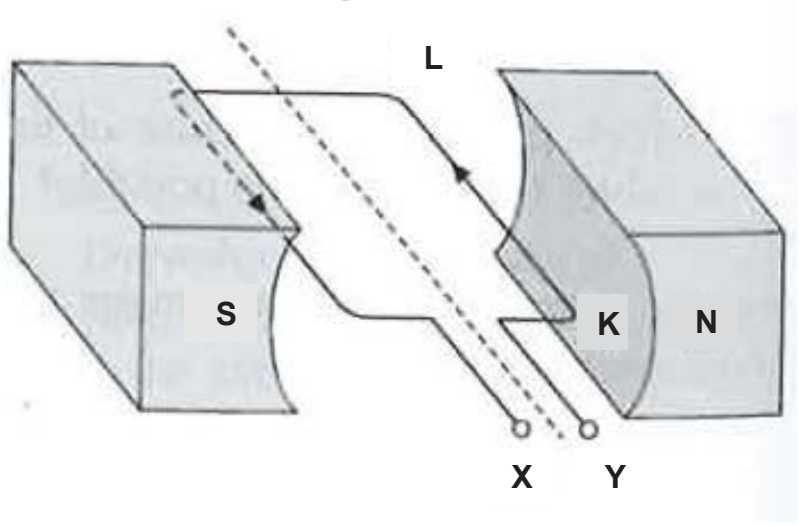


Fig. 8.2

The coil is connected to a dc power supply **Y** which is connected to the positive terminal of the power supply.

(i) If the coil is free to rotate, state and explain in the direction that the side **KL** will initially move.

……

……

……[2]

(ii) State and explain an additional part that need to be connected to the set up for it to work as part of a fan.

……

……

……[2]

Section B

Answer **all** the questions in this section.
Answer only one of the two alternative questions in **Question 11**.

9 Hooke's law states that within its limit of proportionality, the compression of a spring is directly proportional to the force applied on it.

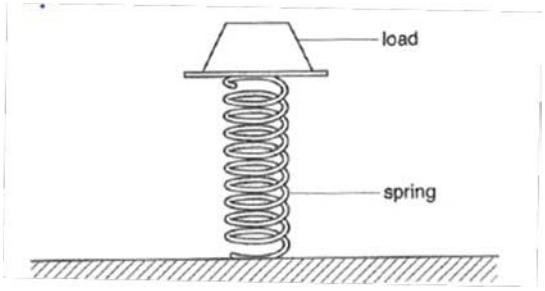


Fig. 9.1

A variation of compression of the spring with the applied load is shown on Fig. 9.2.

