**BAHAGIAN PENGURUSAN SEKOLAH BERASRAMA PENUH
DAN SEKOLAH KECEMERLANGAN**

MODUL *PERFECT SCORE*
SEKOLAH BERASRAMA PENUH
TAHUN 2011

PHYSICS

Panel Penyedia:

NOR SAIDAH BT CHE HASSAN (Kolej Tunku Kursiah) - *Ketua*
PN JENNYTA BT NOORBI (SMS Tuanku Munawir)
HASLINA BT ISMAIL (SMS Hulu Selangor)
PN KAMARIAH BT MOHD ARSYAD (MCKK)
EN JAMALUDIN BIN ABD GHANI (SBPI Batu Rakit)

Guidelines on how to carry out the PERFECT SCORE Workshop:

1. *The workshop is divided into three slots of total of 5 hours. It is suggested that one section to be discussed in 1 hour. (Please refer to the table below)*
2. *Materials and equipments needed for this workshop :*
   - *Perfect Score Module (7 sections - Section I – VII)*
   - *Transparency / A4 paper/test pad*
   - *permanent and whiteboard marker pen*
   - *overhead projector / visualize / direct projector*
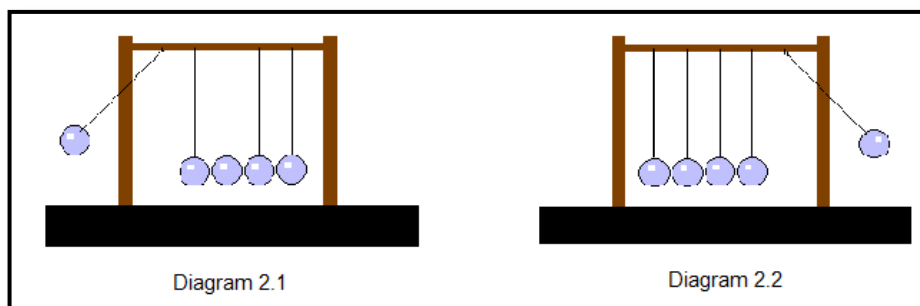   - *whiteboard/ 'majong' paper*

CONTENTS

Question 1 [Forces and Motion]

A 100 m runner try to suddenly stopped when he reached the finished line cause him fell on the ground. Explain the situation using the appropriate physics concept.

[*4 marks*]

Question 2 [Forces and Motion]

When the ball on left end of a Newton's cradle is pulled aside (Diagram 2.1) and allowed to fall, the ball on the far end is knocked away from the others with the same speed as the first ball (Diagram 2.2).
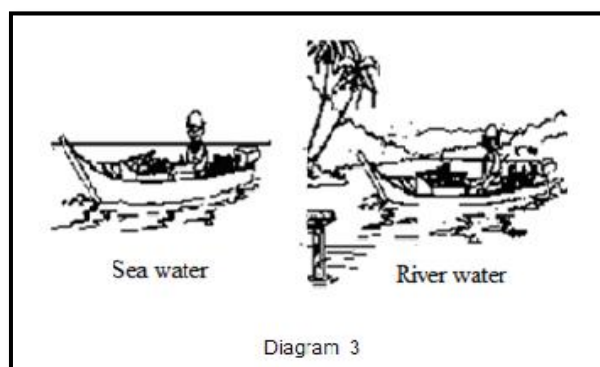

Diagram 2.1   Diagram 2.2

Explain, in term of momentum and energy transfer, why the ball on the opposite end is knocked away from the others.

[*4 marks*]

Question 3 [Forces and Pressure]

Using the physics concepts explain why a boat is at different levels in the sea and in the river, although the boat carries the same load.

[*4 marks*]

Sea water   River water

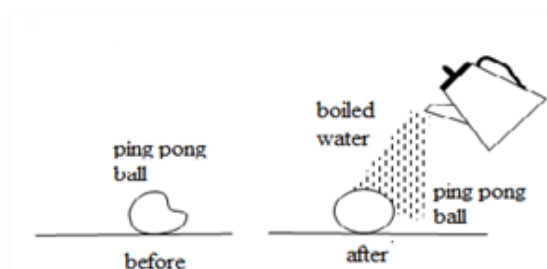Diagram 3

Question 4   [Heat]

Diagram 4

Using kinetic theory of gasses, explain the changes in volume, pressure and temperature of the ping pong ball after boiled water is poured onto it.

[*4 marks*]

Question 5   [Heat]

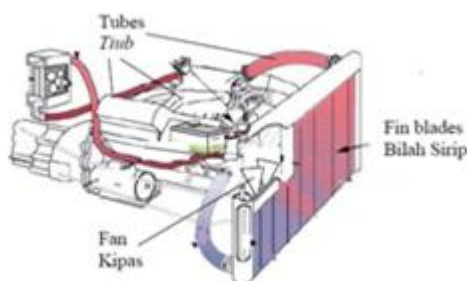Diagram 5 shows a radiator of a car

Diagram 5

Explain how the radiator can be cool. Why water is used to cooling agent.

[*4 marks*]

Question 6   [Light]

Diagram 6 shows Ali standing at the side of a pond. Ali can see the image of the fish and the image of the dragon-fly in the water as shown by the ray diagram.
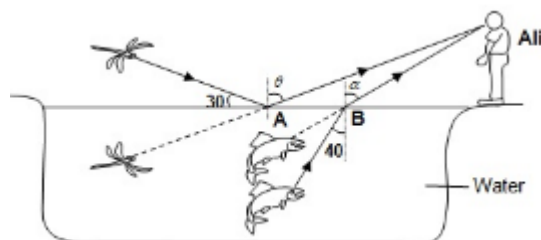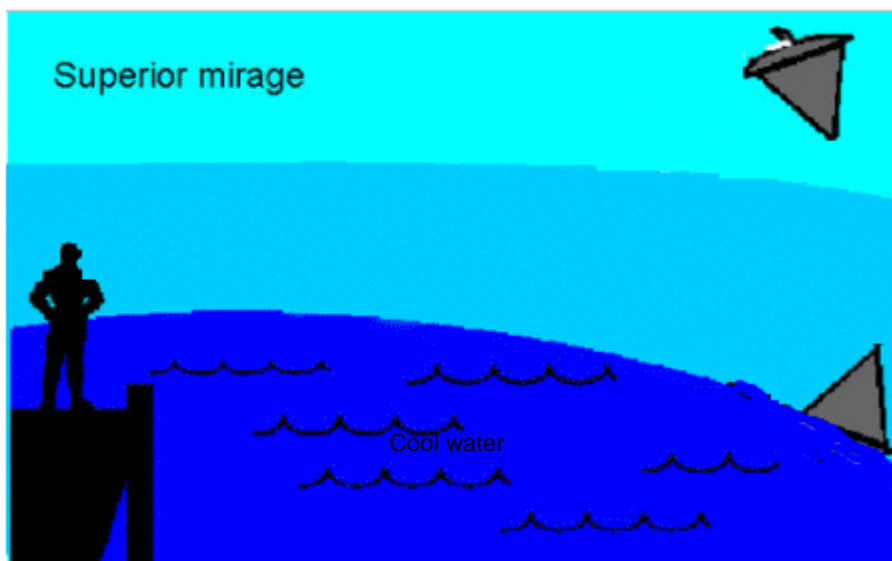

Diagram 6

By using physics phenomenon explain how Ali can see the image of the fish and the image of the dragon-fly..

