Register Number | Class

Candidate's Name

BENDEMEER SECONDARY SCHOOL
2016 PRELIMINARY EXAMINATION 2
SECONDARY 4 EXPRESS
PHYSICS (SPA) PAPER 1
5059/01

DATE : **31 August 2016**

DURATION : **1 hour**

Write in 2B pencil.
Write your name, class and register number on the work you hand in.
Do not use paper clips, glue or correction fluid.

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 2B pencil on the OTAS sheet.

Read the instructions on the OTAS 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 on the question paper.

The use of approved scientific calculator is expected, where appropriate.

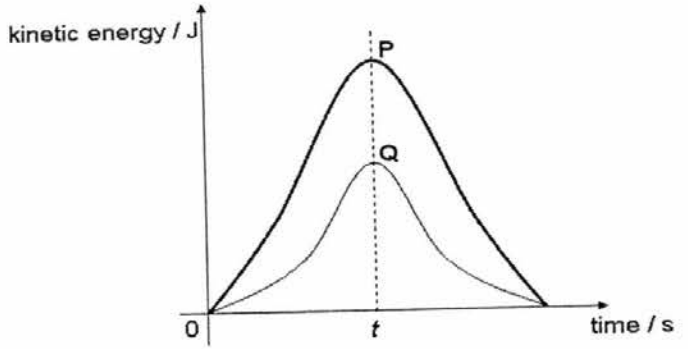
40

partnerinlearning'

This document consists of **20** printed pages.

[Turn over

1 The diagram shows the kinetic energy-time graph of two oscillating pendulums, **P** and **Q**.



Which of the statements below are correct?

I The graph shows both pendulums swinging through 1 complete oscillation.
II The pendulum **P**'s bob has a larger mass than pendulum **Q**'s.
III At instantaneous time ***t***, both pendulums are at their lowest point of their oscillation.
IV Both pendulums have the same length.

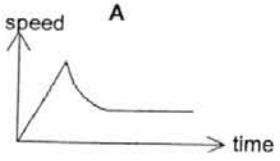
A II and III
B I and IV
C II, III and IV
D I, II, III and IV

2 The following paragraph describes the motion of a diver as he leaves a diving board and dives into a pool of water.

> The diver lifts off from the diving board with an initial speed and decelerates uniformly to a momentary stop before falling with constant acceleration. On entering the water, he experiences a decreasing deceleration and reaches a constant speed.

Which of the following speed-time graphs shows the motion described above?

A



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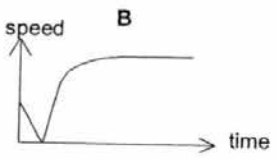

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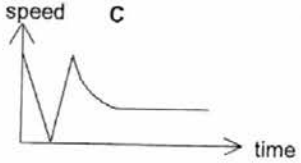
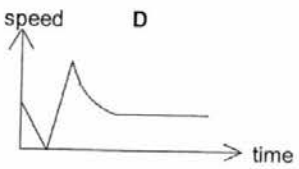
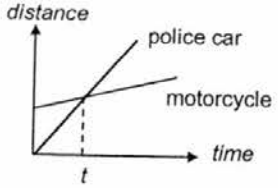


D

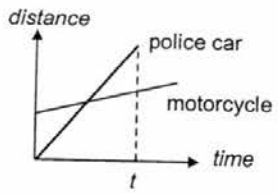


3 A police car starts from rest and accelerates to catch up with a speeding motorcycle within t minutes. Which graph describes the above scenario?

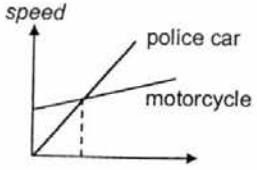
A



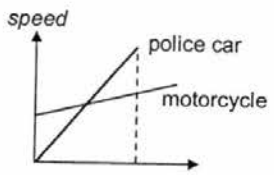
B



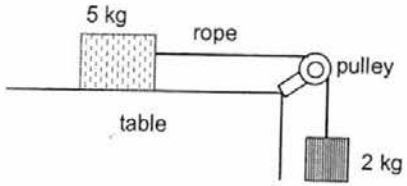
C



D



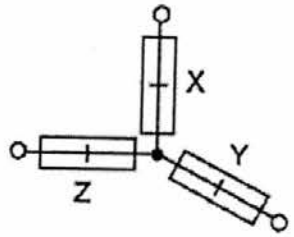
4 A 5 kg mass on a table is connected to a 2 kg mass by a rope which passes over a smooth pulley.



If the acceleration of the 5 kg mass is 2.0 m/s^2, find the friction between the 5 kg mass and the table.

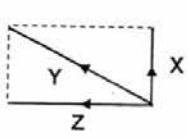
A 6 N B 10 N C 14 N D 20 N

5 The ends of three spring balances are tied together at a point and pulled outwards from it such that the system is balanced. **X**, **Y** and **Z** are the magnitudes shown on the spring balances.



Which of the following vector diagrams cannot be used to represent the forces acting in the system?

A



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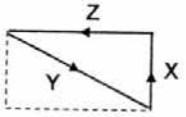

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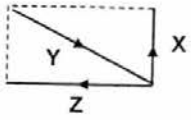
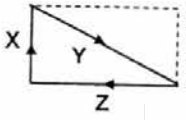


D



6 An object is brought to planet P from planet Q. The gravitational field strength on the surface of planet P is twice of that on the surface of planet Q. No air resistance acts on the object at planet P and Q.

Which statement is incorrect?

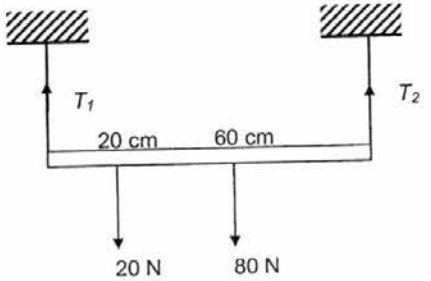
A The object's acceleration during free fall on planet P is twice of that on planet Q.

B The object's gravitational potential energy on planet P is twice of that on planet Q when the object is placed at the same height above ground.

C The object on planet P would have more reluctance to move from its original stationary position as compared to on planet Q.

D The object on planet P would need twice the force to be lifted up as compared to on planet Q.

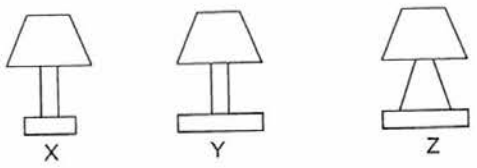
7 A 1.0 m rule with negligible mass is held horizontal by two strings. The tensions on the strings are T_1 and T_2 respectively. Two other forces of 20 N and 80 N act at the 20 cm and 60 cm marks of the ruler respectively.



What are the values of T_1 and T_2?

	T_1 / N	T_2 / N
A	40	60
B	48	52
C	52	48
D	60	40

8 The diagrams show three different designs of a table lamp. The stands are made of iron and they have the same fabric lampshade.



Which of the following is incorrect?

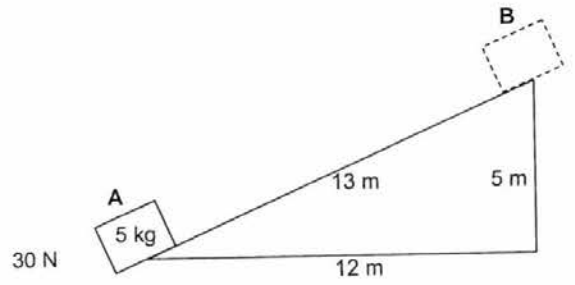
A Y is more stable than X because it has a broader base.

B Z is more stable than Y because it has a lower centre of gravity.

C Z is more stable than X because it has both a lower centre of gravity and a broader base.

D X, Y and Z are all equally stable because the lampshade is lighter than the stand.

9 A block is pushed up a slope by a 30 N force from position **A** to position **B** at a constant speed. The block has a mass of 5 kg.



What is the work done against friction?

A 140 J **B** 150 J **C** 390 J **D** 640 J

10 A motor drives a pump that raises 0.20 m^3 of water up by 5.0 m in 10 minutes. If the efficiency of the pump is 75 %, what is the power generated by the motor? Take density of water to be 1000 kg/m^3.

A 12.5 W **B** 22.2 W **C** 556 W **D** 1330 W

11 A gas is heated in a rigid sealed container. Which quantity does **not** change?

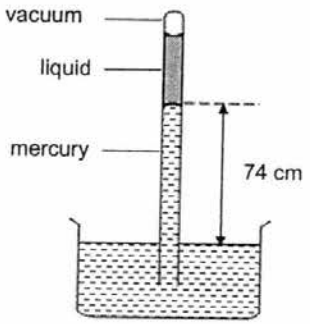
A the average speed of the gas particles

B the average force exerted on the walls of the container by the gas particles

C the average distance between the gas particles

D the frequency of collisions on the walls of the container by the gas particles

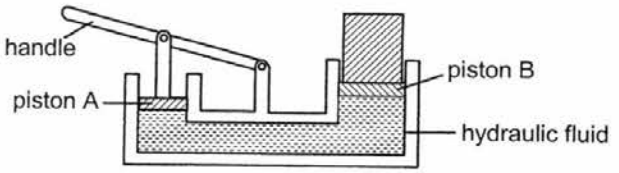
12 The diagram below shows a barometer containing a liquid of density 1 200 kg/m^3 above the mercury column. The density of mercury is 13 600 kg/m^3.



What is the height of the liquid, if the atmospheric pressure is 76 cm Hg?

A 2.0 cm **B** 22.7 cm **C** 26.0 cm **D** 76.0 cm

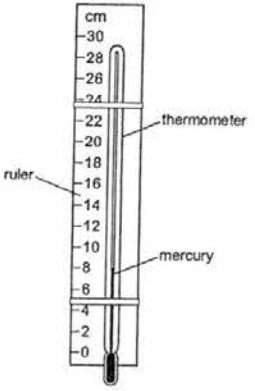
13 The diagram shows a simple hydraulic jack.