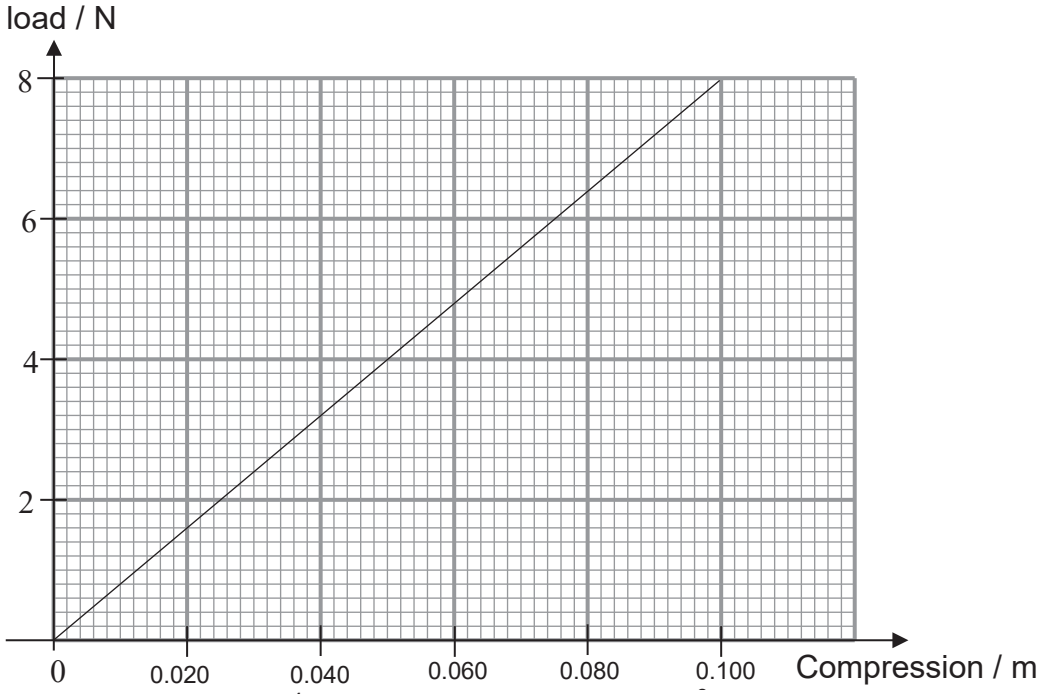


Fig. 9.2

(a) The elastic potential energy stored in a spring can be calculated by the area under the load-compression graph.

Calculate the elastic potential energy when 640 g mass is placed on the spring.

energy stored = …… [2]

(b) Alternatively, the elastic potential energy stored in the spring can be calculated using the equation

$$Elastic\ potential\ energy = \frac{1}{2}kx^2$$

where $\boldsymbol{x}$ is the length of compression and $\boldsymbol{k}$ is the gradient of the load against compression graph.

Calculate the elastic potential energy when 640 g mass is placed on the spring using the equation and show that you will obtain the same answer as in **part (a)**. [2]

(c) The spring in **(a)** is now used to propel a steel ball along a circular frictionless track as shown in Fig. 9.3.

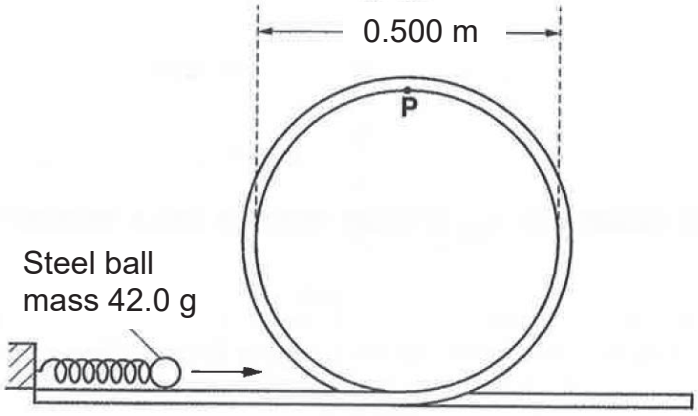


Fig. 9.3

The track loops around to form a vertical circle of diameter 0.500 m. Point **P** is at the top of the track.

The spring is compressed by 0.080 m. The ball of mass 42.0 g is placed next to the end of the compressed spring. The spring is then released so that the ball is fired horizontally on the track.

It may be assumed that all the elastic energy stored in the spring is converted into kinetic energy of the ball.

Calculate

(i) the gravitational potential energy of the ball at point **P**,

gravitational potential energy = ... [1]

(ii) the speed of the ball at point **P**.

speed = ... [3]

(d) The spring is again compressed to 80 mm. Another ball, with a bigger mass of 50.0 g, is placed next to the end of the compressed spring. The spring is then released so that the ball is fired horizontally on the track.

Compare the speed of this ball to the speed of the ball in **part (c)**. Explain your answer. No calculation is needed.

.....

.....

.....[2]

10 Fig. 10.1 shows a telephone ear-piece that makes use of an electromagnet when a signal is received by the ear-piece. In front of the electromagnet is a thin flexible metallic diaphragm which is attracted by the electromagnet.

