Name: _____ ( ) Class: _____

FAIRFIELD METHODIST SCHOOL (SECONDARY)

PRELIMINARY EXAMINATION 2014
SECONDARY 4 EXPRESS

PHYSICS 5059/01

PAPER 1

Date: 29 August 2014 Duration: 1 hour

READ THESE INSTRUCTIONS FIRST

Do not open this Booklet until you are told to do so.
Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, index number and class 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 total number of marks for this paper is 40.

Parent's Signature:

For Examiner's Use	
Paper 1	/40

Setters: Mr Keith Liew & Mrs Jean Ho

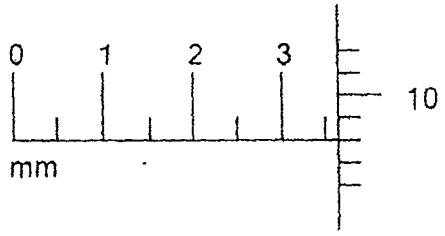
This document consists of 15 printed pages including the cover page.

Name: _____ ( ) Class: _____

1. Which of the following is NOT a base unit?

   A ampere B kelvin
   C metre D newton

2. The diagram shows part of a micrometer screw gauge.

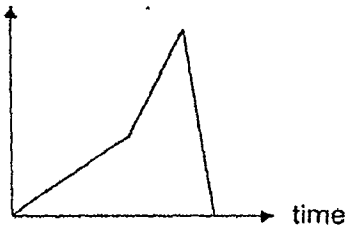


   What is the reading shown?

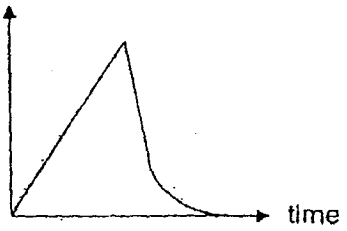
   A 3.08 mm B 3.12 mm C 3.58 mm D 3.62 mm

3. Which of the following graph cannot be used to describe the motion of a car?

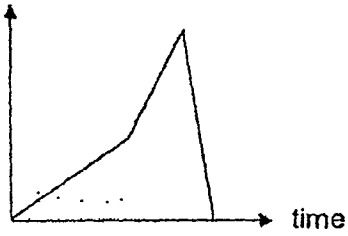
A distance



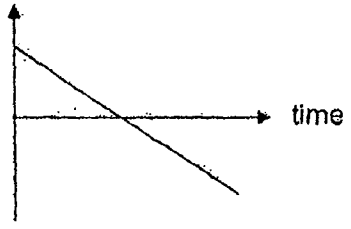
B displacement



C speed



D velocity



4. A lorry moves at a constant velocity of 5 ms^{-1} for 3 s and then accelerates to 10 ms^{-1} in 2 s.

   What is the total distance travelled by the lorry?

   A 5 m B 15 m C 30 m D 45 m

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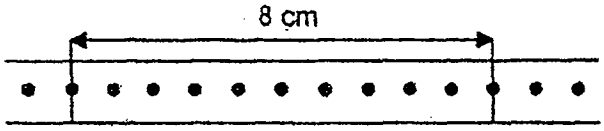
5. The diagram shows a section of tape pulled through a 50 Hz ticker timer.



What is the speed at which the tape is being pulled?

A 0.727 ms^{-1} B 0.800 ms^{-1} C 40 ms^{-1} D 80 ms^{-1}

6. A rifle with a mass of 5 kg was fired and it recoiled with an acceleration of 10 ms^{-2}.

What is the acceleration of the bullet which has a mass of 10 g?

A 5 ms^{-2} B 10 ms^{-2} C 500 ms^{-2} D 5 000 ms^{-2}

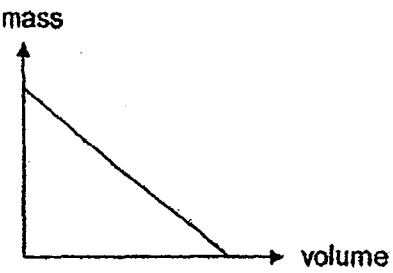
7. A lift and three men inside have a total mass of 550 kg and the lift moves upwards with an acceleration of 2.0 ms^{-2}.

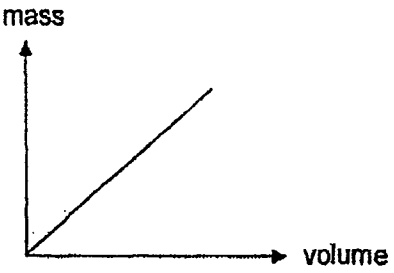
What is the tension in the cable of the lift?

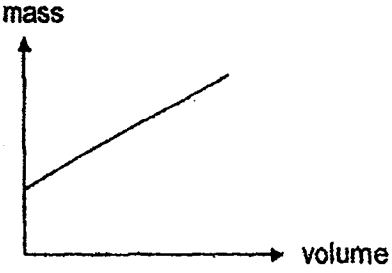
A 1 100 N B 4 950 N C 5 500 N D 6 600 N

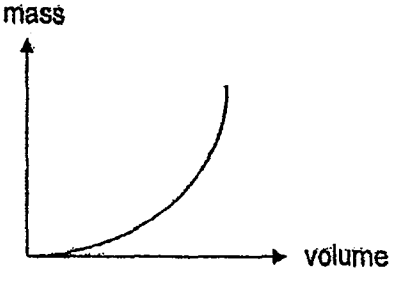
8. In an experiment to determine the density of a certain type of wood, some students measured the masses and volumes of different sized samples of wood.

Which graph shows their results?

A


B


C


D


Name: _____ ( ) Class: _____

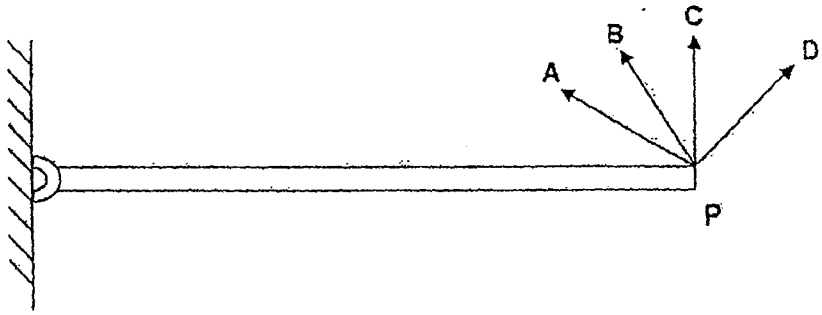
9. An object **K** floats in liquid **L** but sinks in liquid **M**.

   Which of the following statements is correct?

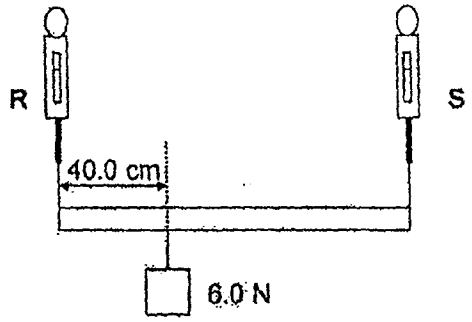
   A Liquid **L** is less dense than object **K**.
   B Liquid **M** is denser than object **K**.
   C Liquid **M** is less dense than liquid **L**.
   D Liquid **M** is denser than liquid **L**.

10. The diagram below shows a force applied in several different directions at the point **P** on a hinged beam.

    In which direction will the same force produce the smallest moment about the hinge?



11. A load of 6.0 N is placed on a light rod which is suspended from two Newton meters **R** and **S** as shown in the figure. The length of the rod is 1.0 m.

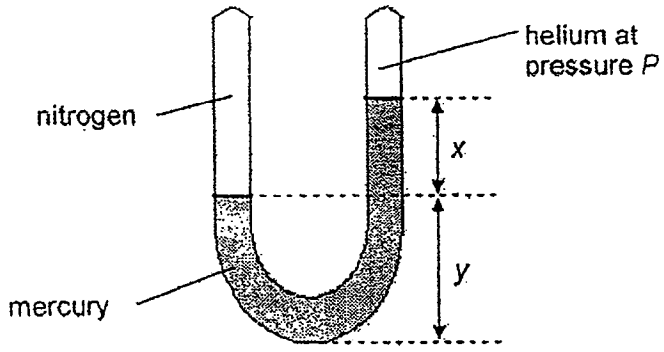


What are the readings on the Newton meters?

	Reading of R	Reading of S
A	2.4 N	3.6 N
B	3.0 N	3.0 N
C	3.6 N	2.4 N
D	6.0 N	6.0 N

Name: _____ ( ) Class: _____

12. A sealed U-tube contains nitrogen in one arm and helium at pressure P in the other arm. The gases are separated by mercury of density ρ. The acceleration of free fall is g.



What is the pressure exerted by nitrogen?

A P
B $P - x\rho g$
C $P + x\rho g$
D $x\rho g$

13. Which of the following best describes the useful energy change that takes place inside a mobile phone when sound is being produced?