[*4 marks*]

Question 7   [Light]

Diagram 7 shows the "superior mirage " which occurs over cold water surface and snow.

Using physics concepts, explain why the observer can only see the image of the ship.

[*4 marks*]

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Question 8   [Light]

With the aid of ray diagram, explain how a man should shot a fish in water so that he hits the target
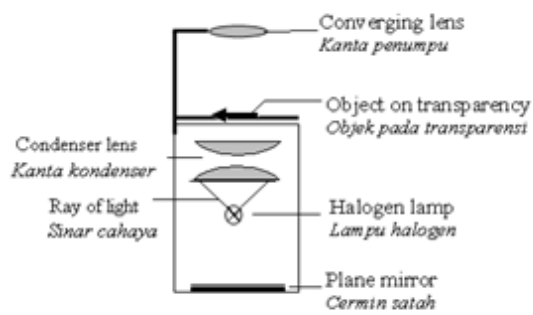
. [*4 marks*]

Question 9 [Light]

Diagram 9 shows a simple overhead projector. An image is formed by the projector on the screen.
With the aid of a ray diagram, show how the ray travel from the halogen lamp to form the image on the screen.

[*4 marks*]

Mirror

Screen **P**
Skrin **P**

Converging lens
Kanta penumpu

Object on transparency
Objek pada transparensi

Condenser lens
Kanta kondenser

Ray of light
Sinar cahaya

Halogen lamp
Lampu halogen

Plane mirror
Cermin satah

Rajah 9

Question 10 [Waves]

Diagram 10 shows the pattern of sea waves when approaching the beach.

Diagram 10

Explain in terms of the wave phenomena, why the water waves follow the shape of the beach as it approaches the shore.

[*4 marks*]

Question 11 [Waves]

Explain why water wave is calmer at the bay then at the cape.

[*4 marks*]

Question 12 [Waves]

Explain how the sound wave is used to determine the depth of an ocean.

[*4 marks*]

Question 13 [Waves]

When two spherical dippers vibrates on a water surface, a wave pattern of interference is produced.
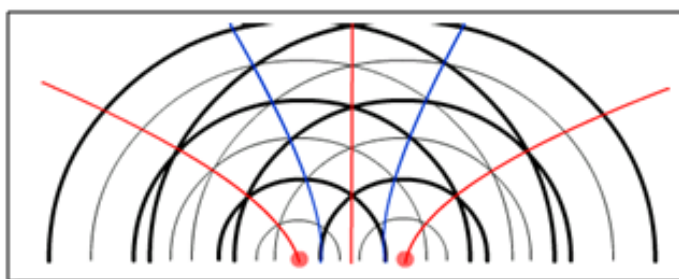

Diagram 12

Explain why the water level in the ripple tank must be at constant depth during the experiment.

[4 *marks*]

Question 14 [Electricity]

Explain the advantages of parallel circuit in a house wiring system

[*4 marks*]

Question 15 [Electricity]

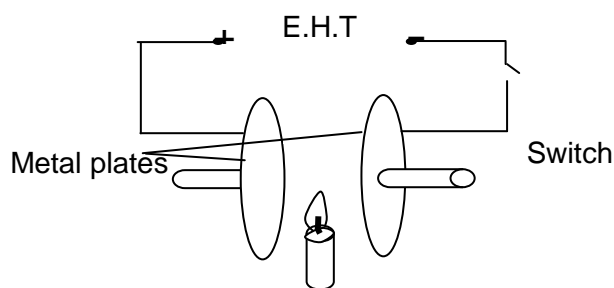Diagram 14 shows the burning candle placed between a pair of parallel metal plates.

Diagram 14

What will happen to the candle flame when the extra high voltage supply (E.H.T) is switch on?
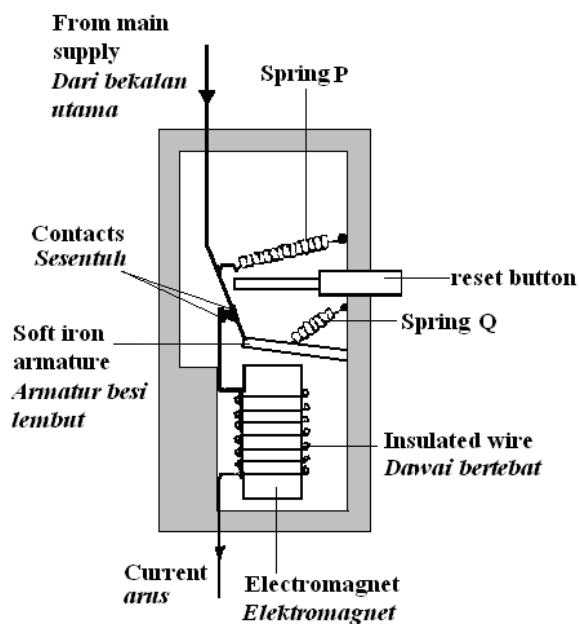
Explain your answers.

[4 *marks*]

Question 16 [Electromagnetism]

Explain the working principle of transformer

[4 marks]

Question 17 [Electromagnetism]

Diagram 10.3 shows a circuit breaker.

Explain how the circuit breaker works.

[*4 marks*]

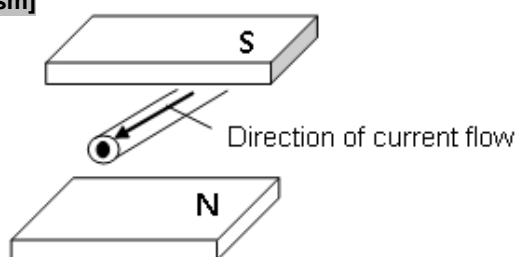**Question 18 [Electromagnetism]**

Diagram 17

When a current carrying conductor is placed in a magnetic field the conductor will move. What causes the conductor to move?   Explain your answer.