Which one of the following changes to the area of the pistons will enable heavier loads to be lifted if the force applied at the handle remains unchanged?

	area of piston A	area of piston B
A	doubled	halved
B	doubled	remains unchanged
C	halved	doubled
D	remains unchanged	halved

14 A mercury thermometer with no scale is taped to a ruler as shown. When the thermometer is placed in steam, the mercury level rises to 22.0 cm. When the thermometer is placed in pure melting ice, the mercury level falls to 2.0 cm.



Which temperature is shown by the mercury level in the diagram?

A 6°C **B** 8°C **C** 30°C **D** 40°C

15 P and Q are 2 objects in thermal equilibrium.
This means that both objects always have the

I same temperature.
II same internal energy.
III same specific latent heat.
IV same specific heat capacity.

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

16 When some ether is spilled onto someone's hand, the hand feels very cold. If water is spilled under the same conditions, the hand will not feel the change in temperature. Why is this so?

A Water does not evaporate as quickly as ether.
B Water has a higher boiling point.
C Water has a higher specific latent heat of vaporisation.
D Water has a lower specific heat capacity.

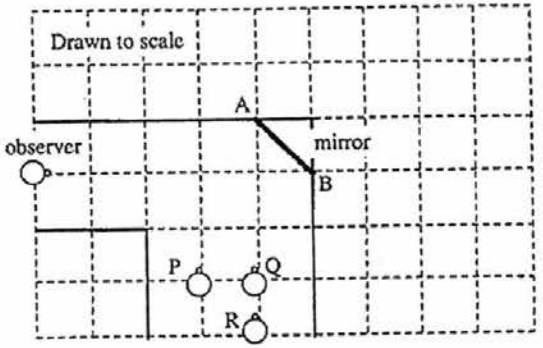
17 Which of the following will not affect the rate of energy transfer of a body by radiation?

A surface area
B surface material
C surface temperature
D colour and texture of a surface

18 A copper container has a mass of 84 g. It contains 84 g of cold water at 10 °C. 46 g of hot water at 100 °C is poured into the water in the copper container.
Given that the specific heat capacity of water is 4200 J/(kg°C) and the specific heat capacity of copper is 400 J/(kg°C), what is the final temperature of the mixture in the container?

A 10.0°C B 26.7°C C 40.0°C D 80.0°C

19 A plane mirror **AB** is positioned at the corner of a road as shown in the diagram.



Which men, **P**, **Q** and/or **R** can be seen by the observer through the mirror?

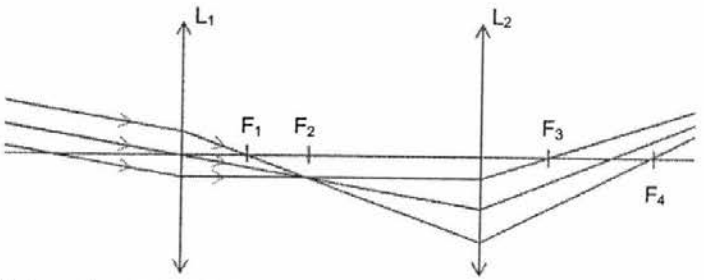
A P and Q
B P and R
C Q and R
D P, Q and R

20 When an object is placed 50 cm from a convex lens, a real image of the same size as the object is formed. The object is then moved 15 cm towards the lens.

Which of the following correctly describes the new image formed?

	image size	image distance
A	diminished	less than 50 cm from the lens
B	magnified	less than 50 cm from the lens
C	diminished	more than 50 cm from the lens
D	magnified	more than 50 cm from the lens

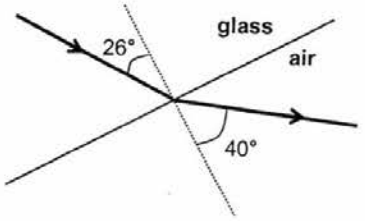
21 The figure below shows parallel rays from a distant object and passes through lens L_1 and L_2.



What are the principal foci of L_1 and L_2?

A F_2 for both lens
B F_1 and F_2 respectively
C F_2 and F_3 respectively
D F_1 and F_3 respectively

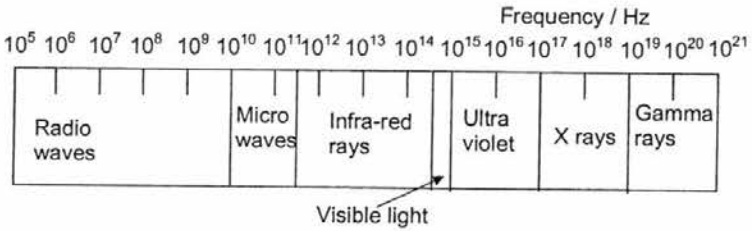
22 The diagram shows a ray of light traveling from glass into air.



If the speed of the light in air is 3.0×10^8 m/s, what is the speed of light in the glass block?

A 1.7×10^8 m/s
B 2.0×10^8 m/s
C 2.2×10^8 m/s
D 4.4×10^8 m/s

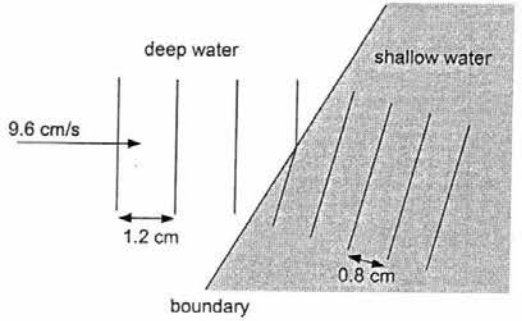
23 The table below shows the electromagnetic spectrum.



A radiation P, has a wavelength of 0.001 m in vacuum. Which section of the spectrum is P in?

A radio waves
B micro waves
C infra-red rays
D visible light

24 A ripple tank is used to demonstrate the refraction of plane water waves.



Waves in deep water have a wavelength of 1.2 cm and a speed of 9.6 cm/s. The wavelength of the waves in shallow water is 0.8 cm. What is the speed of the waves in the shallow water?

A 6.4 cm/s B 8.0 cm/s C 9.6 cm/s D 14.4 cm/s

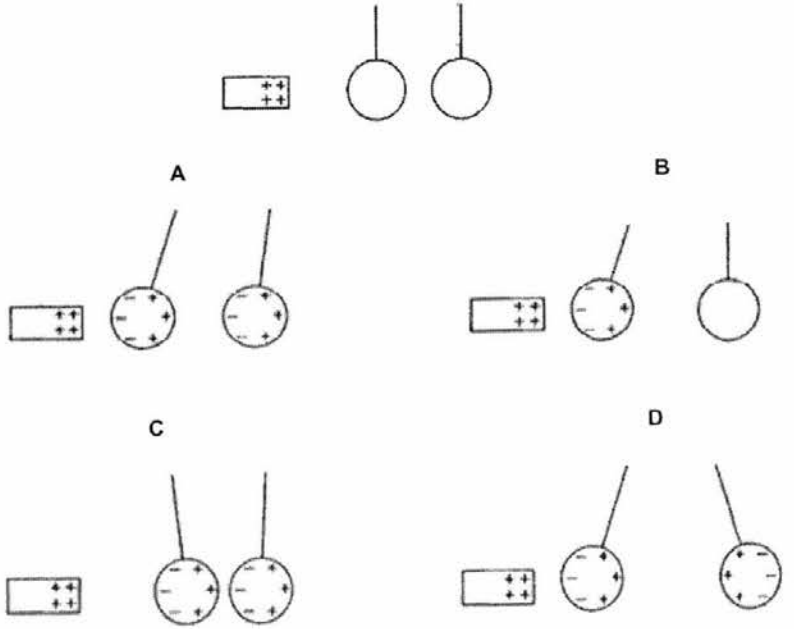
25 What does the speed of sound in air depend on?

A temperature of the air
B pitch of the sound
C loudness of the sound
D distance between the source and receiver of the sound

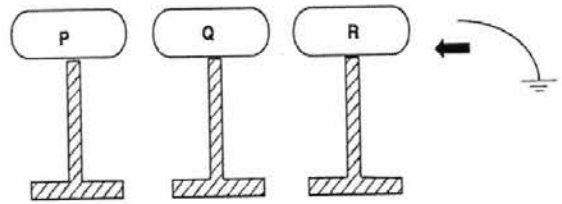
26 A man stands between two parallel walls. When he claps his hands once, he hears the first two echoes 0.4 s and 0.8 s later. If the speed of sound in air is 340 m/s, what is the distance between the walls?

A 68 m B 136 m C 204 m D 408 m

27 Two uncharged metal spheres, not touching one another, are suspended by means of cotton thread. A positively charged rod is brought near. Which diagram shows what happens to the spheres?



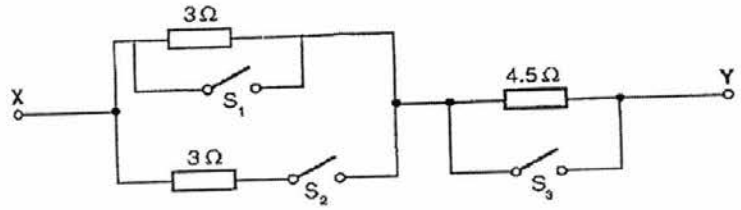
28 P, Q and R represent blocks of copper mounted on insulating stands that are apart from each other as shown in the diagram.



At the start of an experiment, P was charged positively while Q and R were electrically neutral. When R is momentarily earthed, which of the following statements describes **correctly** the charges on Q and R?

A Q and R both carry positive charges.
B Q and R both carry negative charges.
C Q remains neutral but R carries negative charges.
D Q carries negative charges but R carries positive charges.

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



Which switch positions would obtain a resistance of 3 Ω?