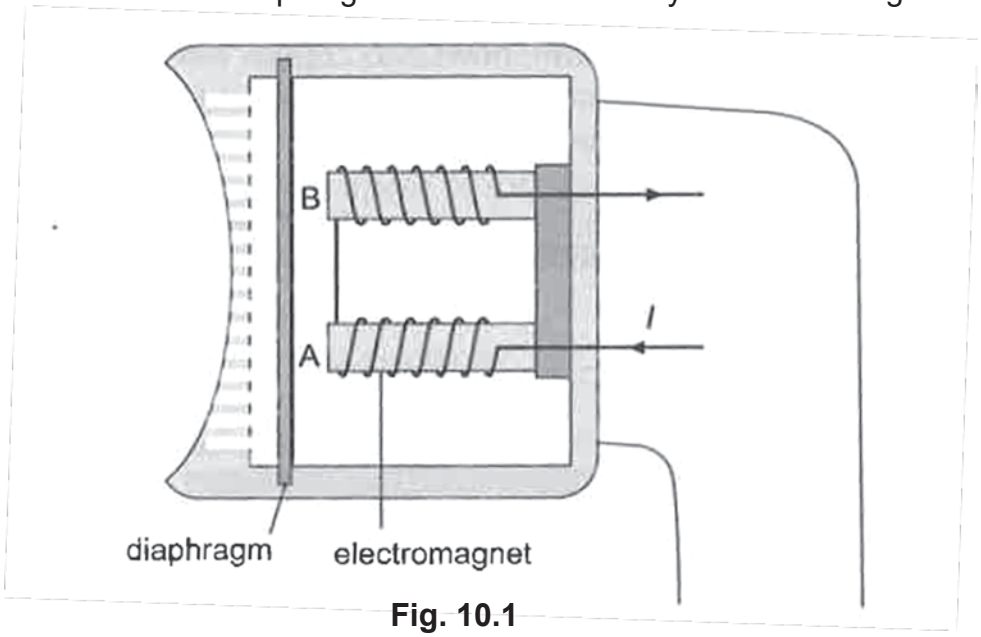


Fig. 10.1

(a) State and explain a suitable metal for the diaphragm.

……

……

……[2]

(b) If the current ***I*** in the coil is in the direction as shown in Fig. 10.1, identify the magnetic poles produced at the ends **A** and **B** of the electromagnet.

……[1]

(c) Explain how sound is produced from the ear-piece when a current of varying magnitude flows in the coil of the electromagnet and is transmitted to the ear.

……

……

……

……

……[4]

(d) The phone is connected to a voltage of a power supply that varies with time as shown in Fig. 10.2.

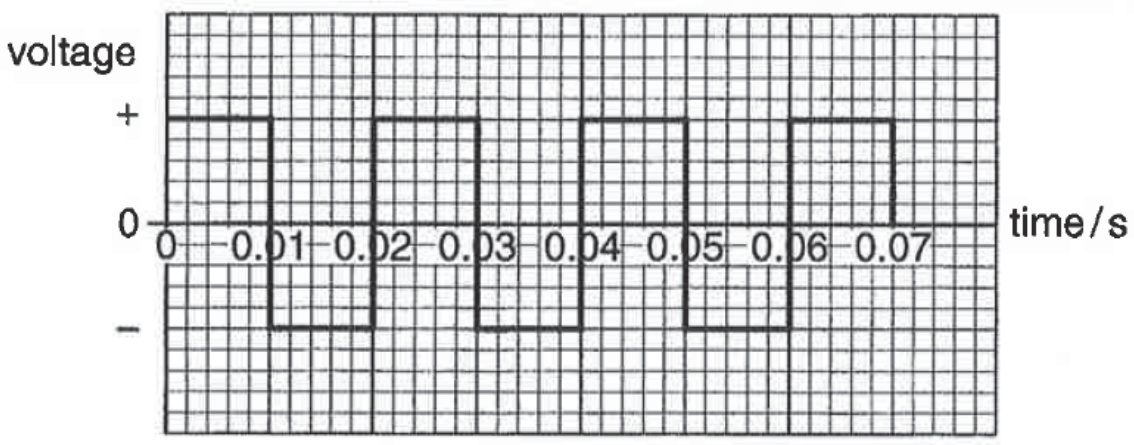


Fig. 10.2

(i) Calculate the frequency of the sound wave produced.

frequency = …… [1]

(ii) A new smaller voltage with a period of 0.01s is used in the coil. Describe and explain how the sound produced is different from the previous sound in **part (i)**.