[*4 marks*]

Question 19 [Electronics]

A semiconductor diode is made from combination of an n-type semiconductor and p- type semiconductor.

Explain how an n-type semiconductor is produced.

[4 *marks*]
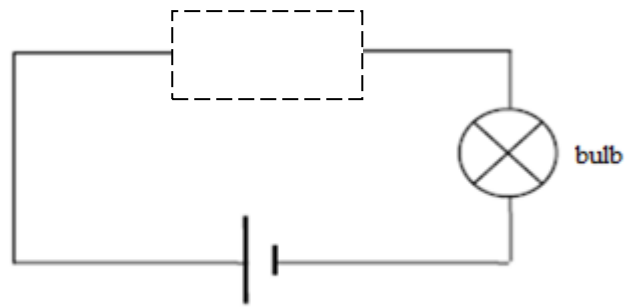
Question 20 [Electronics]

Diagram 19

Diagram 12.1 shows a circuit consisting of a diode and a bulb.

Explain how the bulb will light up

[*4 marks*]

Question 21 [Radioactivity]

Explain how the GM tube is able to detect the radioactivity radiation

[*4 marks*]

Question 1 [Force and Pressure]

Table 1 shows the characteristics of four structures of ship P, Q, R, and S.

Structure of ships	Shape	Strength Of the metal used	Ship Base Cross section area	Volume of the air space in the ship
U	Streamlined	High	Wide	High
V	Oval	Low	Wide	High
W	Circle	High	Small	Low
X	Streamlined	Low	Small	Low

Table 1

As a researcher in a ship manufacturing company, you are assigned to study the structure used to make the ship
to support heavy cargoes.
You are given four choices of the structures P, Q, R and S. The table above shows the structures of the ship.
Explain the suitable characteristics of the structure to be used to make the ship.
Determine the most suitable structure to be used to make the ship to support heavy cargoes.
Give reasons for your choice.

[*10 marks*]

Question 2 [Force and Pressure]

Diagram 2 shows a hydrometer is used to determine the density of a liquid. These apparatus is an

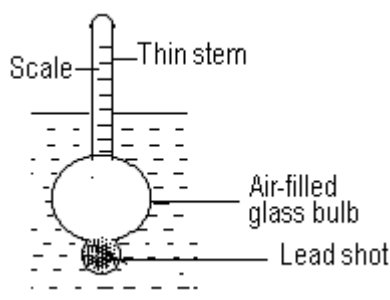application of Archimedes' Principle.

Diagram 2

You are required to build a hydrometer that can be used to measure densities of concentrated acids.

Table 2 shows the characteristics of 4 types of hydrometers L, M, N and O.

Hydrometer	Type of material of hydrometer	Diameter of stem/ cm	Density of shots/ kgm^{-3}	Diameter of bottom bulb/ cm
L	Plastic	0.5	1000	1.0
M	Plastic	2.0	1300	3.0
N	Glass	0.5	9800	3.0
O	Glass	2.0	8000	1.0

Table 2

Based on the table 2;

(i)   Explain the suitable characteristics of the hydrometer so that it can be used to measure different densities of acids.

(ii)   Decide which hydrometer is most suitable and give reasons.

[10 *marks*]

Question 3 [Force and Pressure]

Diagram 3 shows four racing motorcycles, P, Q, R and S, with different specifications. You are required to determine the most suitable motorcycle to move fast and safe when racing.

Study the specifications of all the four motorcycles from the following aspects:

Explain the suitability of the aspects.

Justify your choice.

Racing bike A Type of brake : **without** ABS Mass : 205.0 kg	 Seat height 905 mm Width of the tyre 1440 mm
Racing bike B Type of brake : **without** ABS Mass : 220.0 kg	 Seat height 1010 mm Width of tyre 940 mm

Racing bike C Type of brake : ABS (Antilock Brake System) Mass : 208.0 kg	Seat height 815 mm Width of the tyre 1440 mm
Racing bike D Type of brake : ABS (Antilock Brake System) Mass : 242.0 kg	Seat height 1055 mm Width of the tyre 940 mm

Diagram 3

[10 *marks*]

Question 4 [Force and Pressure]

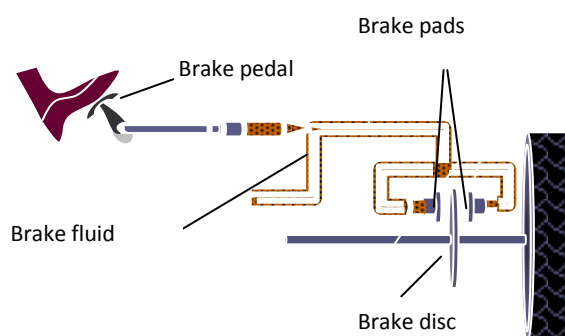Diagram 4 shows the parts of brake systems car.

Diagram 4

Table 4 shows the specifications of components that can be used in brake systems , P,Q,R, S and T.

Brake system	Specifications of components in a car brake system			
	Specific heat capacity of brake disc J kg^{-1} ^{0}C^{-1}	Melting point of brake disc ^{0}C	Compression of brake fluid	The material use of brake pads
P	360	930	Difficult	ceramics
Q	2400	1220	Difficult	steel
R	890	580	Easy	ceramics
S	2210	1940	Difficult	ceramics
T	1460	2070	Easy	steel

Table 4

Based on Table 4;You are required to determine the most suitable brake system and explain the suitability of the aspects in Table 4

[10 *marks*]

Question 5 [Heat]

As a researcher you are assigned to investigate the characteristics of four types of liquid that are suitable to be used as a coolant for a car engine.
Table 5 shows the characteristics of the liquids.

characteristics ⟍ Liquid	Boiling point / °C	Viscosity	Specific heat Capacity / J kg^{-1} C^{-1} .	Ability to react with metals
J	121	High	5500	High
K	128	Low	4750	Low
L	210	High	1195	Low
M	101	Low	3588	medium

Table 5

(i) Explain the suitability of the characteristics of the liquid to be used as a coolant for the car engine.
(ii) Determine the most suitable liquid to be used and give a reason for your choice.