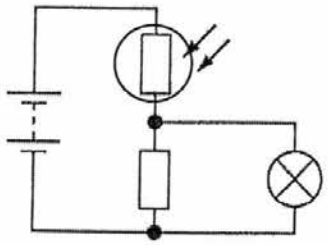
	S_1	S_2	S_3
A	open	open	closed
B	closed	closed	open
C	open	closed	closed
D	closed	open	closed

30 Which of the following expresses the correct units for voltage, charge and current?

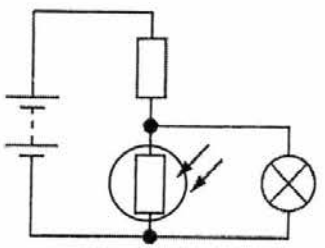
	Voltage	Charge	Current
A	J/C	C/s	C
B	C	J/C	C/s
C	J/s	C	J/C
D	J/C	C	C/s

31 In which circuit will a lamp glow more brightly when the temperature in the surroundings increases?

A



B



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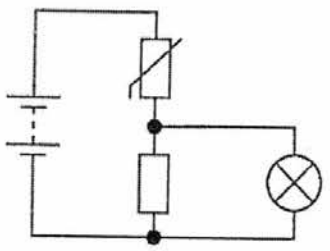

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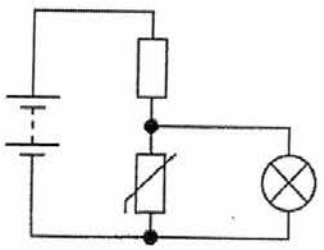


32 The duration of usage of several electrical appliances and their respective power ratings are shown in the table below.

Appliance	Power rating / W	Duration of usage / s
electric iron	400	3600
rice cooker	5 000	1800
lamp	50	36 000

What is the cost of a unit (kWh) of electricity if the total cost of usage from the above table is $2.72?

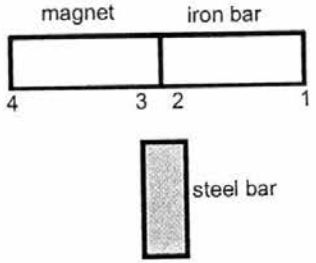
A $0.01 B $0.08 C $0.80 D $9.25

33 The fuse in a particular circuit 'blows' regularly. This could be due to a direct connection between

I the live and neutral wire.
II the live and earth wire.
III the earth wire and the body of the appliance.

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

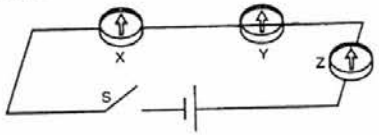
34 A steel bar is brought close to a magnet and an iron bar at different regions (1, 2, 3 and 4).



Which of the following regions will the steel bar be attracted to?

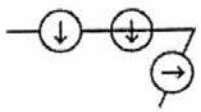
A 1 and 2
B 2 and 3
C 1 and 4
D all of the above

35 The diagram below shows a circuit with a wire connected to a battery through the switch **S**. The compasses **X** and **Z** are placed above the wire and the compass **Y** is placed below the wire.



When **S** is closed, which of the following diagrams correctly shows the orientations of the compass needles?

A



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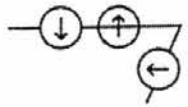
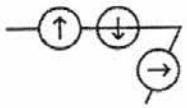
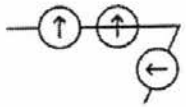


C

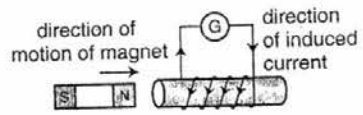


D

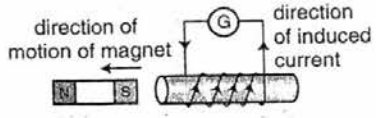


36 Which diagram correctly shows the direction of the induced current when a magnet is moved in the direction shown by the arrow?

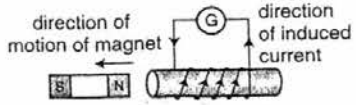
A



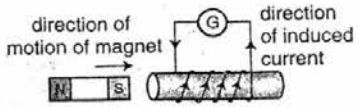
B



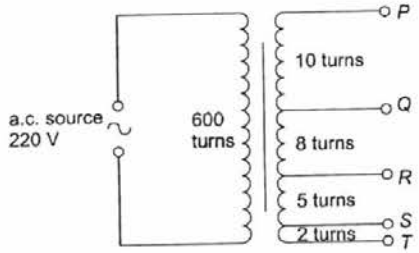
C



D



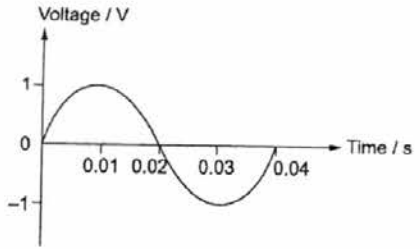
37 The diagram shows a transformer.



Which pair of terminals should be connected to a '5 V, 1 W' light bulb so that it can be lit normally?

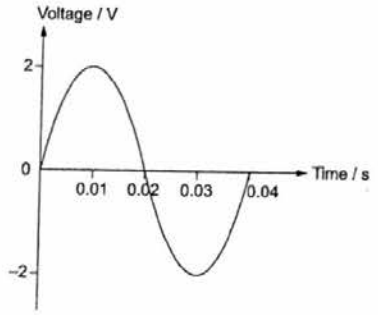
A *RT* **B** *QT* **C** *PS* **D** *PR*

38 The following is a voltage-time graph of a simple a.c. generator.

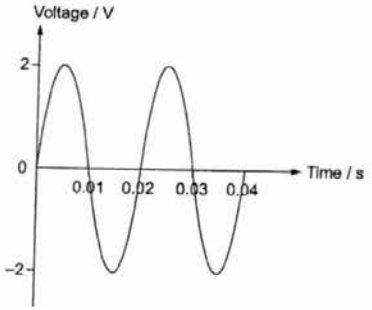


Which of the following is correct if the coil of the generator now has half the number of loops as the original one and is turned at twice the speed?

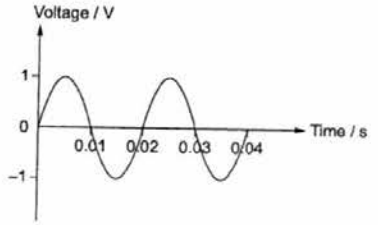
A



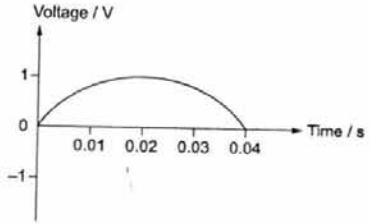
B



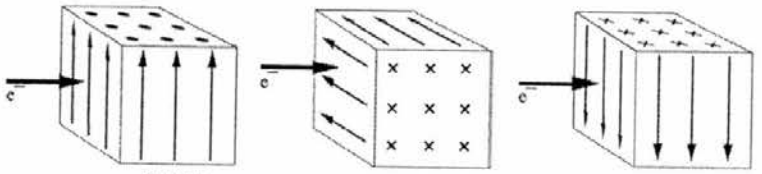
C



D



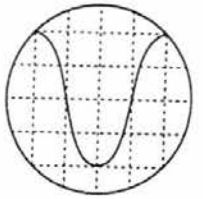
39 Moving electrons can be deflected by electric fields, gravitational fields and magnetic fields. One electron is allowed to enter each type of field, as shown below. If the electron is deflected downwards in each field, what is field 1, field 2 and field 3 respectively?



field 1 field 2 field 3

	field 1	field 2	field 3
A	electric	magnetic	gravitational
B	gravitational	magnetic	electric
C	electric	gravitational	magnetic
D	magnetic	electric	gravitational

40 The diagram illustrates the trace obtained on the screen of an oscilloscope when a given signal is applied to the input terminals. The time-base is set at 2.0 ms/div, and the voltage sensitivity is set at 2.0 V/div. Which of the following correctly represents the peak voltage and frequency of the signal?



A 4 V, 125 Hz
B 8 V, 83.3 Hz
C 4 V, 83.3 Hz
D 8 V, 125 Hz

End of Paper

Register No.	Class

Name _____

BENDEMEER SECONDARY SCHOOL
2016 PRELIMINARY EXAMINATION 2
SECONDARY 4 EXPRESS
PHYSICS SPA PAPER 2
5059/02

DATE : **29 August 2016**
DURATION : **1 hour 45 minutes**

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on the work you hand in.
Write in dark blue or black pen.
You may use a 2B pencil for any diagrams or graphs.
Do not use paper clips, glue or correction fluid.

Section A
Answer **all** questions.

Section B
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.

80

This document consists of **22** printed pages.

Section A: Structured Questions [50 marks]

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

1 Fig. 1.1 shows a car moving along a horizontal road. The car has a mass 800 kg. At one point in its motion, when the combined forces of air resistance and friction acting backwards are 400 N, its acceleration is 1.4 m/s^2.

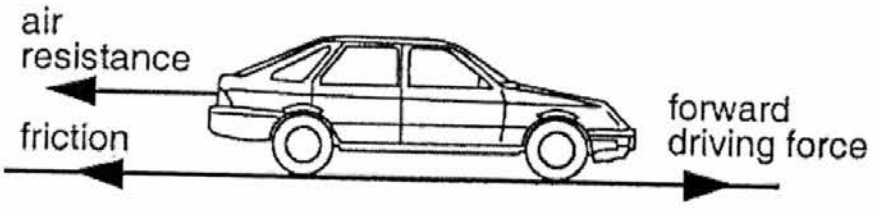


Fig. 1.1

(a) Calculate the forward driving force required to accelerate the car.

forward driving force = ... [2]

(b) With the engine working at constant full power, the car's acceleration decreases as it goes faster. Explain why this is so.

.....

.....

.....

..... [2]

(c) The car will eventually travel at constant speed. Explain why this is so.

.....

.....

.....