……

……

……[2]

11 Either

(a) A thermistor is used as a temperature sensor in a circuit to monitor and control the temperature of water in a tank. Part of the circuit is shown in Fig. 11.1.

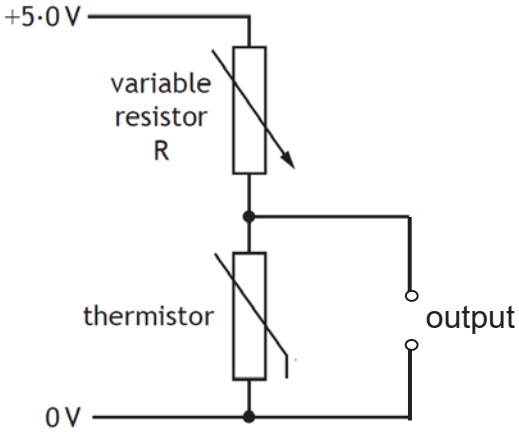


Fig. 11.1

The variable resistor **R** is set at a resistance of 1050 Ω.
Calculate the resistance of the thermistor when the voltage across the thermistor is 2.0 V.

resistance = ... Ω [2]

(b) The circuit is now connected to a relay circuit to operate a heater as shown in Fig. 11.2. The relay circuit consists of a relay coil and switch which acts as an electromagnetic switch that can turn on or off the heater.

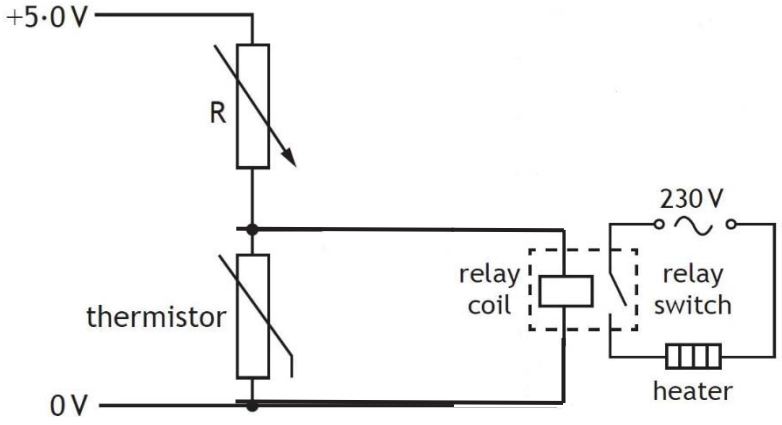


Fig. 11.2

(i) Explain how the circuit operates to switch on the heater when the temperature falls below a certain value.

……

……

……[2]

(ii) The resistance of the variable resistor **R** is now increased.

State and explain the effect this has on the temperature at which the heater is switched on.

……..……

……..……

……...……..……[1]

(iii) The heater is placed in a water tank. Explain why the heater is placed near to the base of the tank.

……..……

……..……

……...……..…..……[2]

(iv) The heater has a power rating of 800 W.

(1) Calculate a suitable fuse rating to be used for the heater.

fuse rating = ……. [1]

(2) Calculate the cost of using the heater for 2 hours daily for a week if the unit cost of electricity is $0.28.

cost = ……. [2]

OR

(a) Fig. 11.3 shows an arrangement of three resistors.