[*10 marks*]

Question 6 [Light]

Diagram 6 shows an astronomical telescope consist of objective lens and eye piece. An astronomical telescope is used to view very large objects like moon.
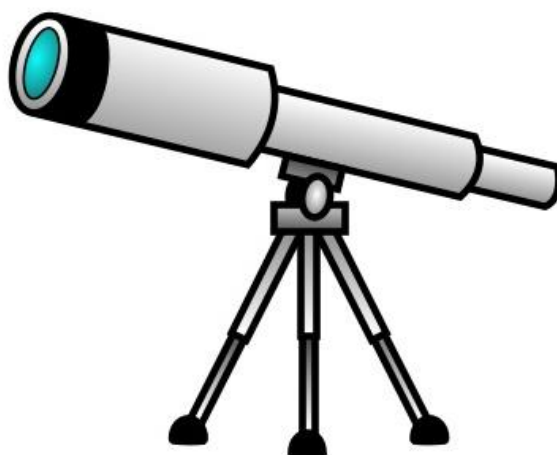

Diagram 6

Table 7 shows the characteristics of four different simple astronomical telescopes.

Telescope	Type of Objective lens	focal length of objective of, f_o /cm	The distance between two lenses / D	Diameter of the objective lens /cm
S	Convex	40	$D < f_o + f_e$	5.0
T	Concave	10	$D > f_o + f_e$	5.0
U	Convex	10	$D < f_o + f_e$	2.5
V	Concave	40	$D > f_o + f_e$	2.5

Table 6

Explain the suitability of **each characteristic** of the telescope and determine the most suitable telescope to be used to observe very far object. Give reason for your choice.

[10 *marks*]

Question 7 [Electromagnetism]

The transmission of electricity over the National Grid Network uses high voltage cables. You are assigned to study the characteristics of cables which could be used as transmission cable. Table 7 shows the characteristics of four transmission cables.

Cable	Resistivity /Ωm^{-1}	Density / kg m^{-3}	Rate of oxidation	Rate of thermal expansion
P	3.0×10^{-7}	5×10^{5}	Low	High
Q	1.8×10^{-8}	2×10^{3}	Low	Low
R	7.5×10^{-7}	8×10^{2}	High	Medium
S	7.0×10^{-8}	4×10^{3}	Medium	High

Table 7

Based on the table 7;

(i)   Explain the suitability of the characteristics of the cables to be used as transmission cable.

(ii)   Determine the most suitable transmission cable to be used and give reasons for your choice.

[10 *marks*]

Question 8 [Electronic/electromagnetism]

You are asked to investigate the design and the characteristics of four alternating current generators shown in Table 8. Explain the suitability of each characteristic of the alternating current generators and determine the alternating current generator which can supply a large direct current to an electrical component X shown in Diagram 8.
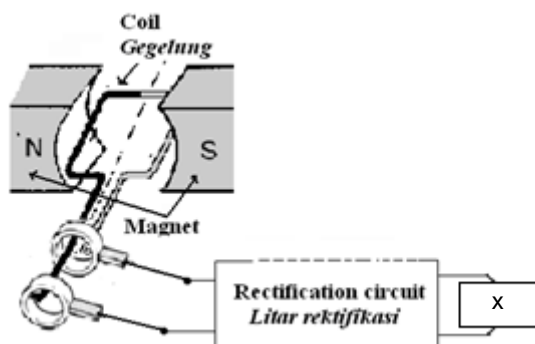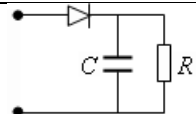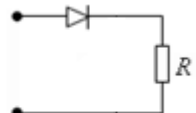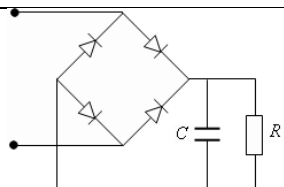

Diagram 8

Generator	Density of the coil / kg m^{-3}	Frequency of rotation	Rectification circuit
G	9200	High	
H	11600	Medium	
I	8960	High	
J	10500	Medium	

[10 *marks*]

Question 9 [Electronic]

As a research engineer in a factory, you are asked to investigate the characteristics of several substances in order to produce p-type or n-type to produce semiconductor diode.

Table 9 shows the characteristics of five semiconductors P, Q, R, S and T

Semiconductor	Electron Valens of intrinsic semiconductor	Electron Valens of doping substance	Size of the doping atom compared with the size of the atom relative to intrinsic semiconductor atom
P	5	2	Big
Q	4	5	Small
R	3	4	Small
S	5	2	Almost the same
T	4	3	Almost the same

Table 9

Explain the suitability of the characteristics of the semiconductor P, Q, R, S and T to be used in the production of a semiconductor diode.

Give reasons for your choice

Which type of intrinsic semiconductor below is the most suitable to be used. Give your reason for your answer.

Type of intrinsic semiconductor
Silicon
Germanium

[10 marks]

Question 10 [Radioactivity]

As a researcher, you are assigned to investigate the characteristics of radioactive substances with to be used for the treatment of cancer.
Table 10 shows radioactive rays directed towards the cancer cells in a patient's brain.

Radioactive	Type of radiation	Half-life	State of matter	Ionizing power
J	Beta	6 hours	Liquid	High
K	Gamma	1620 years	Solid	Low
L	Gamma	5 years	Solid	Low
M	Beta	15 days	Liquid	High

Table 10

(i)   Based on Table 10, explain the suitable properties of the radioactive substances for use to kill cancer cells in patients brains.

(ii) Determine which radioactive substance is the most suitable for the treatment of cancer cells in a patient and give your reasons.

[10 *marks*]

Question 1 [INTRODUCTION TO PHYSICS]