..... [2]

2 An airplane passenger places two identical luggages, each of mass 15 kg, onto a trolley as shown in the diagram. The centre of gravity of each luggage is in the middle of each luggage. He applies a force **F** at the handle to raise the luggages to the horizontal position shown in Fig. 2.1

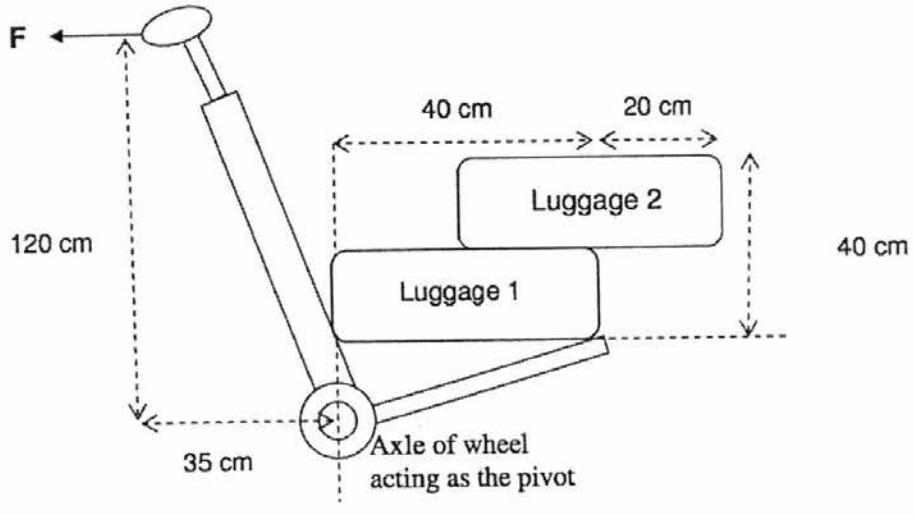


Fig. 2.1

(a) Calculate the force **F** applied at the handle to keep the luggage horizontal.

force **F** = ... [2]

(b) The airplane passenger wheels the trolley as shown in Fig. 2.1 for a distance of 150 m. The frictional force on the trolley is 25 N. What is the useful work done by passenger?

work done = ...

(c) If the airplane passenger releases the handle, the trolley will become upright. What will happen to **luggage 1** and **2**? Explain your answer.

.....

.....

.....

..... [2]

3 Fig. 3.1 shows a children's ride. A carriage containing children is pulled up the slope by a motor. The carriage stops at A and then runs through B, C and D without further input of energy. Between D and E, the carriage turns through a bend at constant speed, as shown in Fig. 3.1. At E, brakes are applied and the carriage slows to a stop at F. The height of the ride is 30 m at A and 10 m at C.

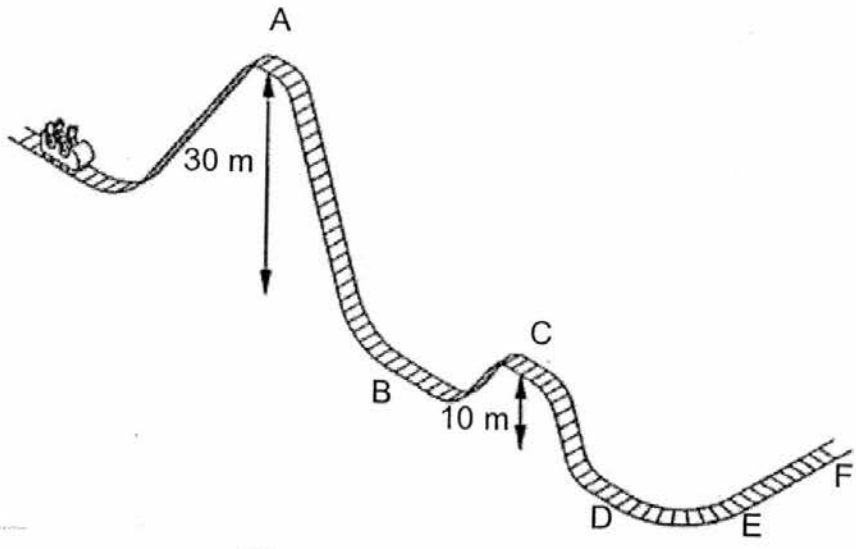


Fig. 3.1

The mass of the carriage and the children is 500 kg.

(a) Calculate kinetic energy of the carriage and children at C.

kinetic energy = ... [1]

(b) Determine velocity of the carriage and children at C.

velocity = ... [2]

(c) The carriage goes round part of a horizontal circle at a constant speed between D and E as shown in Fig. 3.2.

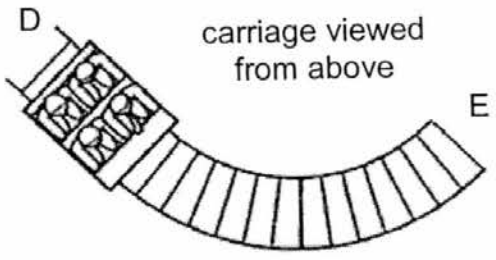


Fig. 3.2

Explain whether the carriage accelerates as it moves from D to E.

.....

..... [1]

(d) Between E and F, a constant frictional force acts on the carriage to slow down the carriage. The carriage comes to a stop after travelling for 50 m under the influence of the frictional force. Calculate the value of this constant frictional force.

frictional force = ...

4 Fig. 4.1 shows a flask connected to a pump and also to a manometer containing mercury. The right-hand tube of the manometer is open to the atmosphere. The pump has been operated so that the mercury levels differ, as shown, by 250 mm. The density of mercury is 13 600 kg/m^3.

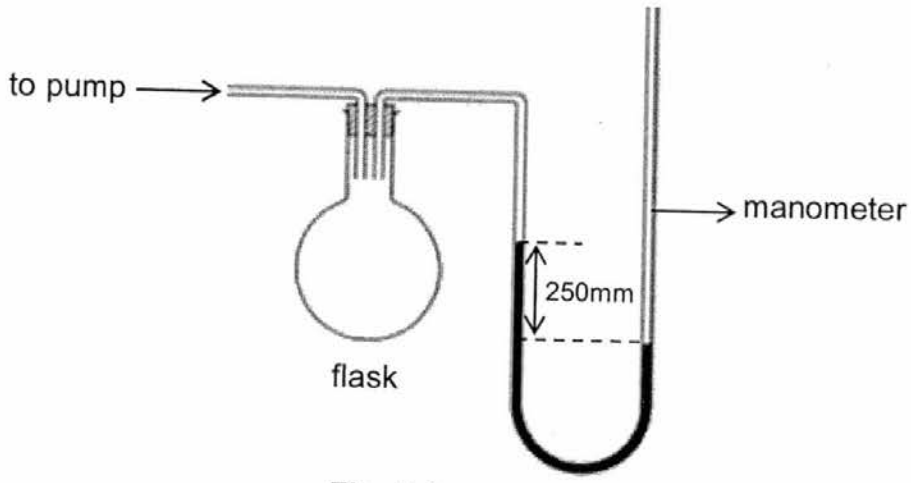


Fig. 4.1

(a) Explain, in terms of movement of molecules, how the gas exerts a pressure on the walls of a container.

.....

.....

.....

..... [2]

(b) Given that the atmospheric pressure is 760 mm Hg, calculate the gas pressure, in Pa.

pressure = ... Pa [2]

Fig. 4.2 shows the flask being sealed. It is then heated.

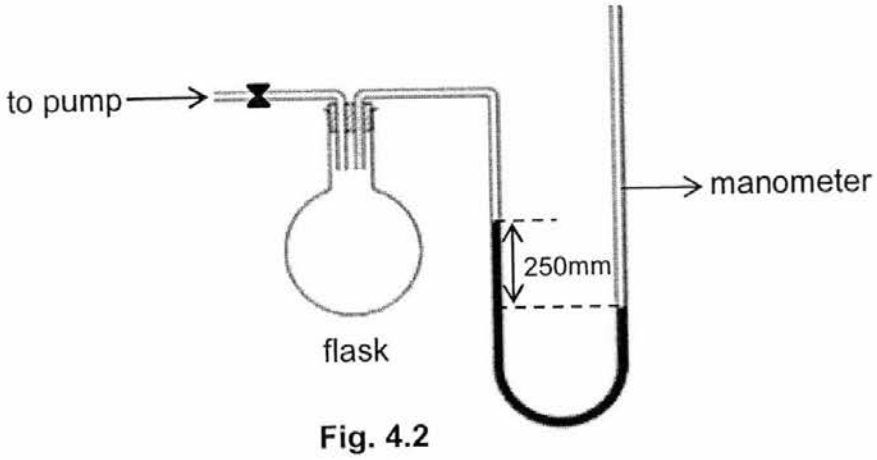


Fig. 4.2

(c) Describe and explain what will be observed.

.....

.....

..... [2]

5 Fig. 5.1 shows a tall cylinder filled with water. The bottom of the cylinder rests on a block of ice.

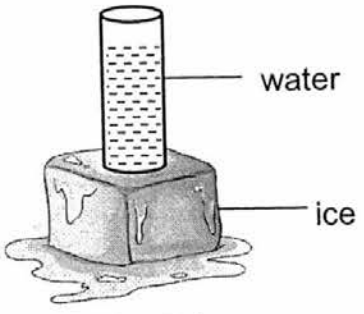


Fig. 5.1

Explain, with reasons, whether the temperature of the water in the cylinder is higher at the top, constant all the way up or higher at the bottom. Assume that the cylinder has been in place for a long time and that room temperature is steady at about 30 ^{0}C.

.....

.....

.....

..... [3]

6 A stage designer uses the set-up shown in Fig. 6.1 to produce a special effect in a laser show. A transparent glass cube, **ABCD**, is made to rotate about its axis as shown in Fig. 6.2 and Fig. 6.3. The resulting effect is to cause the spot of light to oscillate up and down the screen.