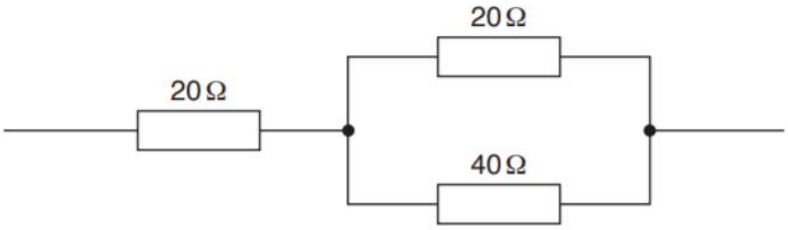


Fig. 11.3

(i) Calculate the total resistance of this arrangement.

resistance = ... [2]

(ii) The arrangement is connected to a d.c. power supply. Voltmeters are placed across the resistors, as shown in Fig. 11.4 . There is a current in each resistor.

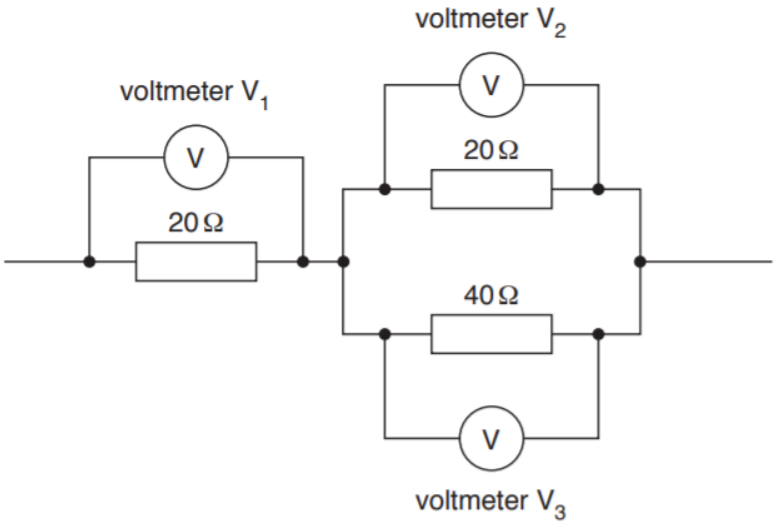


Fig. 11.4

Compare the readings on the three voltmeters. There is no need for any calculation. Explain your answers.

……

……

……

……[3]

(b) A microwave oven has a power input of 920 W.

(i) A container in the oven contains water at its boiling point. The energy absorbed by the water is 45 % of the input energy supplied to the oven.

The specific latent heat of vapourisation of water is 2.3×10^6 J/kg.

Calculate the mass of water that turns to steam in 3 minutes.

mass = …….. [3]

(ii) Fig. 11.5 shows an electrical plug of the microwave oven that is wrongly connected.

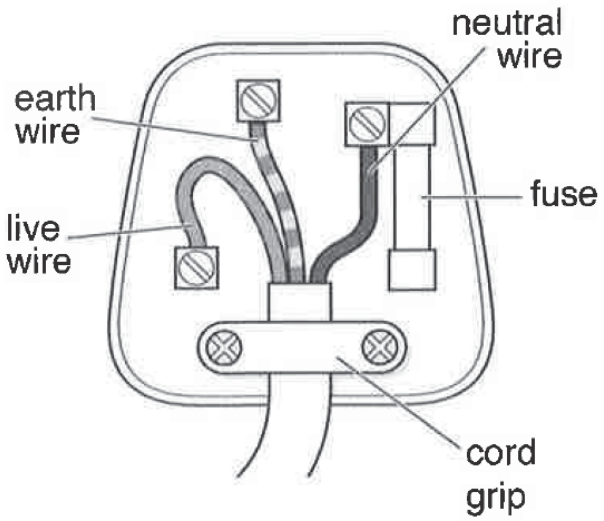


Fig. 11.5

State what is wrong with the wiring and explain why the wiring shown in Fig. 11.5 is dangerous.