A electrical energy → sound energy
B chemical energy → electrical energy → thermal energy
C chemical energy → thermal energy → electrical energy + sound energy
D chemical energy → electrical energy → sound energy

14. An electric motor is required to haul an object of weight 600 N up a vertical height of 100 m in 2.0 minutes.

What will be the electrical power required if the overall efficiency of the motor is 80%?

A 400 W B 625 W C 24 kW D 37.5 kW

15. Smoke particles suspended in the air are viewed through a microscope and are observed to move about in a random motion.

What caused the smoke particles to move in this manner?

A Air molecules colliding with one another.
B Air molecules colliding with smoke particles.
C Convection currents in the air.
D Small changes in the temperature of the air.

Name: _____ ( ) Class: _____

16. Copper is often chosen as the material to make cooking utensils.

Which of the following explanation(s) is / are correct?

I Copper has a low melting point.
II Copper has a low specific heat capacity.
III Copper is a good conductor of thermal energy.

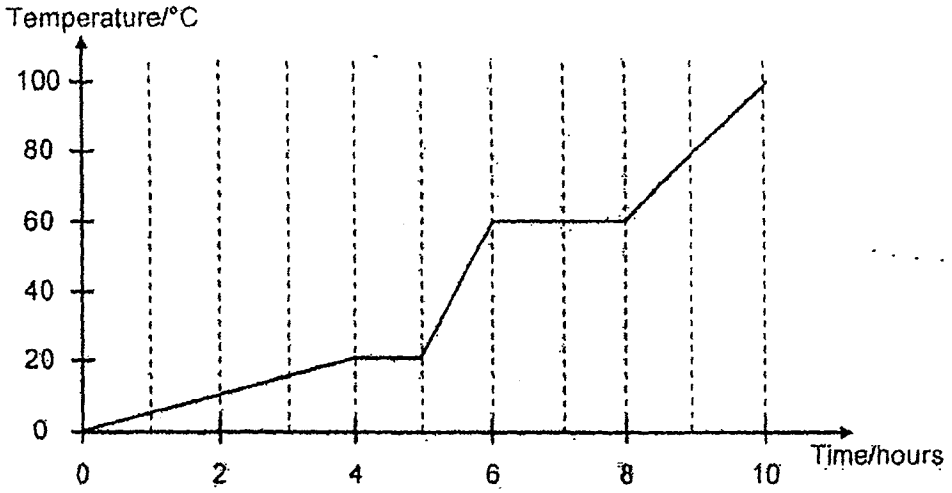
A I & II
B I, II & III
C II & III
D III only

17. A liquid in a thermometer is used to measure a change in temperature.

Which of the following is true of the change in properties of the liquid?

	mass	volume	density
A	change	change	change
B	change	constant	constant
C	constant	change	change
D	constant	change	constant

18. A sample of a material is heated at a constant rate from solid state until it reaches the gaseous state and a graph of temperature against energy is shown below.



Which of the following can be deduced from the graph?

A The heat capacity of the material increases with temperature.
B The specific heat capacity of the material is smallest when in the liquid state.
C The specific latent heat of fusion is larger than the specific heat capacity.
D The specific latent heat of fusion is twice the specific latent heat of vaporisation.

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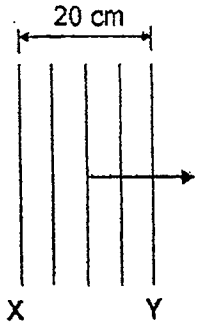
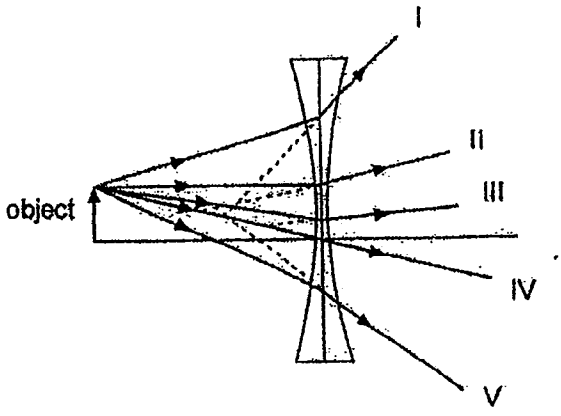
19. The diagram shows parallel water wave travelling in a ripple tank. The wavefront at X travels to Y in 5.0 s.



What is the frequency of the water wave?

A 0.008 Hz B 0.8 Hz C 1.0 Hz D 80 Hz

20. The diagram shows light rays from the object passing through the diverging lens. Two light rays are drawn incorrectly.



Which two light rays are drawn **incorrectly**?

A I and II
B I and V
C II and III
D II and IV

21. A man attempts to read small prints from a book using a magnifying glass. The focal length of the lens is 4.0 cm.

How close can he hold the book to the magnifying glass?

A between 4.0 to 8.0 cm
B exactly at 4.0 cm
C greater than 4.0 cm
D less than 4.0 cm

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22. Which of the following is a possible value for the wavelength of X-rays given than the wavelength of red light is 700 nm?

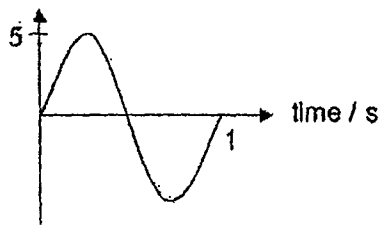
A 5×10^{-10} m
B 5×10^{-7} m
C 5×10^{-5} m
D 5×10^{-2} m

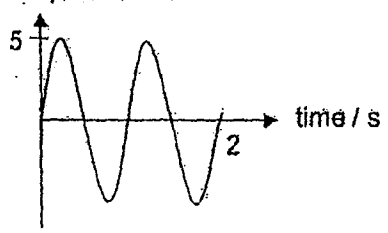
23. Which statement(s) is/are true at the centre of a rarefaction of a sound wave travelling through the air?

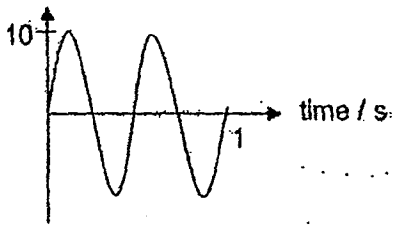
I the air particle is momentarily at rest.
II the pressure of the air is the lowest.
III the displacement of the air particle is the greatest.

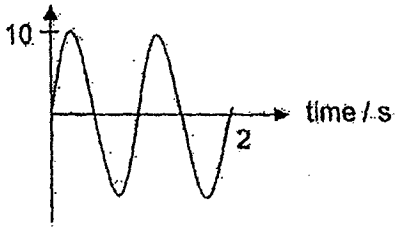
A II only
B III only
C I and III only
D II and III only

24. Which of the following shows a sound that is loudest and of the highest pitch?

A


B


C


D


25. A positively charged rod is brought near but not touching an earthed spherical conductor.

Which statement about the conductor is correct?

A It will be charged negatively by electrons being attracted from the earth.
B It will be charged negatively by protons being repelled to the earth.
C It will be charged positively by protons being attracted from the earth.
D It will not be charged since it is earthed.

Name: _____ ( ) Class: _____

26. The diagram shows two uncharged metal spheres suspended by insulating threads and separated by a plastic sheet. A positively charged rod is brought near to the spheres.

Which diagram shows the correct resulting charge distribution on the spheres?

A

B

C

D

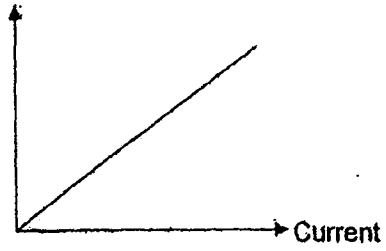
27. What is the amount of charge that passes through a point in a conductor if 20 mA flows pass the point in 5 minutes?

A 0.004 C B 0.1 C C 6 C D 100 C

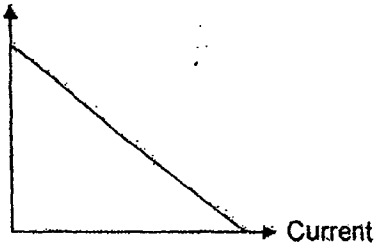
28. The voltage–current graphs for four electrical devices are shown below.

Which graph shows the resistance increasing as the current increases?

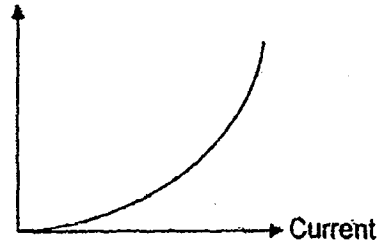
A



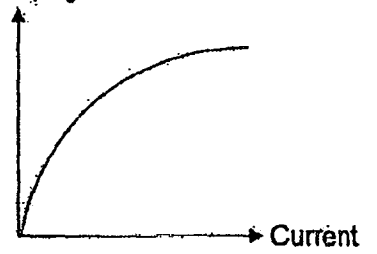
B



C



D



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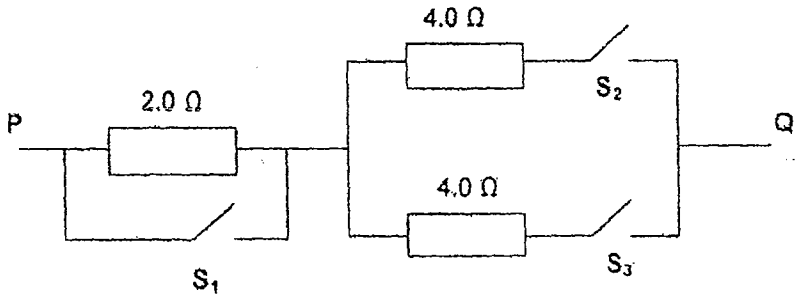
29. The diagram shows part of a circuit in which all the switches are open.