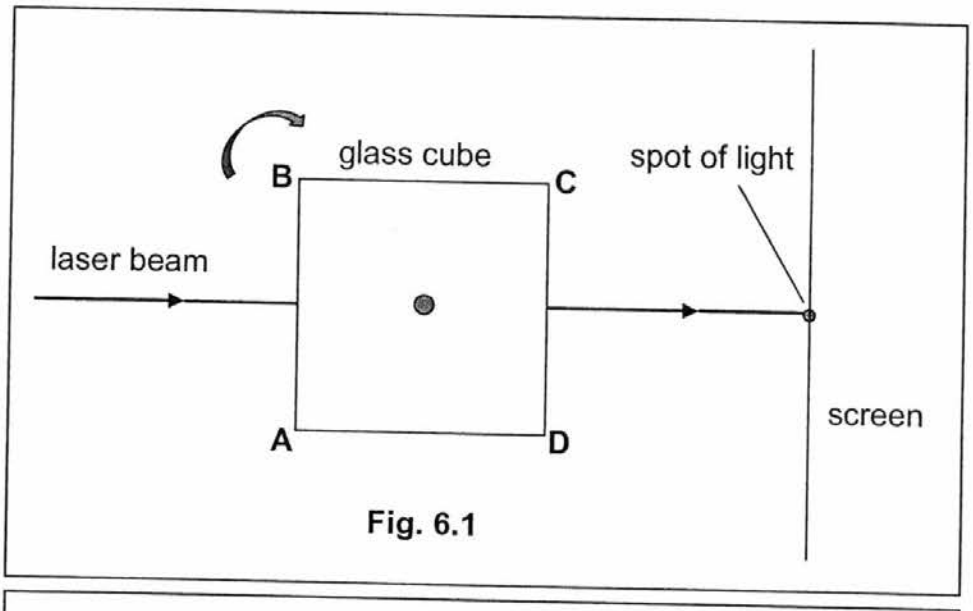


Fig. 6.1

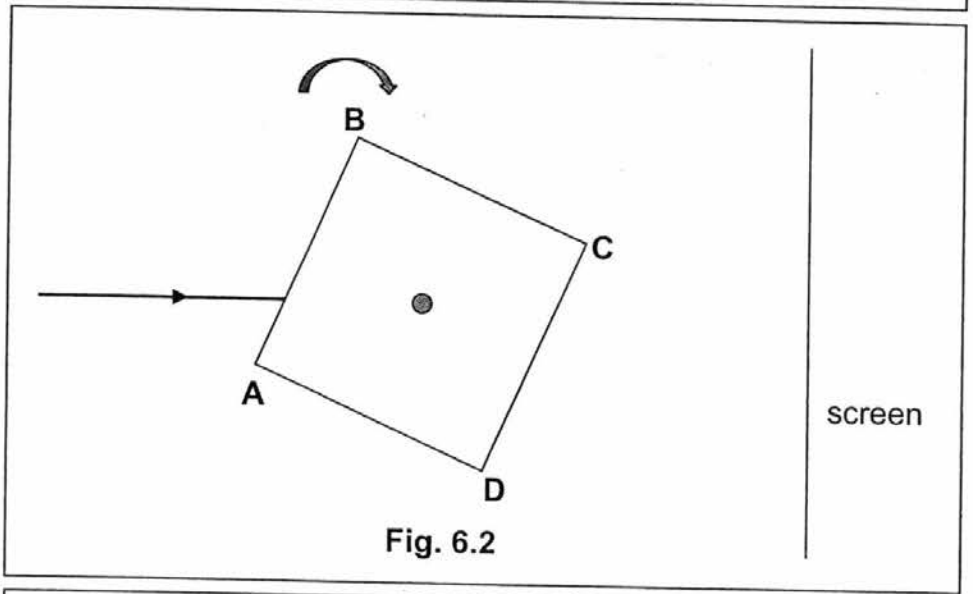
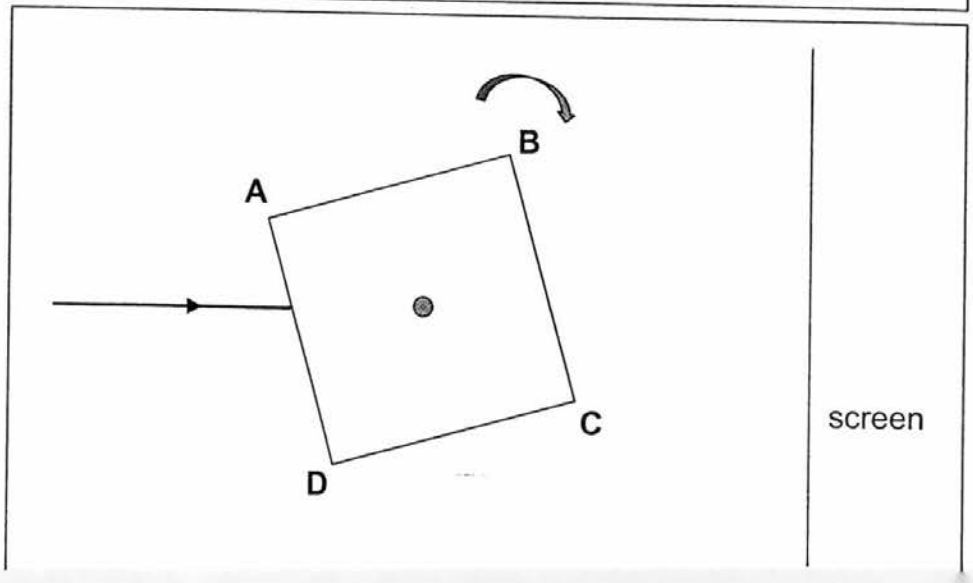


Fig. 6.2



(a) Complete the path of the laser beam in Fig. 6.2 and Fig. 6.3. [2]

(b) If a transparent cube of higher refractive index is used, what will be the difference in the amplitude of oscillation? Explain.

.....

.....

.....

..... [2]

(c) What will be observed if the glass cube is rotated at a faster rate?

.....

..... [1]

7 A sound wave travels through air. Fig. 7.1 represents air molecules along the sound wave at one instant.

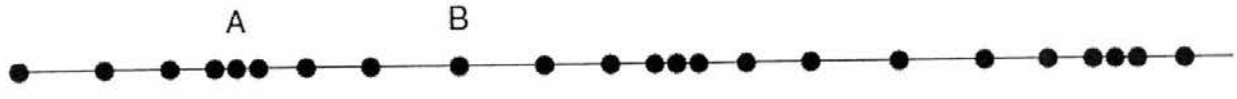


Fig. 7.1

(a) Explain what is meant by the *wavelength* of a wave.

.....

..... [1]

(b) Mark and label on Fig. 7.1 the wavelength of the wave. [1]

(c) Describe the motion of each molecule of air when the sound passes through.

.....

..... [1]

(d) State one difference between the motion of molecule A and the motion of molecule B.

.....

..... [1]

8 Fig. 8.1 shows 3 identical resistors R_1, R_2 and R_3. The resistance of each resistor is 20 Ω. The resistance of the lamp is 10 Ω.

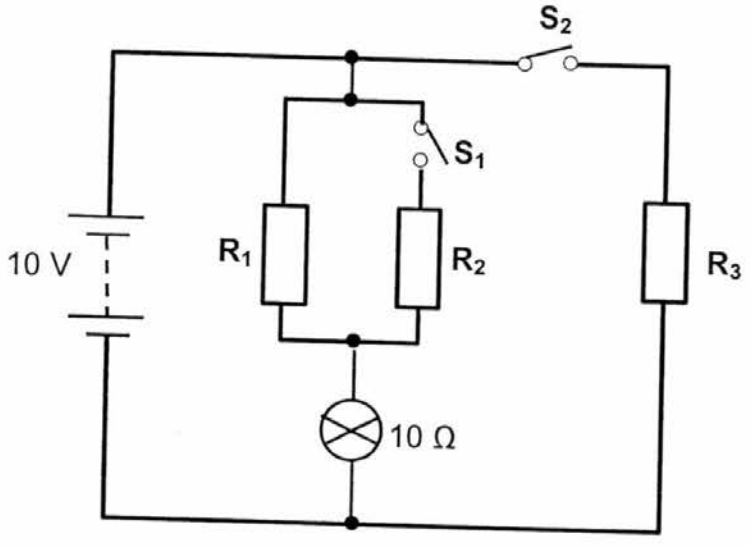


Fig. 8.1

(a) Calculate the current through the resistor R_1 when both switches are left open.

current = ... [2]

(b) State how the brightness of the lamp is affected if the switch S_1 is closed. Explain your answer.

.....

.....

..... [2]

(c) State whether the brightness of the lamp is further affected if the switch S_2 is closed as well. Explain your answer.

.....

.....

..... [2]

9 Fig. 9.1 shows two electromagnets placed next to each other.

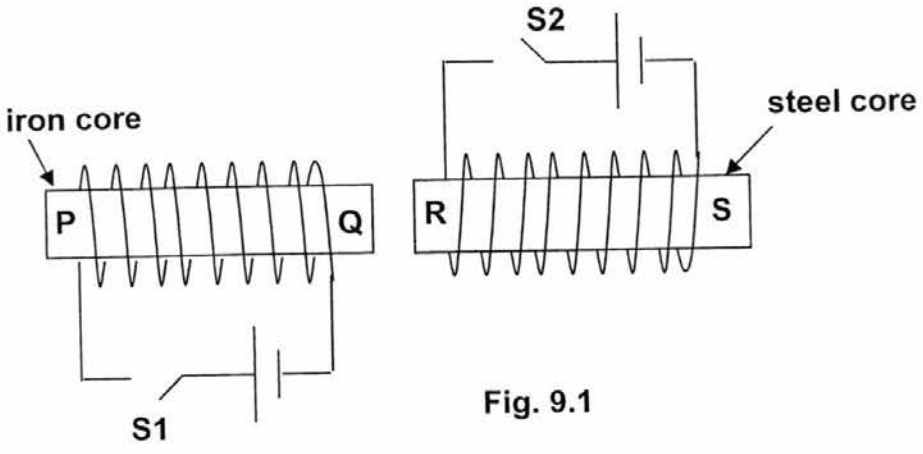


Fig. 9.1

(a) State the polarities at ends **Q** and **R** of the two electromagnets when both switches **S1** and **S2** are closed. What will be observed?

.....

.....

..... [2]

(b) Switches **S1** and **S2** are now opened. State and explain what would be observed.

.....

.....

.....