……

……

……[2]

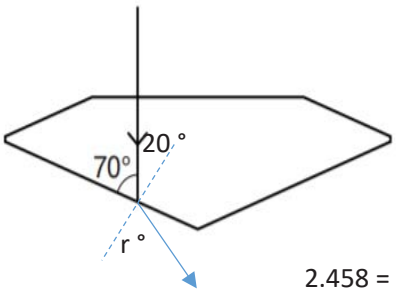
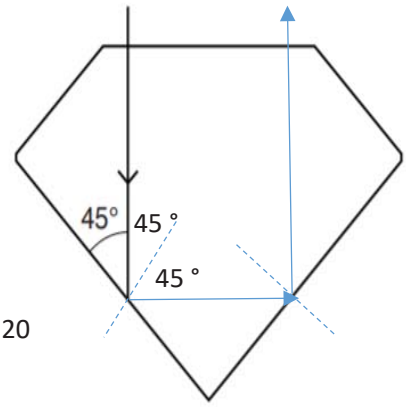
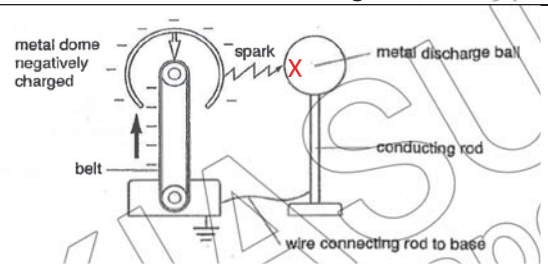
- End of paper -

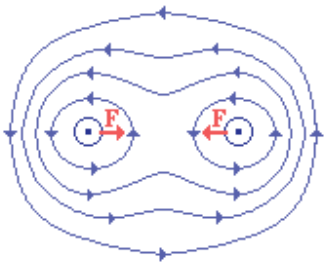
Preliminary Exam 2020
Paper 1

1. B	11. B	21. B	31. A
2. C	12. C	22. D	32. D
3. C	13. C	23. A	33. C
4. D	14. B	24. C	34. D
5. A	15. B	25. B	35. C
6. C	16. B	26. C	36. D
7. C	17. A	27. B	37. D
8. C	18. B	28. A	38. A
9. B	19. A	29. D	39. A
10. C	20. A	30. B	40. B

Physics P2

1(a)	Gravitational field strength is the force of gravity on an object per unit mass.	1
b	Resultant force = 400 N F = ma 400 = **60** x a a = 6.67 m/s^2	1 1
c	Decreasing acceleration Constant speed Speed = 5 m/s	1 1 1
2a	Taking pivot about T_2, 24 000 x 0.40 = T_1 x 1.60 T_1= 6 000 N	 1 1
bi	In Fig. 2.3, the pressure is greater. The same amount of force is applied but on a smaller base area.	1
ii	The base of the pivot acts as a pivot. When the boy tilt further backwards, the line of action of his weight lies outside the base area. The weight causes an anticlockwise moment that causes the boy to fall.	1 1
3a	Infra red and visible light	1
bi	Heat is mainly transferred to the glass bulb by radiation. Matt black is a better absorber of radiation. The liquid column in the glass tube connected to the matt black bulb will be lower.	1 1
ii	The air in the liquid column in the glass tube connected to the matt black bulb will be at a higher pressure. The air molecules gain more kinetic energy and hit the surface of the liquid with a greater force. The rate of collision of the air molecules with the surface of the liquid also increases relatively more.	1 1 1
iii	P = ρgh 1.2 x 10^4 = 12 600 x 10 x h H = 0.095 m	 1
4a)	0.8 m	1
b	V = f λ 1.8 = f x 0.8 f = 2.25 Hz T = 1/ 2.25 = 0.4 s	 1 1
c	Particle moves up to the crest *at 0.1 s*, then moves to the trough *at 0.3s* and back to the rest position at *0.4 s*.	1,1
ii	1/8 x 0.4 = 0.05 s	1
5a	Critical angle is the *angle of incidence in the denser medium* where the angle of refraction is 90°.	1 1
b	n=1/sinc = 1 / sin 24 = 2.458 = 2.5	1
ci	Light is not refracted when it enters the denser medium at angle of incidence of 0°.	1