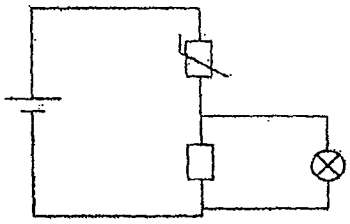


Which of the following combinations will result in a resistance of 2.0 Ω between P an Q?

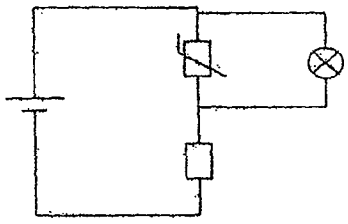
	S_1	S_2	S_3
A	Closed	Closed	Closed
B	Closed	Opened	Closed
C	Opened	Closed	Closed
D	Opened	Opened	Closed

30. In which of the circuits below will the bulb glow more brightly when less light shines c the circuit?

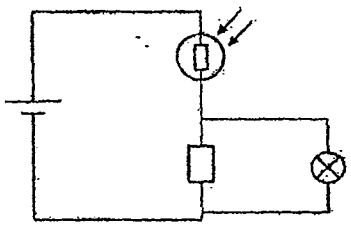
A



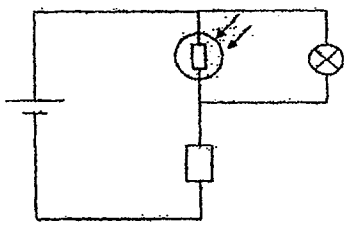
B



C



D



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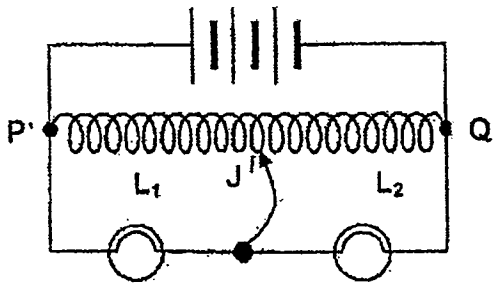
31. The circuit shows a coil of resistance wire PQ. The sliding contact J is slowly moved towards P.



What is the effect on the brightness of the lamps L_1 and L_2?

A Both become brighter.
B Both become dimmer.
C L_1 becomes brighter and L_2 becomes dimmer.
D L_1 becomes dimmer and L_2 becomes brighter.

32. Two heaters of rating "1 kW, 220 V" and "3 kW, 220V" respectively are connected in series to a 220 V supply.

What is the total power consumed by the heaters?

A 0.75 kW
B 1.5 kW
C 2.5 kW
D 4 kW

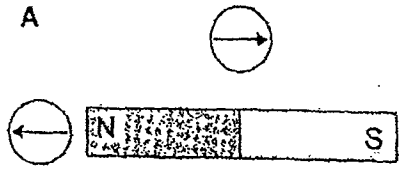
33. Which of the following best gives the reason why the earth wire is a necessity for many household appliances?

A To complete the circuit in order for the device to work.
B To protect the device against damage by preventing the excess current from flowing through the device.
C To protect the fuse in the electric plug.
D To protect the user against electrocution if the appliance becomes faulty.

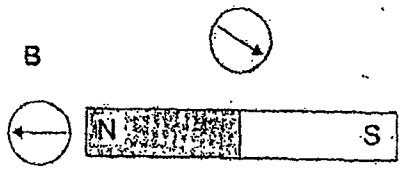
Name: _____ ( ) Class: _____

34. Which diagram correctly shows the directions of the plotting compasses placed around a bar magnet?

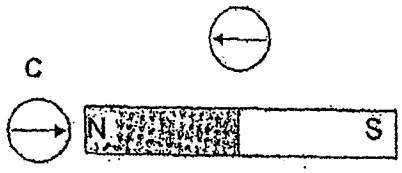
A



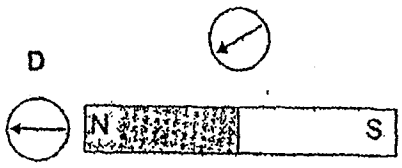
B



C



D



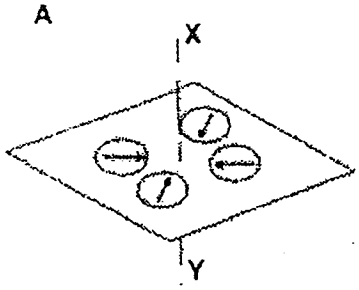
35. In which of the following devices should a permanent magnet be used?

A electric bell
B electric motor
C filament light bulb
D step-up voltage transformer

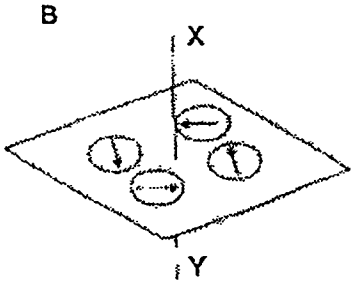
Name: _____ ( ) Class: _____

36. Which diagram correctly shows the direction of the plotting compasses when current flows from X to Y?

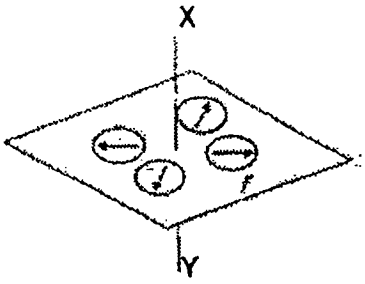
A



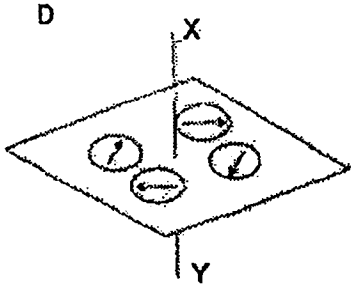
B



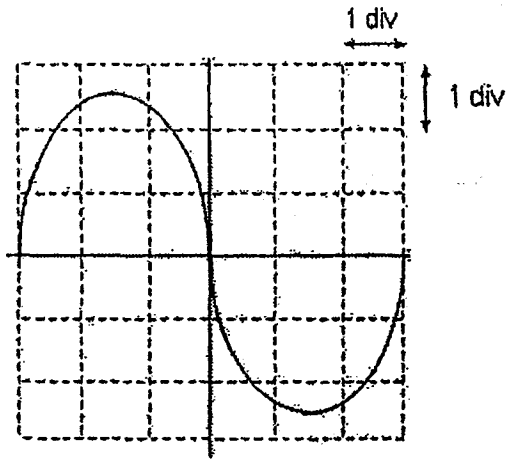
C



D



37. The diagram shows the voltage trace obtained when a source is connected to a c.r.o. The voltage gain is 2 V/div and the time base is 5 ms/div.

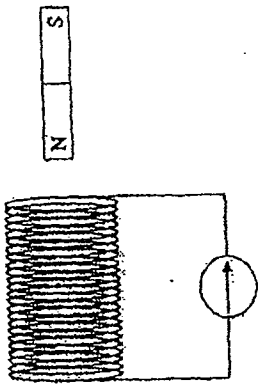


What are the amplitude and period of the input source?

	Amplitude / V	Period / ms
A	5	15
B	5	30
C	10	15
D	10	30

Name: _____ ( ) Class: _____

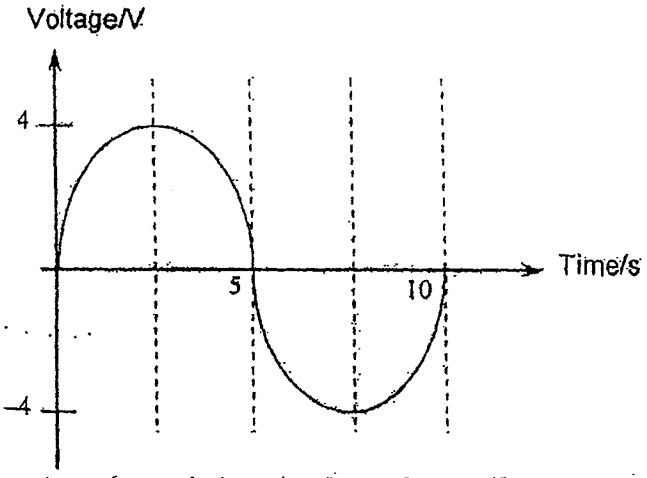
38. A bar magnet is dropped into a coil connected to a galvanometer. When the magnet approaches the top of the coil, the galvanometer pointer deflects momentarily to the left from the zero position.