10 Fig. 10.1 represents, in simplified outline, an electrical supply system from a generating station to a house.

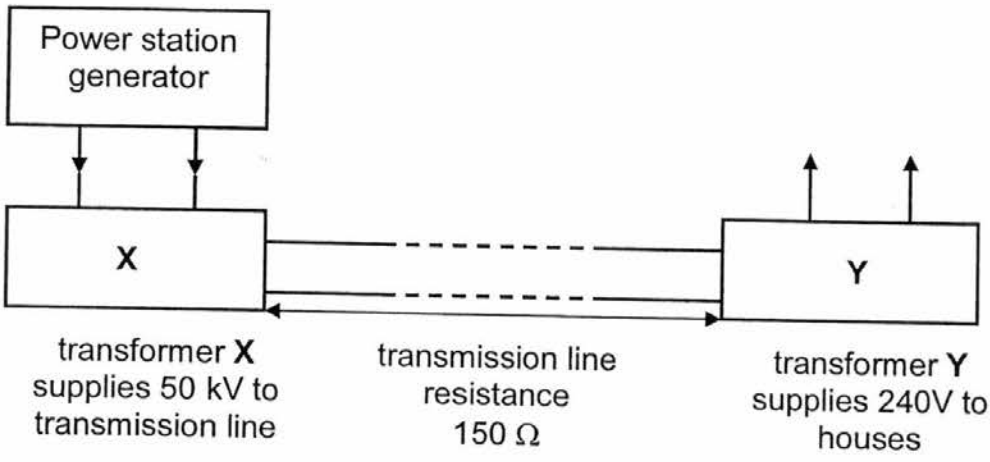


Fig. 10.1

(a) If the power station is transmitting a power of 3.0 kW at 50 kV from transformer **X** to transformer **Y**, calculate the current flowing through the transmission lines.

current = ... [1]

(b) Calculate the power loss in the transmission lines which has 150 Ω resistance.

power loss = ... [1]

(c) With reference to your answers from **(a)** and **(b)**, explain why the power station does not transmit the same power to the houses at 240 V?

.....

.....

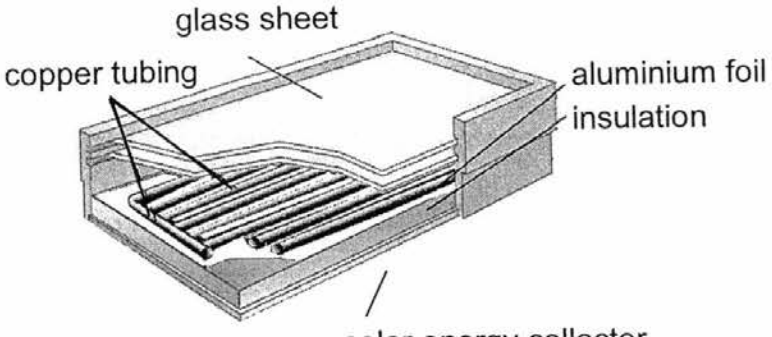
.....

..... [2]

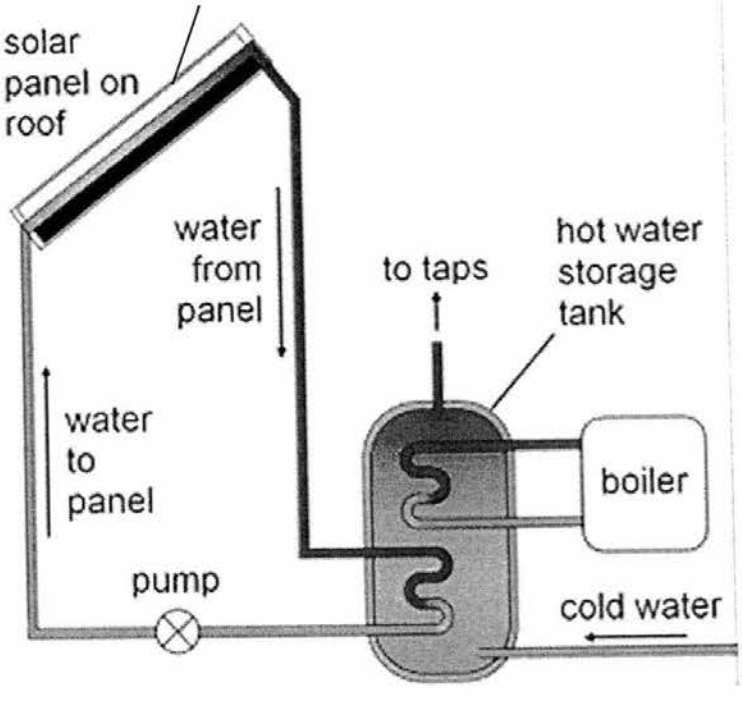
Section B: Structured Questions [30 marks]
Answer **all** questions. Question 13 has a choice of parts to answer.

11 Read the following article and then answer the questions that follow.

Flat solar panels of area approximately 5.0 m^2 are installed onto the roof.
The front glazing is 4.0 mm thick glass and each collector contains 7.0 m of copper tubing which is painted black.
The tubing is backed with an aluminium foil reflector and fiberglass is used as insulation.
A copper waterway is incorporated which circulates water (with the aid of a pump) from the solar panels to the water tank and back again.
The infra-red rays of shorter wavelength from the Sun pass through the glass into the collector.
They then hit the absorber surface, changing into infra-red rays with longer wavelength that are then trapped in the collector (producing a 'greenhouse effect').
See Fig. 11.1.



solar energy collector



[Turn o

Fig. 11.1

(a) Explain why the copper pipes are painted black.

.....

..... [1]

(b) From the article given, describe two features in which the solar panels reduced heat lost.

1. .....

2 ..... [1]

(c) Before deciding to install these solar panels, it will be useful to determine the possible savings. This could be done by comparing the costs of heating the water using a conventional electric immersion heater with that of the solar panels.

Here is some data:

Cost of installing the solar heating system = $220
Guaranteed working condition ≥ 3 years
Solar energy received by 5.0 m^2 of panel per second = 3500 J
Duration where solar energy is received = 10 hours
Efficiency of the solar heating system = 20%
Specific heat capacity of water = 4200 J/(kg K)
Temperature of water entering tank = 5 °C
Temperature of water required by the user = 35 °C
Cost of 1 kWh of electricity = 8 cents
No. of days per year for which panels can be used = 200

(i) Calculate the total amount of useful energy produced by the solar heating system per day.

total amount of useful energy = ... [2]

(ii) Calculate the mass of water that can be heated per day.

mass of water = ... [2]

(iii) Calculate the energy required, in kWh, of electricity required to heat that mass of water.

energy = ... kWh [1]

(iv) Since there are only 200 days in the year that the solar heating system can be used, calculate the cost of electricity for 3 years if an electrical heater was used.

cost = ... [1]

(d) Is it advisable to install the solar heating system? Explain your answer.

.....

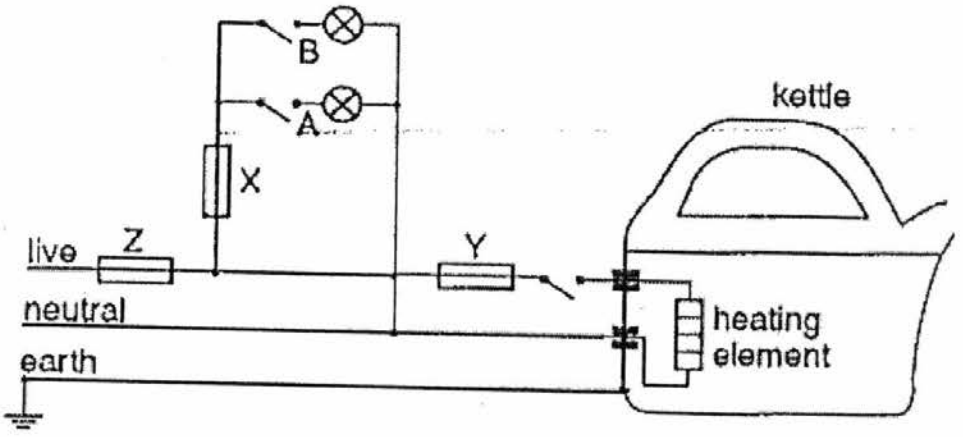
.....

.....

.....

..... [2]

12 Fig. 12.1 shows part of the mains electrical circuit in a house.



Two lamps **A** and **B**, each rated at 60 W 230 V, are connected to the live wire through fuse **X**. An electric kettle, rated at 750 W 230 V, is connected to the live wire through fuse **Y**. Fuse **Z** protects the whole circuit.
The electric kettle has a metal case which is connected to Earth.
The mains supply voltage is 230 V.

(a) Calculate the current in each of the three fuses when the electric kettle and both of the lamps are all switched on.

current through fuse **X** = ... [2]

current through fuse **Y** = ... [1]

current through fuse **Z** = ... [1]

(b) The switches and fuses to the lamps and the kettle are all in the live wire. Explain why this is necessary.

.....

..... [1]

(c) Instead of using fuses that have to be replaced when 'blown', circuit breakers are used. Fig. 12.2 and Fig. 12.3 show a circuit breaker before and after it has been activated respectively.

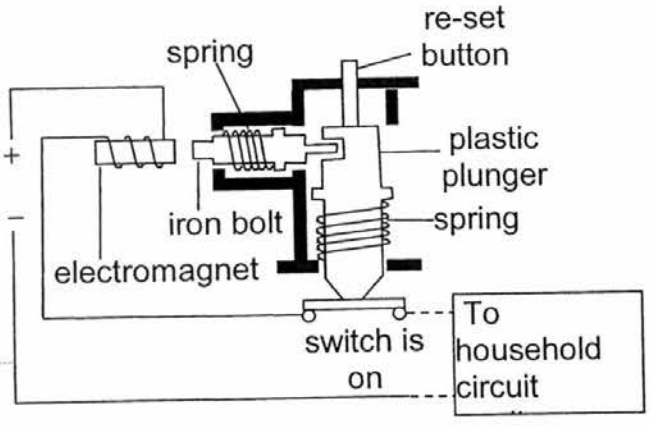


Fig. 12.2

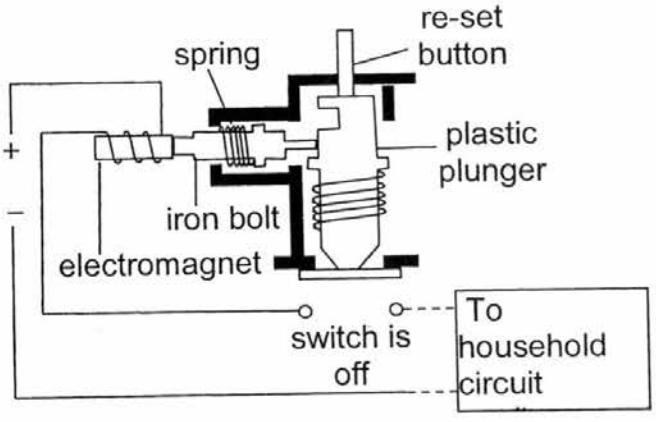


Fig. 12.3

(i) Referring to Fig. 12.2 and Fig. 12.3, explain how the circuit breaker works when a fault occurs and how it can be reset.