Diagram 1.1 and 1.2 shows a vernier calipers and a micrometer screw gauge used to measure the external diameter of a same glass rod.
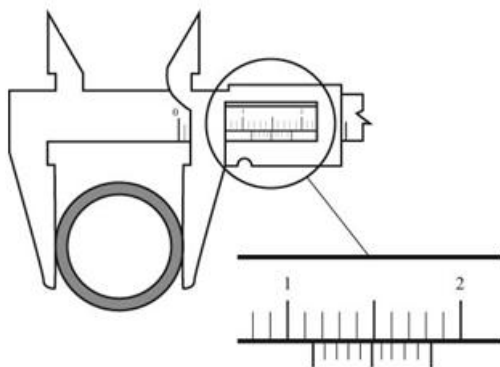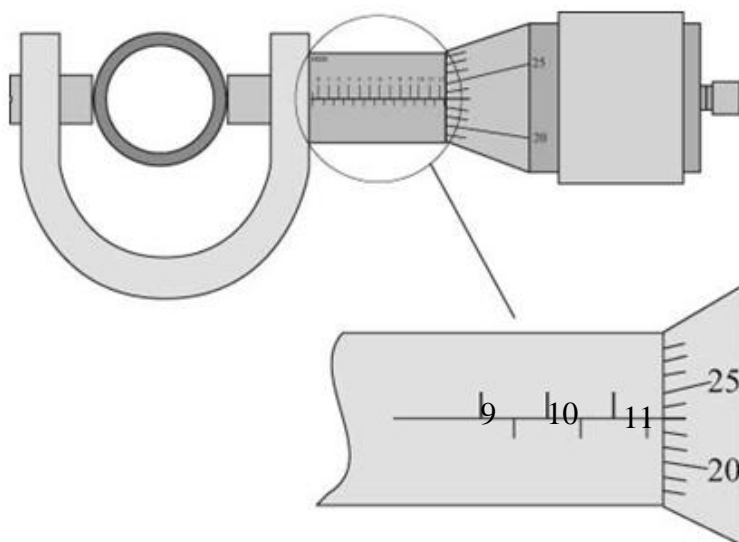

Diagram 1.1

Diagram 1.2

(a) What are the readings of vernier calipers and a micrometer screw gauge
   in centimeter shown in diagram 1.1 and diagram 1.2 ?

[2 marks]

(b) Based on the Diagram 1.1 and Diagram 1.2,
   (i)   compare the accuracy of the readings

[1 mark]

   (ii) compare smallest scales in both measuring instruments.

[1 mark]

   (iii) relate the accuracy readings with the smallest scale used

[1 mark]

   (iv) relate the sensitivity of instrument readings with the smallest scale used

[1 mark]

   (v) deduce the relation between the accuracy of reading and sensitivity of instrument.

[1 mark]

Question 2 [FORCES AND MOTION]

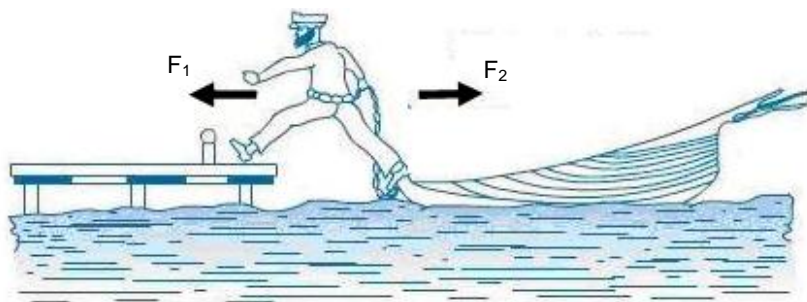Diagram 2.1 shows a man gets off from a small boat and diagram 2.2 shows a rocket that is moving upwards.

Diagram 2.1   **Diagram 2.2**

(a) (i)   Compare the magnitude of forces involved in Diagram 2.1 when man jump to the river band and
         the magnitude forces involved when the rocket is propelled in Diagram 2.2.

[1 mark]

  (ii)   Compare the direction of the two forces involved in both diagram.

[1 mark]

 (iii)   By using answer a(i) and a(ii) relate the forces in terms of action and reaction.

[2 marks]

 (iv)   Name the Physics Law related to the both situations.

[1 mark]

Question 3 [FORCES AND MOTION]

Diagram 3 shows 2 lorries, *P* and *Q* with same power are moving with different amount of loads.
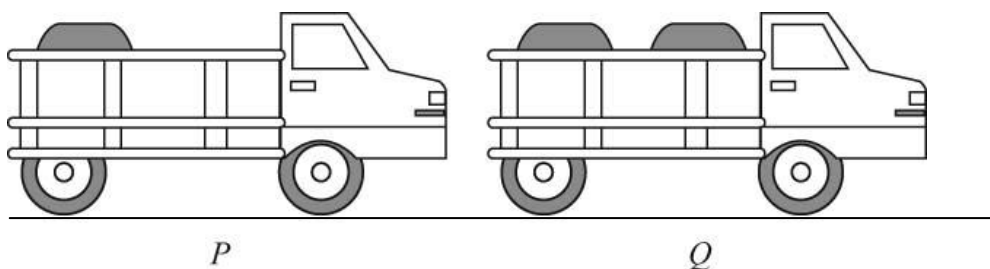

Diagram 3

Based on diagram 3,
(a) Compare
    (i) the total mass of the lorries and their loads
    (ii) the difficulties in stopping both of them.

[2 marks]

(b)   Relate the mass of the lorries to the difficulties in stopping them and hence deduce a relevant physics
        concept involved.

[3 *marks*]

Question 4 [FORCES AND PRESSURE]

Diagram 4 shows two identical blocks floating in two different liquids, water and salt solution.

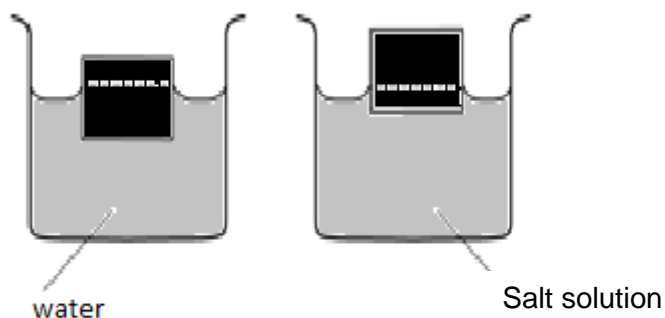water   Salt solution

Diagram 4

(a) Based on diagram 4, compare
    (i)   the density of the liquids,
    (ii)   the portion of the block immersed in the liquid
    (iii)   the buoyant force acting on the blocks when it is immersed in water and salt solution.

[3 marks]

(b) Hence, deduce the factors which affect the buoyant force acting on the blocks immersed in a liquid and
      how the factors relate to each other.