How will the galvanometer pointer behave when the south pole of the magnet drops out from the bottom of the coil?

A deflects to the left and then to the right
B deflects to the left and then to the zero position
C deflects to the right and then to the left
D deflects to the right and then to the zero position

39. A simple a.c. generator produces a voltage that varies with time as shown.

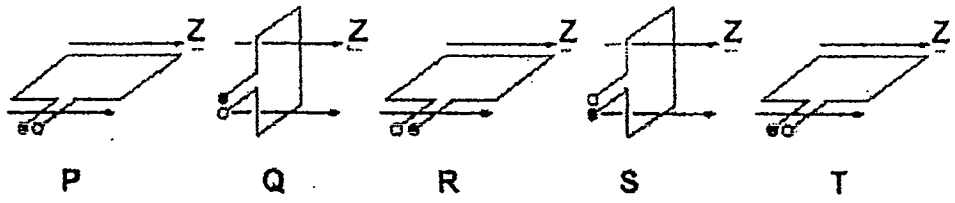


How will the period and maximum induced voltage change if the speed of rotation of the coil in the generator is doubled?

	Period of wave / s	Maximum voltage / V
A	5	2
B	5	8
C	20	2
D	20	8

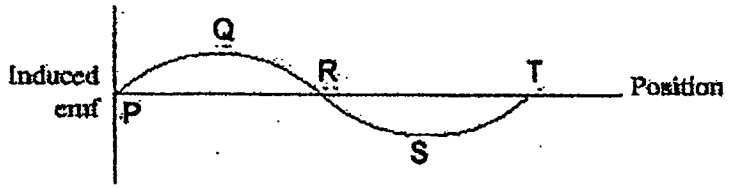
Name: _____ ( ) Class: _____

40. The coil of an a.c generator rotates at a constant rate in a magnetic field **Z** as shown.

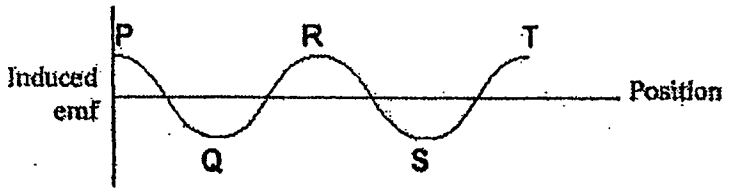


Which of the following shows the correct graph of induced emf against position?

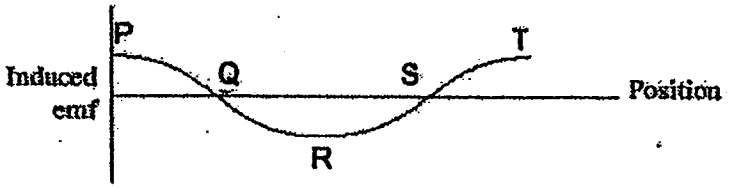
A



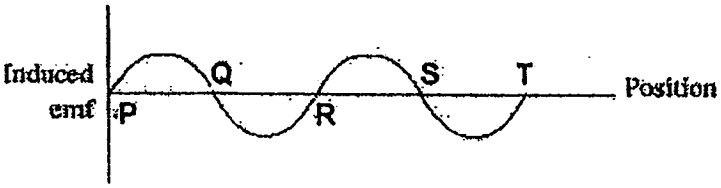
B



C



D



- End of paper 1 -

2014 FMSS Sec 4 Physics Prelim

ANSWER

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

Name: _____ ( ) Class: _____

FAIRFIELD METHODIST SCHOOL (SECONDARY)

PRELIMINARY EXAMINATION 2014
SECONDARY 4 EXPRESS

PHYSICS **5059/02**

PAPER 2

Date: 26 August 2014 **Duration: 1 hour 45 minutes**

READ THESE INSTRUCTIONS FIRST

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

Section A
Answer **all** questions.

Sections B
Answer **all** questions. Question 14 has a choice of parts to answer.
Hand in section A and section B separately.

Candidates are reminded that all quantitative answers should include appropriate units.
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.

The total number of marks for this paper is 80.

Parent's Signature:

For Examiner's Use	
Section A	/ 50
Section B	/ 30
Total	/ 80

Setters: Mr Keith Liew & Ms Jean Ho

This document consists of 19 printed pages including the cover page.

Name: _____ ( ) Class: _____

Section A (50 marks)
Answer **all** the questions in this section.

1. A small bearing of mass 30 g is dropped from rest at the mouth of a long glass tube which is partially filled with viscous oil as shown in Fig. 1.1. The velocity of the ball bearing varies with time as shown in Fig. 1.2.

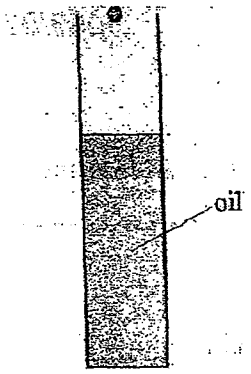


Fig. 1.1

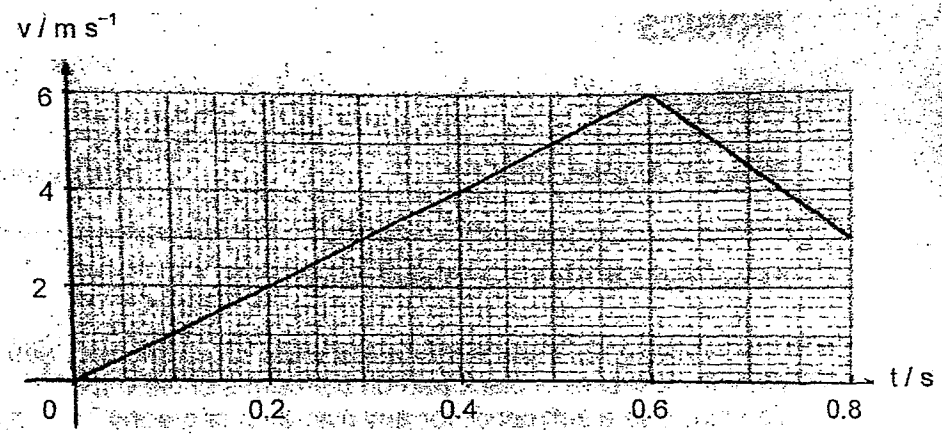


Fig. 1.2

a) Explain why the velocity of the ball decreases after t = 0.6 s. [2]

.....

.....

.....

b) Calculate the deceleration of the bearing in the oil. [2]

c) The ball reaches the bottom of the tube at t = 0.8 s. Calculate the height of the oil in the tube. [2]

Name: _____ ( ) Class: _____

2. Fig. 2.1 shows a ball of mass 1 kg hanging from a string that is pulled sideways by another rope exerting a horizontal force, P, on it. The figure is not drawn to scale.

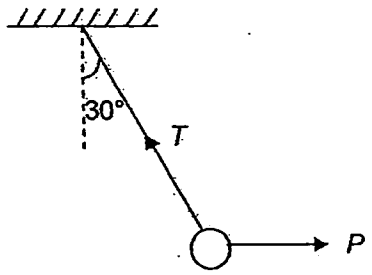


Fig 2.1

a) Draw, using an appropriate scale, a suitable vector diagram showing the forces acting on the ball and use your diagram to determine P and the tension, T, in the rope. [4]

T = ...

P = ...

b) The horizontal rope is then cut to allow the ball to swing.

Calculate the acceleration of the ball at the point of release. [2]

Name: _____ ( ) Class: _____

3. Fig 3.1 shows a ball of diameter 20 cm placed against a step of height 10 cm.

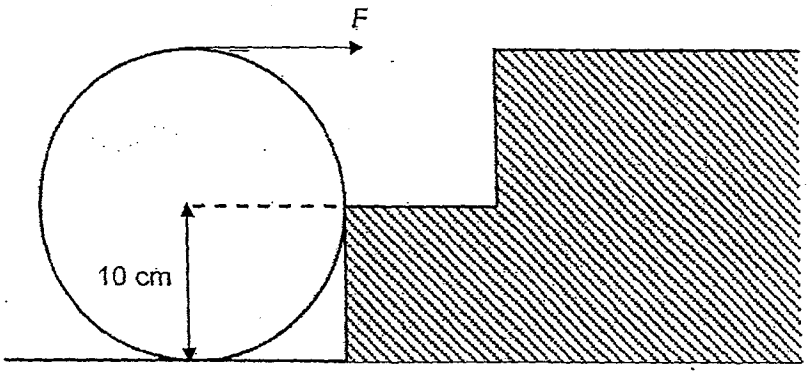


Fig 3.1

The ball has a mass of 5 kg and it is to be moved up the step.

Calculate the minimum force, F, that needs to be applied at the point shown in the figure to move the ball up the step. [2]

4. A mercury barometer was set up to measure atmospheric pressure. Due to an error in setup, some air was trapped at the top of the mercury column, as shown in Fig 4.1.