.....

.....

.....

.....

..... [4]

(ii) Explain why the circuit breaker cannot be reset if a steel bolt is used instead of the iron bolt.

.....

.....

EITHER

13 (a) Fig. 13.1 shows an iron rod *AB* that is resting in a magnetic field and connected to a circuit. The rod can move freely in the magnetic field.

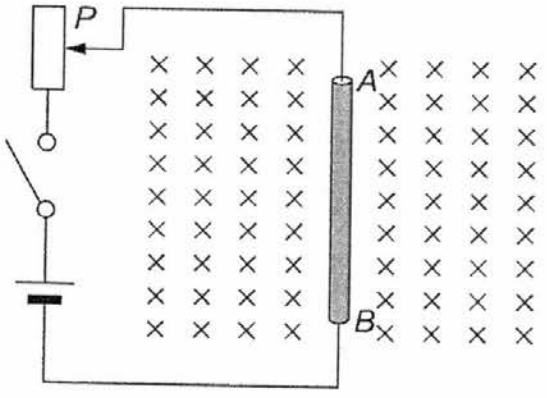


Fig. 13.1

(i) Fig. 13.2 shows the magnetic lines of force around *AB* when the current is flowing, when viewed from the top. Fig. 13.3 shows the lines of force of the magnetic field when viewed from the top.

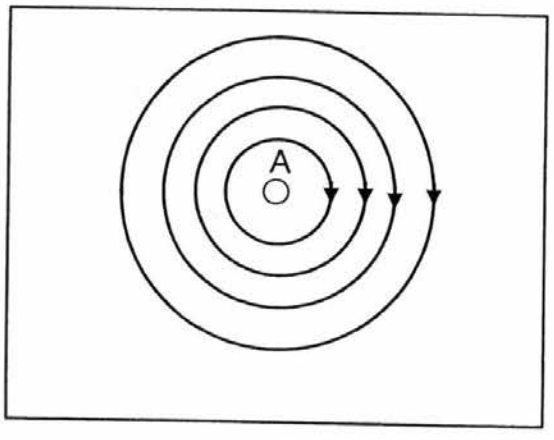


Fig. 13.2

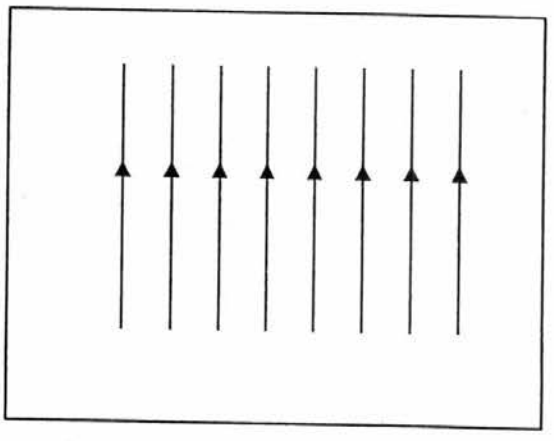
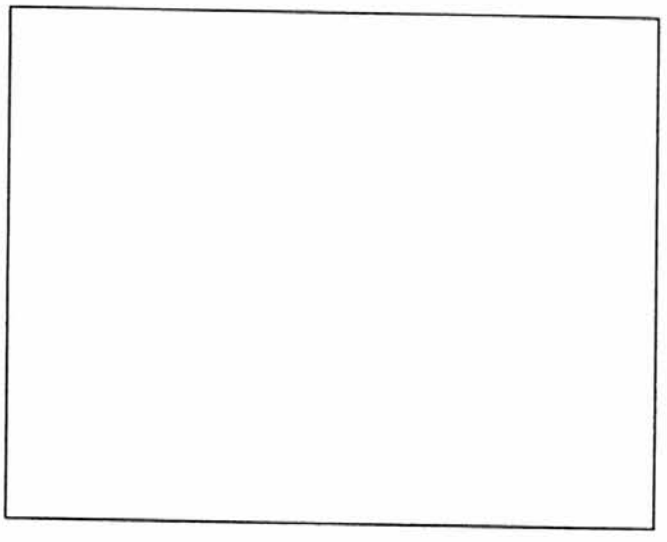


Fig. 13.3

In the space below, draw the combined magnetic field of the current flowing through *AB* and the given magnetic field. [2]



(ii) Referring to your diagram, state and explain what will happen to the rod.

.....

.....

.....

..... [2]

(b) Fig. 13.4 is a sketch of a moving-coil loudspeaker and Fig. 13.5 is the end view of the magnet as seen from the paper cone.

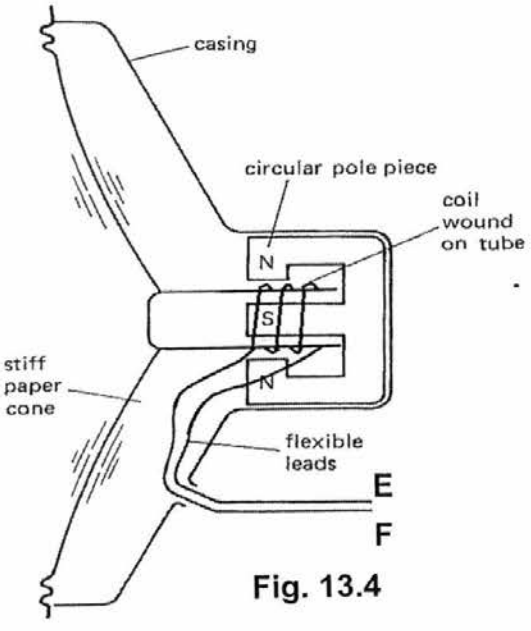


Fig. 13.4

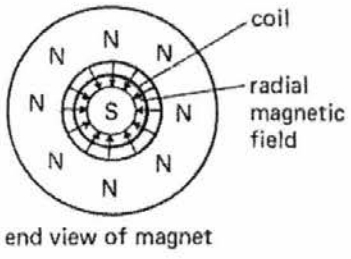


Fig. 13.5

The input voltage varies with time as shown in Fig. 13.6. Positive voltage indicates that the potential at **E** is positive and **F** is negative. Negative voltage is the reverse.

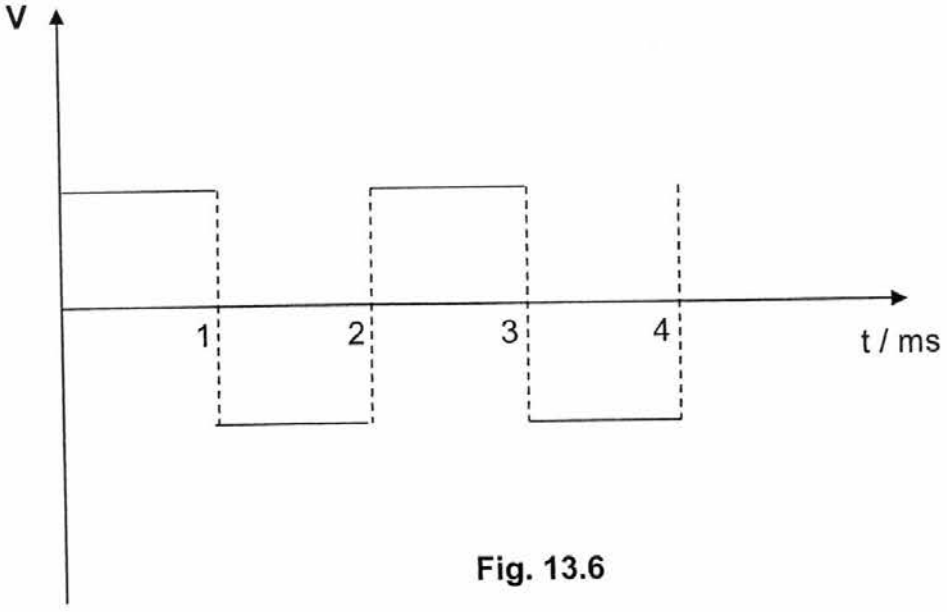


Fig. 13.6

[Turn o

(i) With reference to Fig. 13.6, state what will happen to the paper cone in the first 0.001 s.

.....

..... [1]

(ii) What will happen to the paper cone in the next 0.001 s?

.....

..... [1]

(iii) What is the frequency of the sound produced?

frequency = ... [1]

(iv) Another square voltage signal is fed into the loudspeaker replacing the one above. A louder and lower pitch sound is produced. The loudness is doubled and the frequency is halved. Draw in Fig. 13.6, the new input signal. [2]

(v) Suggest one change to the loudspeaker that can increase the loudness of the sound produced.

.....

..... [1]

OR

13 Fig. 13.7 shows the structure of a moving-coil microphone which converts an approaching sound into an alternating current (a.c.) output. The diaphragm is flexible and is connected to a circular coil which is wound around the South pole and is movable perpendicular to the magnetic field. The two ends of the coil are connected to a galvanometer.

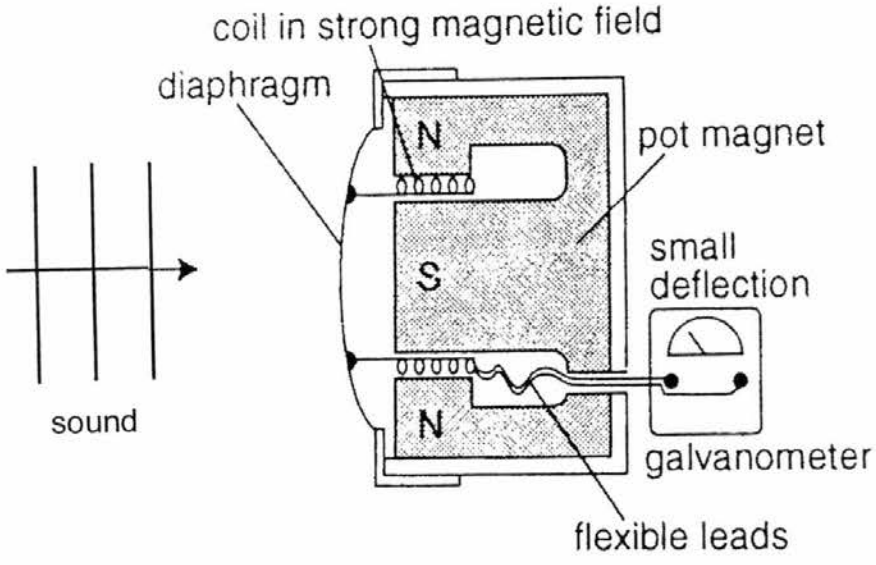


Fig. 13.7

(a) What is meant by "electromagnetic induction"?