[2 *marks*]

(c) Name the physics principle involve.
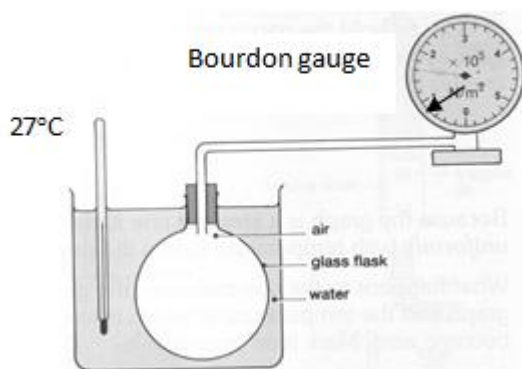
[1 *mark*]

Question 5 [HEAT]

Diagram 5.1   Diagram 5.2
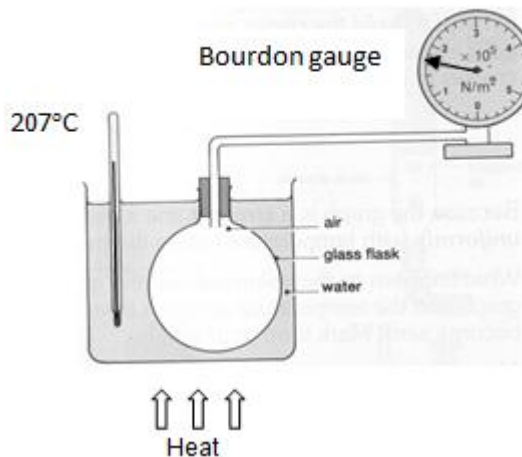
(a) What is meant by temperature ?   [1 mark]
(b) Observe diagram 5.1 and diagram 5.2. compare
     (i)   temperature of the trap air in the glass flask
     (ii)   pressure of the trap air
     (iii)   volume of the trap air
                                                  [3 marks]
(c) relate the pressure and the temperature for the trap air
                                                  [1 mark]
(d) based on the answer in (b) (i),(ii) and (iii), deduce the gas law involved in the experiment.
                                                      [1mark]

Question 6 [LIGHT]

Diagram 6.1 and Diagram 6.2 show the light rays from two identical objects strike the surface of concave mirrors. Both the mirrors produce real images. F is the focal point and C is the centre of curvature of the mirrors. I is the image and O is the object.
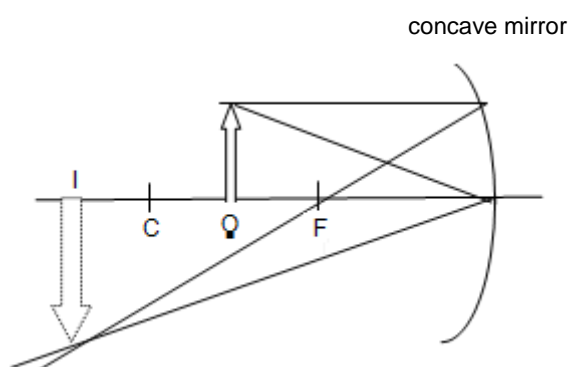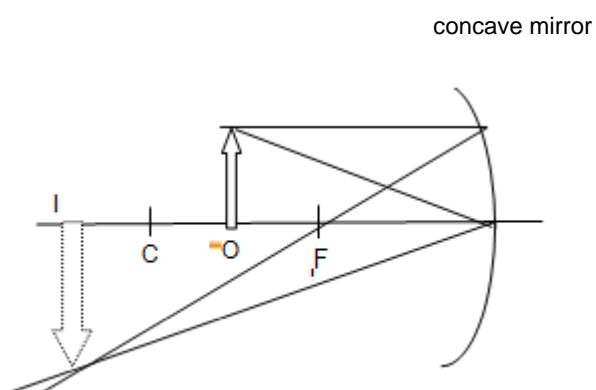

Diagram 6.1   Diagram 6.2

(a) (i) What is meant by real image?

[1 *mark*]

(ii) State the object distance relative the focal length in order to form the real image for the concave mirrors.

[1 *mark*]

(ii) Compare the object distance, the image distance and the size of the image produced by the mirrors in diagram 6.1 and diagram 6.2. Make a deduction regarding the relationship between the object distance and the size of the image.

[5 *marks*]

Question 7 [LIGHT]
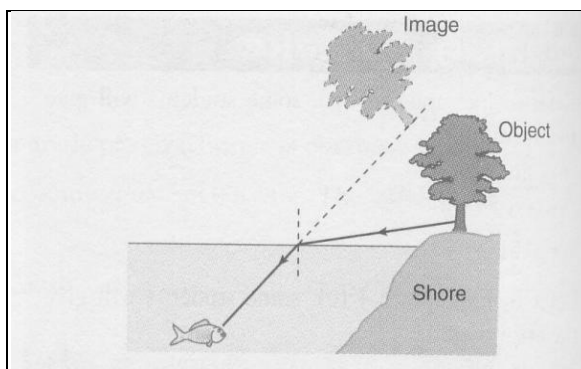

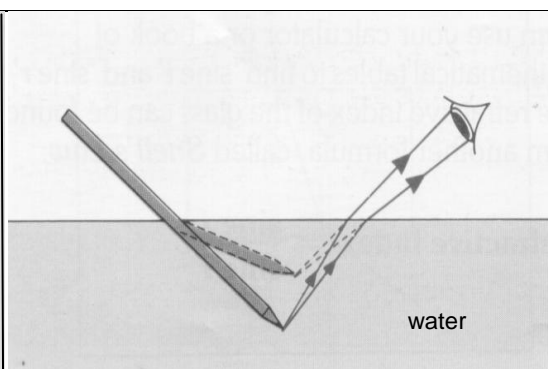Diagram 7.1   Diagram 7.2

Diagram 7.1 shows a fish's eye view of a tree. Diagram 7.2 shows a pencil in water looks bend at the surface from a man's eye view.

(a) Based on Diagram 7.1 and Diagram 7.2, compare

(i) the propagation of light in terms of density of medium.
(ii) the direction of light rays in relation to normal, when it travel in different medium.

[3 marks]

(b) Relate the direction of propagation the light in different medium.

[1 mark]

(c) Name the phenomena involved.