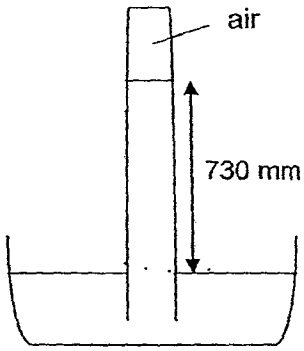


Fig 4.1

a) Given atmospheric pressure to be 1.01×10^5 Pa and the density of mercury to be 13 600 kg/m^3, calculate the pressure exerted by the air in the space above the mercury column. Leave your answer in Pa. [2]

b) The tube was pushed further down into the trough and the difference in mercury level was observed to decrease to 725 mm.

Using the kinetic model of matter, explain what has happened to the pressure exerted by the air in the space above the mercury column. [2]

.....

.....

.....

5. Fig. 5.1 shows block **P** of mass 5 kg on a smooth slope. **P** is released from rest at the top of the slope and travels beyond **B**, the base of the slope.

Take the value of g to be 10 m s^{-2} and ignore air resistance.

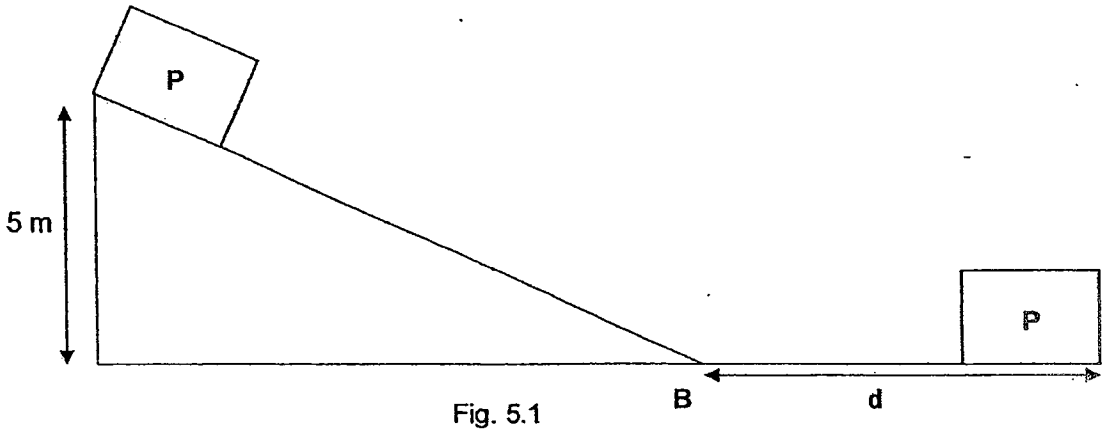


Fig. 5.1

a) Calculate the potential energy possessed by **P** at the top of the slope. [2]

b) Block **P** travels on rough ground after passing **B**. The frictional force acting on **P** is 20 N on the rough ground. Block P travels a distance d m before coming to a stop.

Calculate the distance d travelled by the block. [2]

Name: _____( ) Class: _____

6. Fig. 6.1 shows a hot water tank fitted with an immersion heater.

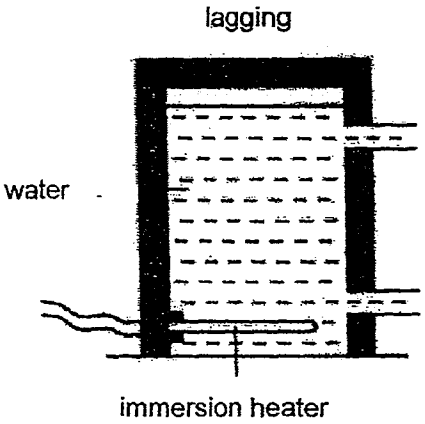


Fig. 6.1

a) Explain why foam is suitable as a lagging for the tank. [2]

.....

.....

b) Which colour, white or black, would you want to paint on the exterior of the water tank? Explain your answer. [2]

.....

.....

Name: _____ ( ) Class: _____

7. The experiment set-up shown in Fig. 7.1 is used to measure the specific latent heat of vaporization of water. Water in a beaker is kept boiling by an immersion heater which is connected to the main supply through a kilowatt-hour meter.

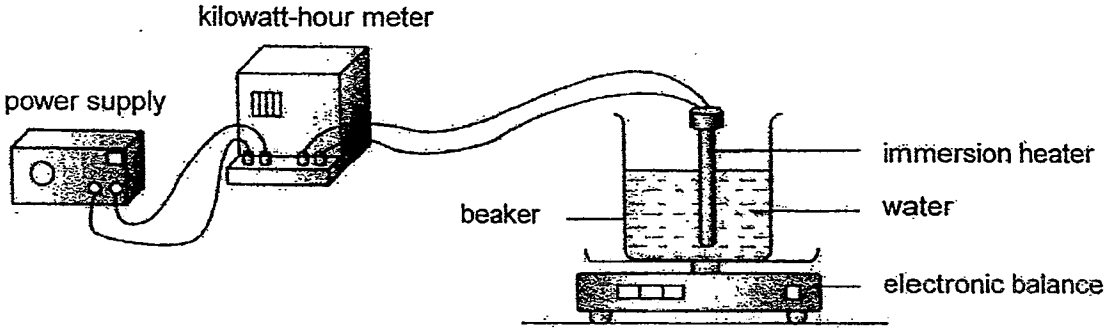


Fig. 7.1

The following data is obtained from the experiment:

Energy consumed by the heater = 0.128 kWh

Initial reading of the electronic balance = 0.864 kg

Final reading of the electronic balance = 0.712 kg

a) Calculate the specific latent heat of vaporization of water in J/kg using the data provided. [3]

b) Temperature of water remains constant when the water is boiling although the immersion heater continues to deliver energy to the water. Explain why the temperature remains constant. [2]

.....

.....

Name: _____ ( ) Class: _____

8. For proper eye sight, the cornea and the lens must properly focus light rays on the retina as shown in Fig. 8.1

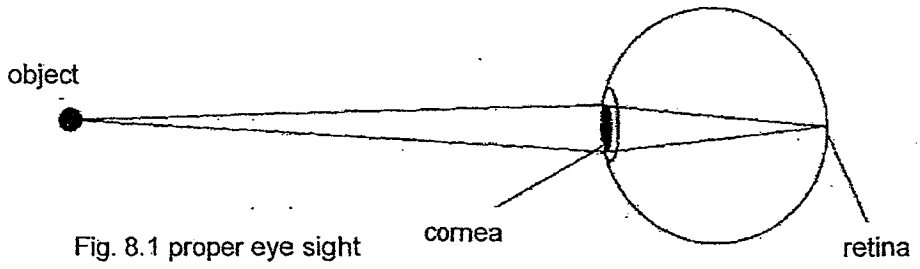


Fig. 8.1 proper eye sight

If the length or shape of the lens is not ideal, the light rays may get focused in front of the lens (see Fig. 8.2 for short-sightedness) or behind the retina (see Fig. 8.3 for long-sightedness) resulting in a blurred image on the retina.

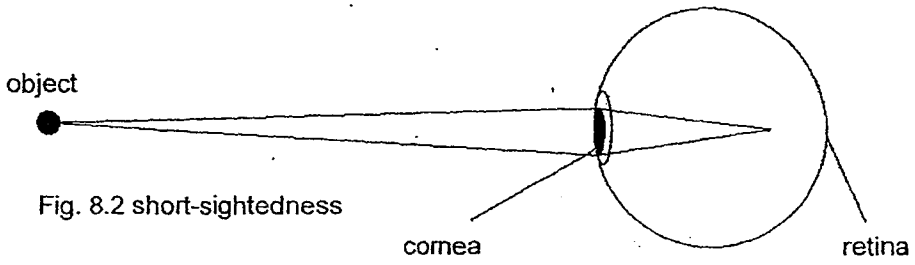


Fig. 8.2 short-sightedness

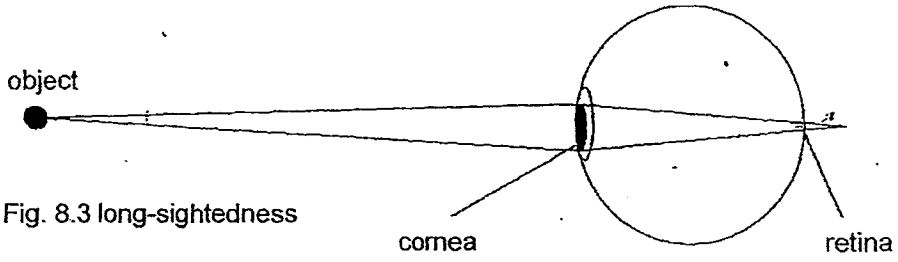


Fig. 8.3 long-sightedness

Corrective glasses are used to focus light rays properly on the retina.