ii	 2.458 = sin r / sin 20 r =  Refraction Angle of refraction = Total internal reflection Angle of reflection = 45 °	 1 1 1 1
6	The negative charge on the dome repel the electrons from the metal discharge ball as like charges repel. Electrons flows from the discharge ball to the earth.	1 1
b		1
c	I = Q/t 0.3×10^{-3} = Q /0.0015 Q = 4.5×10^{-7} C	 1 1
7a i	P = V^2 / R = 220^2 / R = 806.66 = 807 W	 1 1
ii	Q/t = m/t c $\Delta\theta$ 806.66 = 0.04 x 1000 x $\Delta\theta$ $\Delta\theta$ = 20.167 θ = 48.9 °C	 1 1
b	Given the same voltage (220V), with higher resistance, the current flowing through the branch will be smaller. The motor will move slower and smaller rate of air flow. The power of the heating element remains the same. Since the same amount of heat generated to heat a smaller mass of air and the temperature of the air will be higher.	1 1

8a)	 Diagram Magnetic field around the wires in correct direction Resultant force of attraction	 1 1 1
b i	KL will move upwards. Using Fleming's left hand rule, the magnetic field is to the left, current is into the paper and force is upwards	1 1
ii	Split ring commutator It enables the direction of the current in the coil to change every 180°. This enables the coil to turn continuously.	1 1

Section B

9a	Compression = 0.080 m ½ x **6.40** x 0.08 = 0.256 J	 1 1
b	Gradient = 8/ 0.100 = 80 ½ x 80 x 0.080 x 0.080 = 0.256 J	1 1
Ci	GPE = mgh = 0.042 x 10 x 0.500 = 0.210 J	1
ii	KE = 0.256 – 0.210 = 0.046 J $0.046 = ½ \times 0.042 \times v^2$ V = 1.48 m/s	1 1
d	The speed will be the lower. For a bigger mass, more of the elastic energy is converted to the gravitational potential energy. Lesser Kinetic energy is left at P	1 1
10a	Iron which is a soft magnetic material. It is easy to magnetized and easy to demagnetized.	1 1
B	South and South	1
c	Different current will results in different strength of the magnetic field. The attraction force of the diaphragm will change and cause it to vibrate and produce sound. The vibration of the diaphragm will cause the air particles beside it to vibrate. This form a series of compression and rarefaction. The sound energy is transmitted through the longitudinal wave.	1 1 1 1
Di	f = 1/0.02 = 50 Hz	1

ii	Smaller period will result with a higher frequency of the voltage. Higher frequency will produce sound with a higher pitch.	1 1
11a	V = RI 3 = 1050 x I I = 3/1050 V = RI 2 = R 3/1050 R = 700 Ω	 1 1
bi	When the temperature decrease, the resistance of the thermistor increases, Voltage across increases, voltage across external circuit increases.	1 1
ii	It will take a greater decrease in temperature to achieve the same voltage across the thermistor and to switch on the external circuit.	1
iii	To enable convection current to take place. Hot water rises, cold water sink. Hot water has lower density than cold water.	1 1
iv (1)	P=IV 800 = I x230 I= 3.478 = 3.48 A Fuse rating = 5 A	 1
(2)	E = Pt = 0. 800 x 2 x 7 = 11.2 Cost = 11.2 x $0.28 = $3.136 = $3.14	 1 1
Or A i	1/R = 3/40 R = 13.3Ω Total resistance = 33.3 Ω	 1 1
ii	V_2 is equal to V_3 because they are parallel. Current through the resistor connected to V_1 is bigger before it is split at the branch. V=RI, therefore the 20 Ω resistance will have a bigger voltage than the 20 Ω that is in parallel. V_1 is bigger than V_2	1 1 1
B i	45% x 920 = 414 W E = 414 x 3 x 60 = 74 520 J 74 520 = 2.3 x 10^6 x m m = 0.0324 kg = 0.032 kg	1 1 1
ii	The switch and fuse will be connected to the live wire. Even when the switch is off or the fuse blows, the appliance is still connected to the high voltage supply. User may get electric shock when touching the appliance.	1 1