[1 mark]

Question 8[WAVES]

8. Diagram 8.1 shows the propagation of wavefronts of sound waves at daytime while,
    Diagram 8.2 shows the propagation during at night.
.
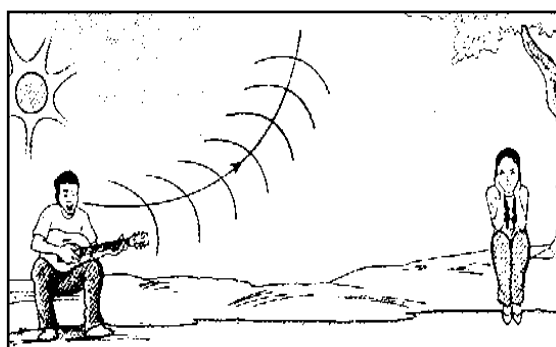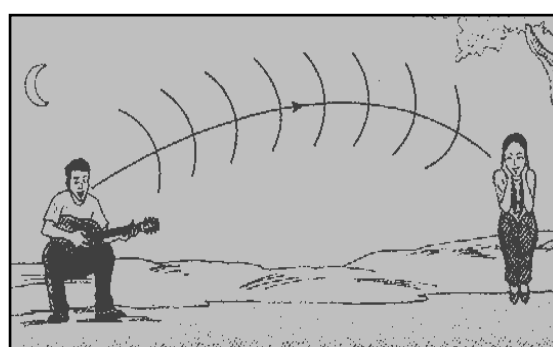

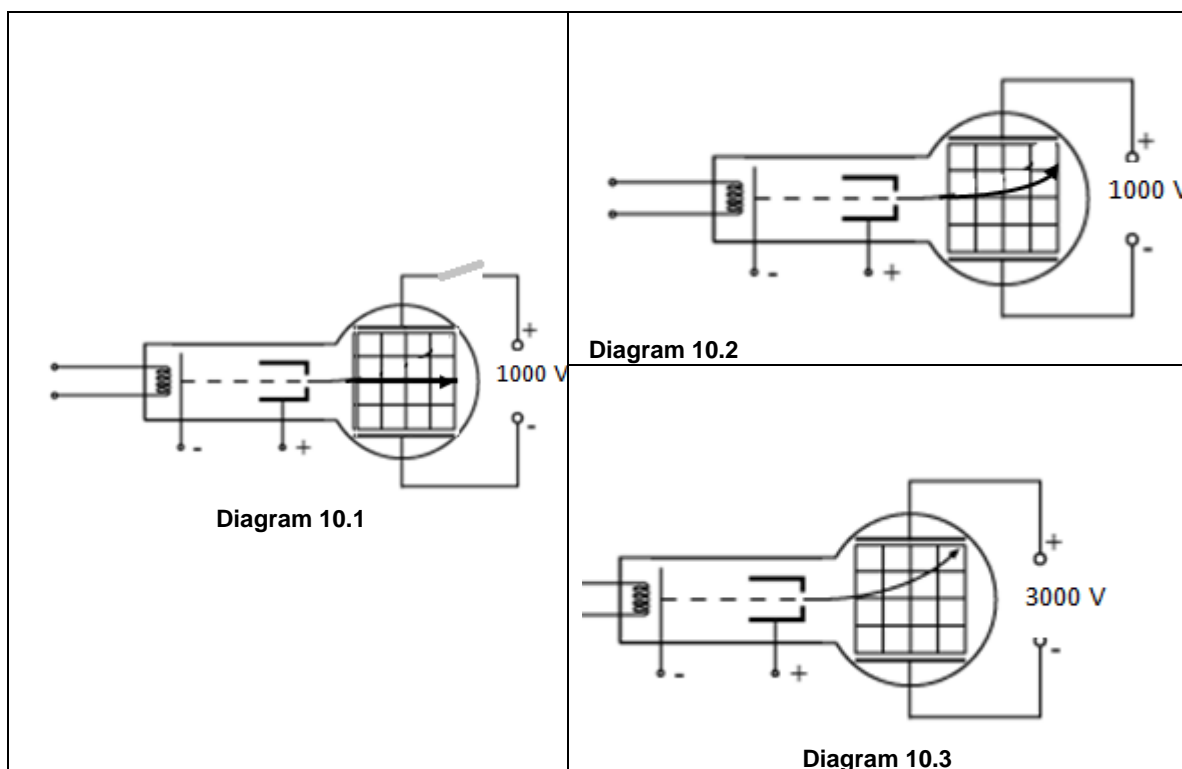
Diagram 8.1   Diagram 8.2

(a) Based on diagram 8.1 and diagram 8.2, compare
   (i)   the density of air close the ground and density of air at the upper path.
   (ii) direction of propagation of wave.
   (iii) the loudness of the sound waves that can be heard by the girl.

[3 marks]

  (b) Hence, find the relationship between the density of air, the loudness and direction of propagation to
       explain the phenomena observed.

[2 marks]

Question 10[ELECTRONIC]

Diagram 10.1

Diagram 10.2

Diagram 10.3

  (a)   State the charge of the cathode ray.

[1mark]

(b)   Based on diagram 10.1, 10.2 and 10.3, compare

   (i) the existence of the field

   (ii) the voltage of the EHT between the two plate

   (ii) that change the deflection of the cathode ray,

[3 marks]

 (c) State the relation between voltage of the EHT and the strength of the electric field between the plate and the
     relation between the strength of the electric field between   the plates and the deflection of the ray .
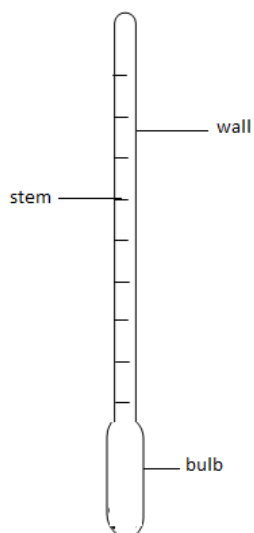
[2 marks]

Question 1 [Force and Pressure]

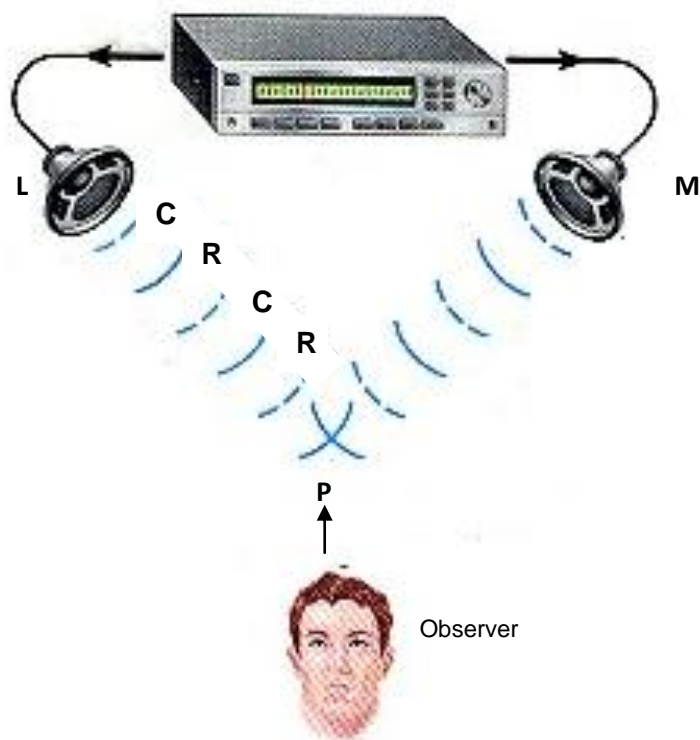Diagram 1 shows a hydrometer which is used to measure the density of the acid in a car battery

You are required to give suggestions to design a hydrometer which can work efficiently. Using your knowledge on buoyancy, and the properties of material, explain the suggestion based on the following aspects;

(i)   the material used to make hydrometer
(ii)   the size of the bulb
(iii)   the scale division and the size of the stem
(iv)   the material used to fill the bottom bulb

Diagram shows two identical loudspeakers, L and M connected to an audio signal generator which produces a note of constant frequency.