a) State whether converging or diverging lens is used for people suffering from

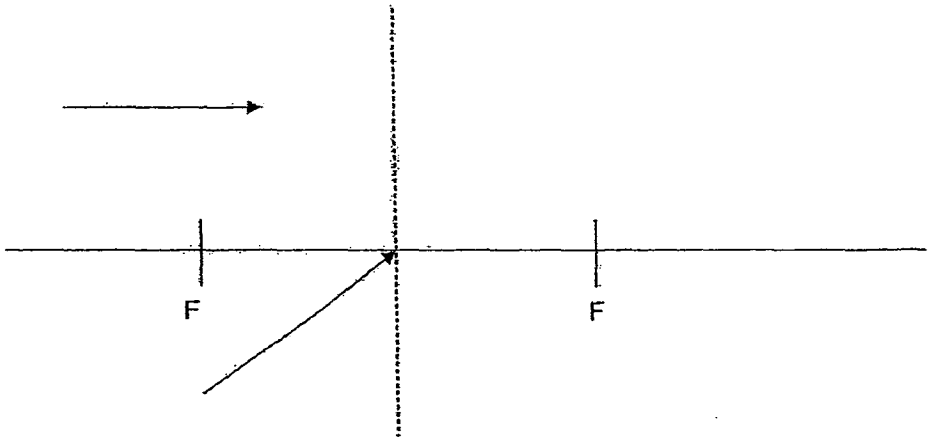
i) short-sightedness [1]

.....

ii) long-sightedness. [1]

.....

b) Complete the ray diagram to show how the lens to correct **short-sightedness** affects the two light rays which are striking the lens. [2]



c) Is the image formed by the lens in the eye real or virtual? Explain. [2]

.....

.....

9. Fig. 9.1 shows an incomplete lighting and power circuit in a house.

a) Complete the diagram by drawing wires to join
i) the lighting circuit to the distribution box, [2]
ii) the power socket to the ring circuit. [1]

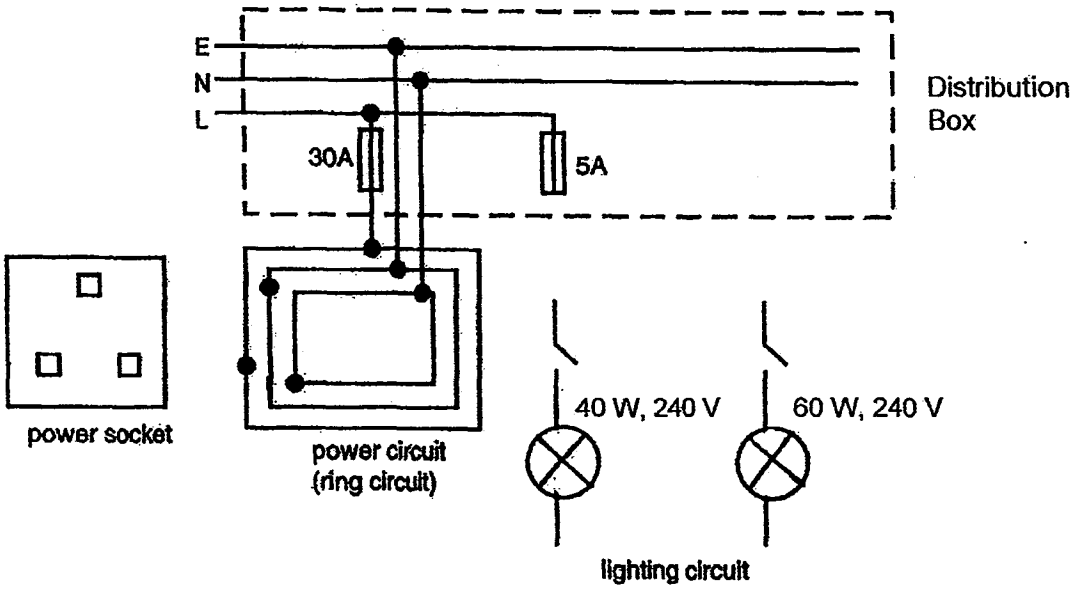


Fig. 9.1

b) Explain why the fuse and switch must be placed on the live wire of a circuit. [2]

.....

.....

Name: _____ ( ) Class: _____

10. A mixture of plastic and foam beads is released from a plastic nozzle. The beads fall down into a region of uniform magnetic field as shown in Fig. 10.1. Three containers **X**, **Y** and **Z** are placed below the magnetic field. It is observed that, after passing through the magnetic field, the plastic beads landed in **Y** and the foam beads landed in **Z**.

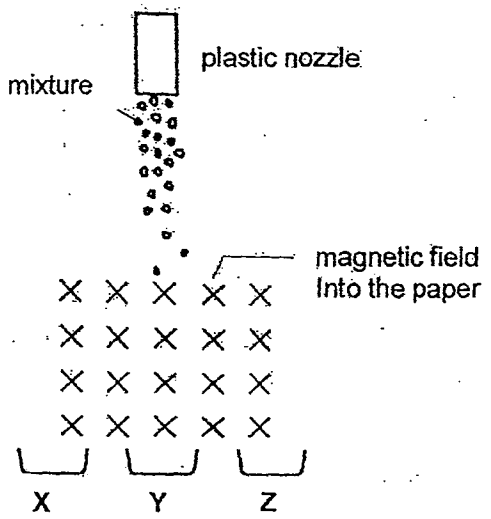


Fig. 10.1

a) Explain why the plastic beads land in **Y**. [2]

.....

.....

b) Explain why the foam beads land in **Z**. [2]

.....

.....

c) Suggest one method such that the foam beads will fall into **X** instead of **Z**. [1]

.....

Name: _____ ( ) Class: _____

11. A student produces wavefronts using a dipper in a ripple tank to demonstrate refraction, as shown in Fig. 11.1. He places a glass sheet under the water on the left-hand side of the tank. The arrows show the direction of movements of the wavefronts. The dipper produces waves at a constant rate.

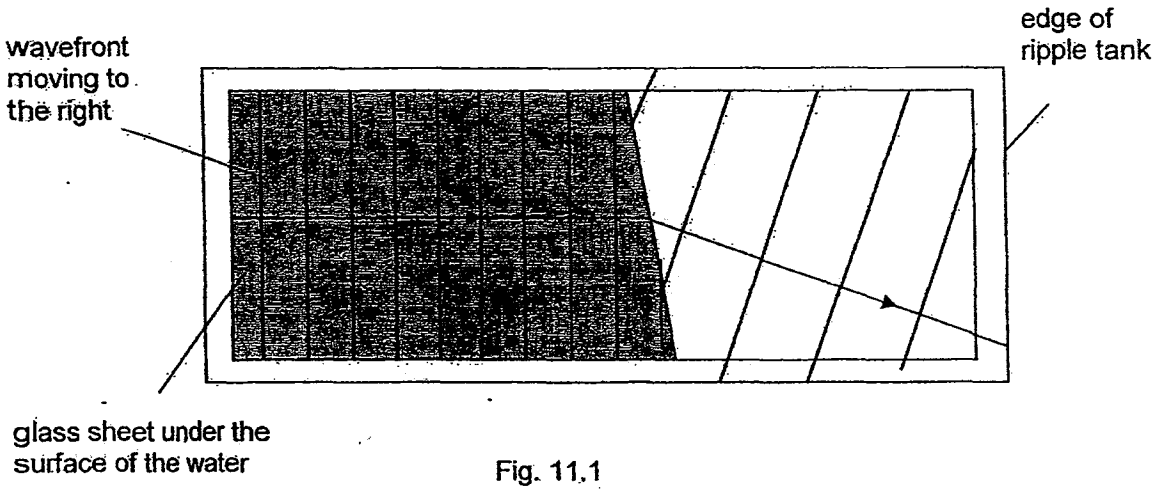


Fig. 11.1

State what happens to each of the following quantities as the wavefronts change direction.

a) Frequency

.....[1]

b) Speed

.....[1]

c) Wavelength

.....[1]

- End of section A -

Name: _____( ) Class: _____

Section B (30 marks)
Answer **all** the questions from this section.
Answer only one of the two alternative questions in **Question 14**.

12. Fig. 12.1 shows a coal power station. Coal is burnt in the boiler and makes water boil. The steam is then used to turn a steam turbine that is connected to a generator. The steam is then cooled down back to water in a condenser.

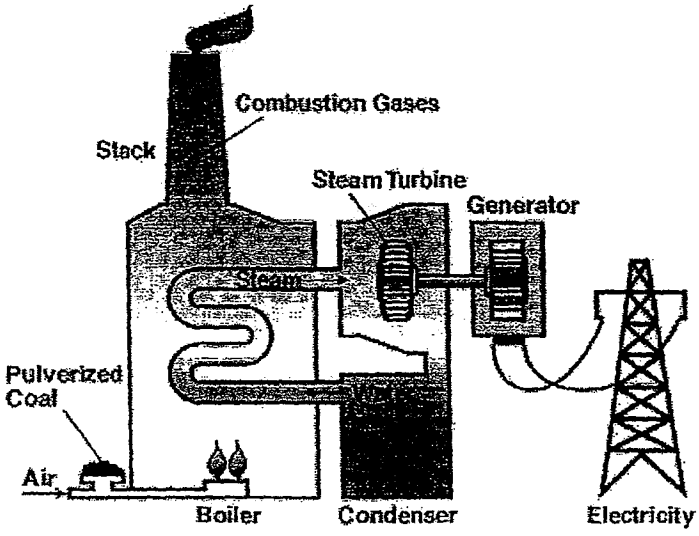


Fig. 12.1

a) State the principal energy conversions starting from the coal to output from generator. [1]

.....

b) State two advantages of a hydroelectric power station over a coal power station. [2]

.....