.....

.....

.....

..... [2]

(b) State what happens to the diaphragm when the sound waves strike it?

.....

..... [1]

(c) Hence, explain how an induced alternating current is produced as shown by the pointer of the galvanometer.

.....

.....

.....

.....

.....

..... [3]

(d) If the frequency of the sound is higher, explain the effect on the induced alternating current.

.....

.....

.....

..... [2]

(e) State two ways in which the induced alternating current can be increased for a particular frequency of sound.

1. ..... [1]

2. ..... [1]

End of Paper

BENDEMEER SECONDARY SCHOOL
MARKING SCHEME
2016 PRELIMINARY EXAMINATION 2
SECONDARY FOUR EXPRESS

PAPER 1

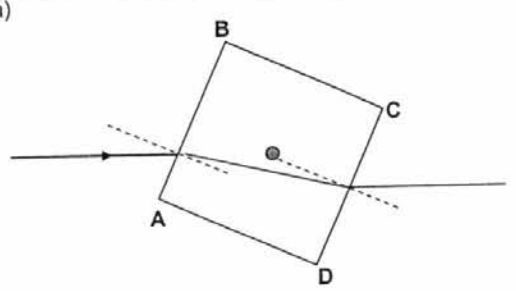
1	C
2	D
3	D
4	A
5	A
6	C
7	B
8	D
9	A
10	B

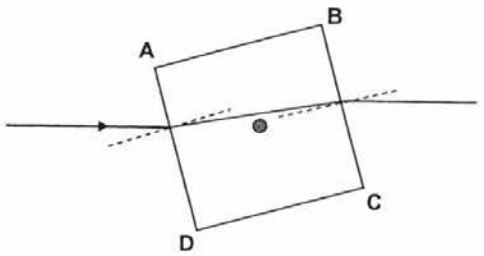
11	C
12	B
13	C
14	C
15	A
16	A
17	B
18	C
19	C
20	D

21	C
22	B
23	B
24	A
25	A
26	C
27	A
28	C
29	A
30	D

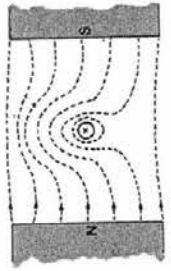
31	C
32	C
33	A
34	C
35	C
36	B
37	B
38	C
39	A
40	A

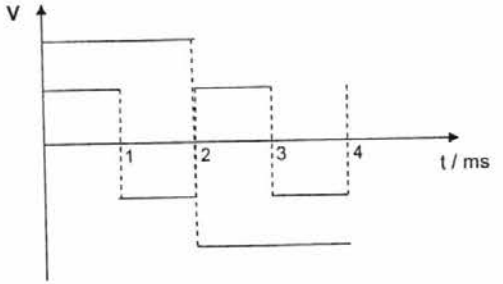
PAPER 2

		Marks
1.	(a) F = ma (Forward driving force – 400) = 800 x 1.4 Forward driving force = 1120 + 400 = 1520 N (b) As velocity increases, air resistance increases. [1] The resultant force decreases. Since F = ma, acceleration decreases. [1] (c) When air resistance increases such that the total resistive force is equal to the forward driving force, [1] the resultant force is zero. Acceleration is zero, so velocity is constant. [1]	1 1 2 2
2.	(a) Taking moments about the axle, F x 1.2 = (150 x 0.2) + (150 x 0.4) F = (30 + 60) / 1.2 F = 75 N (b) Workdone = Force x distance moved = 50 x 150 = 7 500 J (c) For luggage 1, its weight lies within the base and the anticlockwise turning effect will bring it back on the trolley. [1] For luggage 2, its weight lies outside the base. A clockwise turning effect will cause it fall off the trolley. [1]	1 1 1 1 2
3.	(a) Loss in potential energy = gain in kinetic energy = m g h = 500 x 10 x 20 = 100000 J (b) KE = ½ x m x v^2 100000 = ½ x 500 x v^2 v = 20 m/s (c) Speed is constant but direction is changing, so there is change of velocity or acceleration. (d) Loss of potential energy = workdone against friction m g h = F x d 500 x 10 x 30 = F x 50 F = 3000 N	1 1 1 1 1 1
4.	(a) The gas molecules are moving at high speeds in all directions. [1]They hit against the walls of the flask and exert forces on the walls. The total force divided by the area is the gas pressure. [1] (b) Pressure = (760 – 250) / 1000 x 13600 x 10 Pa = 69400 Pa (3 sf) (c) When the air is heated, the molecules gain kinetic energy and move faster. They hit the walls more violently and more frequently. [1] The total force increases and the pressure increases and the left hand side mercury level will move downwards and the right hand side will move upwards. [1]	2 1 1 2
5.	The temperature will be higher at the top and lower at the bottom. [1] The water at the bottom will lose heat to the melting ice, contracts and volume decreases. Since density = mass/volume, density increases. [1] It becomes denser and stays at the bottom. Warmer water at the top will not sink. [1]	3
6.	(a)  	1

	 (b) If the refractive index is higher, the ray bends more towards the normal [1] and the ray will go higher above the centre and lower below the centre. The amplitude is higher. [1] (c) The dot of light will make more oscillations per unit time. The frequency increases.	1 2 1
7.	(a) Wavelength is the distance between two consecutive molecules that are in phase. (b) Distance from the middle of compression or rarefaction to the middle of the next compression or rarefaction. (c) Each molecule will vibrate to the right and to the left parallel to the direction of wave travel. (d) Molecule A and molecule B are moving in opposite direction.	1 1 1 1
8.	(a) Current = 10/(20 + 10) = 0.333 A (3 s.f.) (b) The combined resistance of the 2 resistors in parallel is lower. The total resistance is lower. [1] The current will increase and the lamp is brighter. [1] (c) The current through the lamp is unchanged as R_3 is connected parallel. [1] The brightness is the same as (b). [1]	1 1 2 2
9.	(a) Q – North R – North They will repel each other. (b) The iron core will lose its magnetism as it is only a temporary magnet when the current is on. [1] Steel will retain its magnetism and becomes a permanent magnet. It will attract the iron as it will induce a south pole and attracts it. [1]	2 2

10.	(a) Current = Power/Voltage = 3000/50000 = 0.06 A (b) Power loss = 0.06 x 0.06 x 150 = 0.54 W (c) If the voltage is 240 V, I = 3000/240, will be high. [1] When this current flows through the transmission cable of 150 Ω, the heat generated will be very high. This is energy loss and money loss.[1]	1 1 2
11.	(a) Black surface is a better absorber of heat radiation. (b) Heat is reflected from the silvered surface to the copper tubing. Since fiberglass is a poor conductor of heat, it minimizes heat lost to the surroundings. (c) (i) Energy received by the panel per day = 3500 x 10 x 60 x60 = 126 MJ Useful energy per day = 126 MJ x $\frac{20}{100}$ =25.2 MJ or 2.52 x 10^7 J (ii) $Q = mc\Delta\theta$ 25.2 x 10^6 = m(4200)(30) M = 200 kg (iii) No. of kWh = 25.2 x 10^6 ÷ (1000 x 60 x 60) = 7.0 kWh (iv) Cost per year = 7 x 0.08 x 200 x 3 = $336 (d) Cost of installing the system = $220 Since the system can be used for more than 3 years and the cost of installing the system is cheaper than paying electrical bills for three years, [1] it is advisable to install the heating system. [1]	1 ½ ½ 2 2 1 1 2
12.	(a) Current through X = 2 x (60/230) = 0.522 A Current through Y = 750/230 = 3.26 A Current through Z = 3.26 + 0.522 = 3.78 A	2 1 1

	(b) When the switch is open or when the fuse blows, the appliances are disconnected from the high voltage.	1
	(c) (i) When there is an electrical fault and the current is very high, the electromagnet will be strong enough to attract the iron bolt to the left. [1] The plastic plunger will move upwards and opens the switch because of the spring. [1] The current stops flowing and the electromagnet loses its magnetism. [1] To reset, the plastic plunger has to be pushed down and catches the iron bolt to close the switch. [1]	4
	(ii) If a steel bolt is used, it will be magnetized permanently and will still be attracted to the electromagnet.	1
13.	(a) (i) Drawing of magnetic field 	2
	(ii) When the magnetic lines of force of the magnetic field on the left are in the same direction as the circular magnetic lines of force, they add up to a stronger magnetic field. [1] When they are in opposite directions on the right, they cancel each other and produce a weaker field. [1] The stronger field will push against the weaker field and a force acts on the wire AB to the right.	2
	(b) (i) The coil will receive an inward force as viewed from the cone.	1
	(ii) The current changes direction and the coil will receive an outward force.	1
	(iii) f = 1/0.002 = 500 Hz	1
	(iv) Drawing of voltage-time graph	2

		
	(v) Have more turns in the coil or increase the strength of the magnet.	1
13	(a) Electromagnetic induction is whenever there is change in the linking between magnetic lines of force and a circuit, an e.m.f and thus a current is induced in the circuit.	2
	(b) The sound wave causes the air to vibrate to and fro. This causes the diaphragm to go and out of the magnet.	1
	(c) When the coil moves in and out of the magnet, there is a change in the linking between the magnetic lines of force and the coil. [1] A current is induced. [1] When the coil is going in, the induced current flows in one direction and when the coil is going out, it flows in the opposite direction, thus producing alternating current. [1]	3
	(d) If the frequency of the sound wave is higher, the speed that the coil goes in and out of the magnet increases, [1] thus increasing the magnitude of the induced current and increasing the frequency of the alternating current.[1]	2
	(e) Have more turns in the coil Use a stronger magnet.	1 1