.....

c) Fig. 12.2 shows the generation and transmission of power from the generating station to the households. Table 12.3 shows the corresponding data.

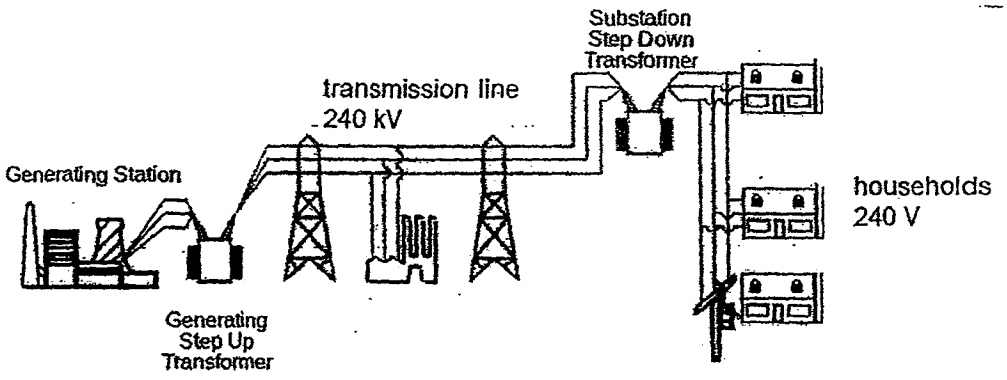


Fig. 12.2

Name: _____ ( ) Class: _____

Electrical power output of generator i.e before step-up transformer	1000 kW
Efficiency of generating step-up transformer at power station	80 %
Transmission voltage	240 kV
Transmission line resistance	0.005 $\Omega\ m^{-1}$
Transmission line distance	100 m
Efficiency of step-down transformer at substation	80%
Mains voltage at households	240 V

Table 12.3

i) Calculate the electrical power transmitted along the transmission lines. [1]

ii) Calculate the power loss in the transmission line. [3]

iii) Calculate the final power available to households. [2]

iv) Explain why thick cable is used in the transmission lines. [1]

.....

.....

13 A student uses the circuit in Fig. 13.1 to investigate the emf, E_0, of a battery which has an internal resistance. The variable resistor R is adjusted to different values and the corresponding ammeter readings are recorded. The data obtained from the experiment is recorded in Table 13.2.

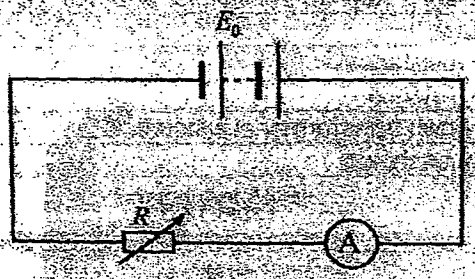


Fig. 13.1

R / Ω	10	20	30	40	50
I / A	0.94	0.52	0.36	0.28	0.22
$\frac{1}{I}$ / A^{-1}					

Table 13.2

a) Complete Table 13.2 by filling in the values for $\frac{1}{I}$ [1]

b) Plot a graph of $\frac{1}{I}$ against R. [2]

c) Calculate the gradient of the graph. Hence determine the e.m.f E_0. [2]

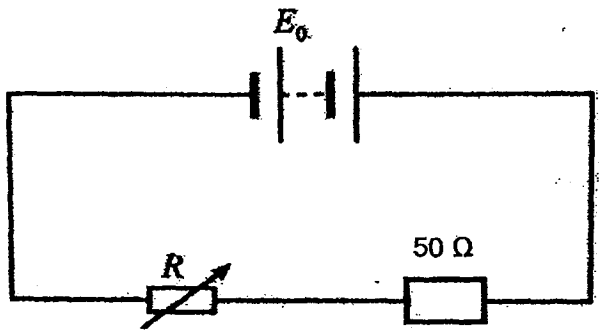
d) i) Determine the potential difference across the variable resistor R when the resistance is equal to 25 Ω. [2]

ii) Explain why the value obtained in (d)(i) is different from the e.m.f of the battery. [1]

.....

.....

e) The circuit is now re-wired such that a fixed resistor of 50 Ω is in series with the variable resistor. The variable resistor is adjusted to a resistance of 10 Ω.



Calculate the potential difference across the fixed resistor of 50 Ω. Ignore the internal resistance of the battery. [2]

Name: _____ ( ) Class: _____

14. **EITHER**

Fig. 14.1 shows a d.c. motor.

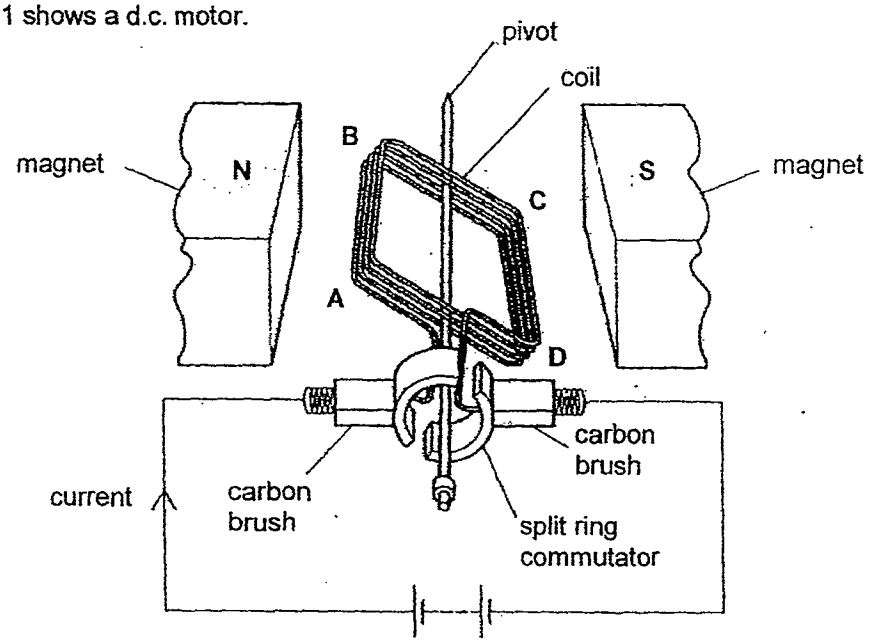


Fig. 14.1

a) On Fig. 14.1, indicate the direction of movement of side **AB** and of side **CD** when the current is in the direction given in the diagram. [1]

b) Explain why there is no force acting on the sides BC and AD. [1]

.....

.....

.....

c) The middle of **BC** is the pivot and **BC** measures 0.500 m.

If the maximum moment generated by the coil is 100 Nm, calculate the maximum force acting on side **AB** of the coil. [2]

d) Explain why:

i) each carbon brush must not be allowed to touch both halves of the split-ring at the same time; [2]

.....

.....

.....

ii) sometimes the motor does not start when switched on. [2]

.....

.....

.....

e) State two ways in which the direction of rotation of the coil can be reversed. [2]

i) .....

ii) .....

14. **OR**

In an experiment to study sound waves, a tuning fork is struck and placed near a microphone.

a) Explain how the sound waves are transmitted from the tuning fork to the microphone. [2]

.....

.....

.....

b) The microphone converts the sound into electrical signal which is input into a cathode ray oscilloscope. Fig. 14.1 shows the trace obtained on the screen of the CRO when the input signal is applied to it.

The time-base of the CRO is set at 2 ms/div.

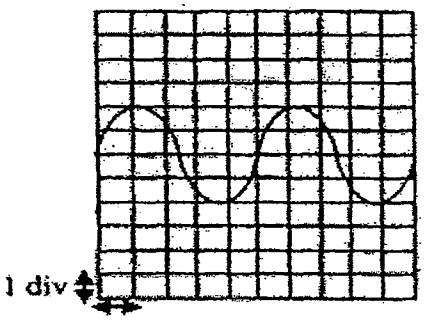


Fig. 14.1

i) Calculate the frequency of the sound waves produced by the tuning fork. [2]

ii) Calculate the wavelength of the sound waves, given that the speed of sound in air is 340 ms^{-1}. [1]

iii) State and explain the effect on the trace on the screen when the tuning fork is moved further away from the microphone. [2]

.....

.....

.....

c) In a second experiment, the tuning fork is replaced by a device which emits an ultrasound.

i) Explain the term **ultrasound**. [1]

.....

.....

ii) State the effect on the trace on the screen when the ultrasound is input into the CRO. [1]

.....

.....

iii) State one practical application of ultrasound. [1]

.....

- End of section B -

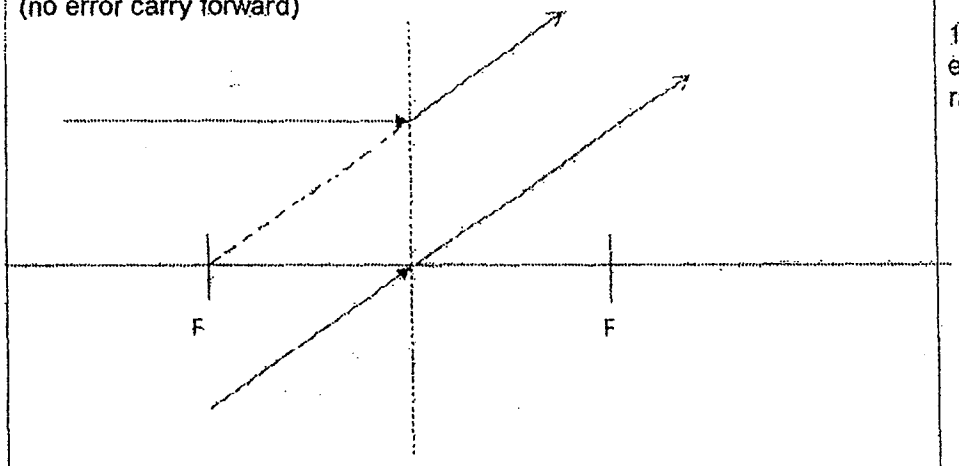
2014 FMSS Sec 4 Physics Prelim

ANSWER

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

Paper 2 Section A

1a	After t=0.6s, the upward resistive force from the oil is greater than the downward weight of the bearing. Resultant force is negative or acts upwards, hence object decelerates. (mention relate to resultant force and deceleration)	1 1
1b	deceleration = (6 – 3) / 0.2 = 15 m/s^2	1 1
1c	Ball enters oil at t = 0.6 s height of oil = area under graph = 0.5 X (6+3) X 0.2 = 0.9 m	 1 1
2a	Vector diagram Shape Scale 1 cm : 1 N P = 5.8 N (±10%) T = 11.6 N (±10%)	 1 1 1 1
2b	F = ma 5.6 = 1 x a a = 5.6 m/s^2	 1 1
3	F x 0.1 = 5 x 10 x 0.1 F = 50 N	1 1
4a	P_{air} + 0.73 x 13 600 x 10 = 1.01 x 10^5 P_{air} = 1 720 Pa	1 1
4b	The number of molecules per unit volume increases. This causes more collisions per second by the molecules on the wall of the tube. Since pressure is force per unit area, the pressure increases. (MUST express understanding that pressure is force per unit area)	1 1
5a	Ep = 5 x 10 x 5 = 250 J	1 1
5b	Work done against friction = energy possessed by box at bottom of slope 20 x d = 250 d = 12.5 m	 1 1
6a	Foam contains pockets of air. Since air is a poor conductor of thermal energy, it reduces the loss of thermal energy due to conduction.	1 1
6b	White White surfaces are poor emitters of radiation. This would reduce thermal	1 1

	energy loss from the heater.	
7a	Energy consumed by water = m l_v 0.128 X 1000 X 60 X 60 = (0.864 – 0.712) l_v l_v = 3031579 = 3 X 10^6 J/kg (must convert kWh to J, no answer mark if students do not leave answer using standard form)	2 1
7b	The energy absorbed from the immersion heater is used to overcome the forces of attraction between the particles and to push back against the atmosphere. There is no change in kinetic energy of the particles, hence temperature remains constant.	1 1
8ai	diverging lens	1
8aii	converging lens	1
8b	(no error carry forward)  	1 for each ray
8c	The image is real. As the image is formed by the intersection of light rays or can be captured on a screen – retina	1 1
9ai	correct connection to live wire , ie switches must be on live wire correct connection to neutral wire (must be a parallel circuit)	1 1
9aii	correct connection of each pin to ring circuit.	1
9b	When switch is off or when fuse is broken, the swtich and fuse will be disconnected from the mains live wire/or high potential. This prevents the possibility of getting an electric shock when someone accidentally touches the live wire/high potential.	1 1
10a	Plastic beads are not charged. No force acts on it due to the magnetic field/not influence by the magnetic field, but only gravitational force. Thus it lands in Y. (must relate to the magnetic field)	1 1
10b	The foam beads are charged positively. Using Fleming's Left Hand Rule, the index points into the paper for magnetic field, the thumb points to the right for force on foam, leaving the middle finger down for motion of positive charge	1 1

	(must use Fleming's LHR to explain how conclusion that beads must be positive charge)	
10c	Reverse the direction of the magnetic field such that it points out of the paper	1
11a	Constant / same	1
11b	Faster / increases	1
11c	Increases	1

Paper 2 Section B

12a	chemical potential energy -> thermal energy ->kinetic energy ->electrical energy (accept if student write chemical energy instead of chemical potential energy)	1
12b	hydroelectric power station provides : - Clean energy - Renewable energy - Pollution free - Sustainable energy (any two)	2
12ci	Electrical power transmitted along the transmission lines = power output of generator X efficiency of step-up transformer = 1000 X 0.8 = 800 kW	1
12cii	transmission line resistance = 0.005 X 100 = 0.5 Ω Current in transmission line = transmitted power / transmission voltage = 800 / 240 = 3.33 A Power loss in transmission line = I^2R = 3.33^2 X 0.5 = 5.54 W or = $(800/240)^2$X0.5 = 5.56 W	1 1 1
12ciii	Power available to households = power output after step-down transformer = (800 – 5.56/1000) X 0.8 = 640 W	 1 1
12civ	Thick cable is used in the transmission lines as thick cable has lower resistance and that helps to reduce the power loss in the cable.	1
13a	<table><tr><td>R / Ω</td><td>10</td><td>20</td><td>30</td><td>40</td><td>50</td></tr><tr><td>I / A</td><td>0.94</td><td>0.52</td><td>0.36</td><td>0.28</td><td>0.22</td></tr><tr><td>$1 / I$ / A^{-1}</td><td>1.1</td><td>1.9</td><td>2.8</td><td>3.6</td><td>4.5</td></tr></table> (all correct, then receive one mark. No half mark)	1
13b	All points correctly plotted Best fit straight line	1 1
13c	Gradient = (5.3 – 2.8) / (60 – 30)	1

	= 0.0833 Gradient = 1 /(I X R) = 1 / E_0 Emf E_0 = 1/gradient = 1 / 0.0833 = 12 V (To both marks awarded are answer marks)	 1
13di	Student must use the graph to find the value of current when R = 25 Ω, $1/I = 2.35$ V = I X R = (1/2.35) X 25 = 10.6 V (answer based on student's graph)	1 1 1
13dii	Battery has an internal resistance, so there will be a potential drop across the internal resistance too.	1
13e	potential difference across fixed resistor = 50/(50+10) X E_0 = 10 V Or I = E_0 / (50+10) = 0.2 A potential across fixed resistor = 0.2 X 50= 10 V	1 1 1 1
14	**either**	
a	AB downwards, CD upwards	1
b	Sides BC and AD experience no force as current flowing in them are parallel to the direction of the field lines.	1
c	Max moment = F x d 100 = 2 x F x 0.25 F = 200 N	 1 1
di	If the carbon brush touches both halves of the split-ring, there will be a **short circuit** across the split-ring and the **motor will not run**	1 1
dii	The carbon brush is at the **gap** between the split-ring so **current does not flow** into the coil	1 1
ei & ii	Reverse the direction of the battery. Reverse the direction of the magnet.	1 1
14	**Or**	
a	The vibrating tuning fork causes a series of **compressions and rarefactions** of the air particles. The **air particles** themselves just **vibrate** back and forth about their original positions, **transferring energy** to the neighbouring particles.	1 1
bi	T = 5 x 2 x 10^{-3} = 10 ms $f = \frac{1}{T} = \frac{1}{10\times10^{-3}} = 100Hz$	1 1
bii	$v = f\lambda \Rightarrow 330 = 100 \times \lambda \Rightarrow \lambda = 3.3m$	1
biii	The trace will have smaller amplitude, As the sound waves travel through a longer distance, energy is	1 1

	dispersed in all direction.	
ci	Ultrasound are sound waves that have a frequency of greater than 20 kHz.	1
cii	The trace shown on the screen will have a very small period of less than 0.05 ms	1
ciii	• Ultra sound can be used in ultrasound scanning to examine internal tissues and organs of a patient/ detect abnormal growths (e.g. liver canner) in a patient's body. • It can be used in ultrasound scanning to check the development of foetuses in pregnant women. • It can be used in ultrasound flow meter to measure the speed of blood flow in the body. • It can be used in a technique known as shock wave lithotripsy to break kidney stones into small pieces. • It can be used in sonar to locate underwater objects / determine the depth of the seabed. Anyone of the above & any other reasonable answer	1