C – Compression   R – Rarefaction

Diagram 2.1

(a) (i)   Name the phenomenon shown in Diagram 2.1.

[1 mark]

(ii) The loud sound is heard by the observer at P. Explain what happens at point P.

[1 mark]

(b) Given that the frequency of the audio signal generator is 2000 Hz and the velocity of sound in air is 340ms^{-1}.
Calculate the wavelength of the sound wave.

[2 marks]

(c) The observer then walks slowly along ST. He hears loud sound and weak sound alternately. Diagram 7.2 shows the positions of the loud and weak sounds.
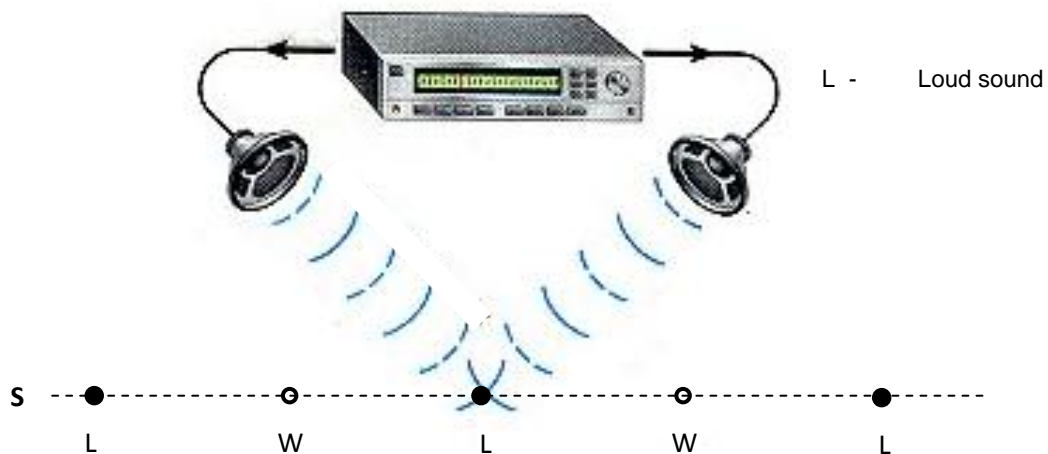
Diagram 7.2

State how to decrease the distance between two points where loud sounds are heard in terms of the frequency of the audio signal generator.

Explain your answer.

....

Explanation : ....

[2 marks]

(d) Diagram 2.3 shows a headphone which is used by an air traffic officer at the airport to reduce incoming loud noise. The incoming noise is detected by the microphone and is processed by a system of a computer inside the headphones.

(i) Suggest another component that is needed in the headphone to reduce the noise heard by the observer. Give a reason for your answer.

Component : ....

Reason : ....

[2 marks]

(ii) State the phenomenon that is used to reduce the noise and draw a diagram to explain your answer.

[2 marks]

Question 3 [Electric]

Diagram 3 shows a fuse which is used to protect electrical appliances which cannot stand high current surge for too long
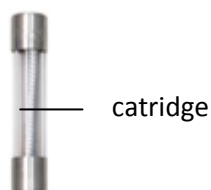

— catridge

Diagram 3

You are required to give suggestions to design a fuse which can work efficiently and can protect a 240 V, 2400 W electrical device. Using your knowledge, explain the suggestion based on the following aspects;

   i.   The thickness of wire.
   ii.   Heat capacity
   iii.   The catridge type.
   iv.   The rating of the fuse.
   v.   The melting point.

[10 marks]

QUESTION 4 [ELECTRICITY]

Diagram 4 shows the lamps in a domestic lightning circuit are connected in parallel.
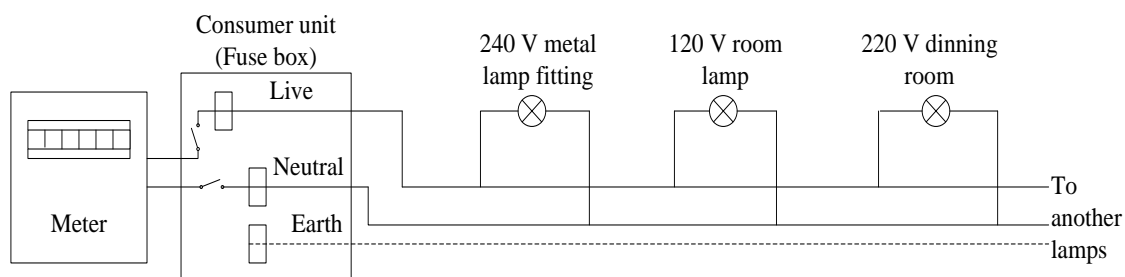

Diagram4

The circuit is not complete and not efficient for electrical energy consuming and less safety.
Suggest modifications that need to be done to the circuit to improve safety, produce the lamps lights up with normal brightness and to increases the efficiency of electrical energy consuming.

[10 *marks*]

QUESTION 5 [ELECTRICITY]

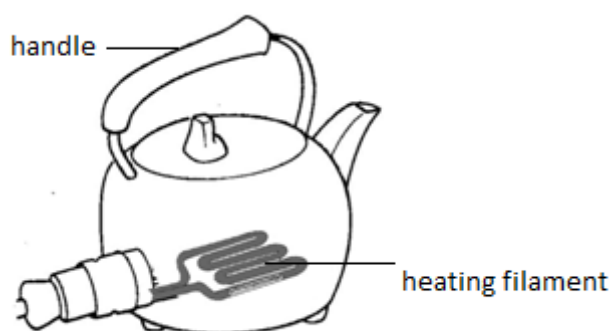Diagram 5 shows the structure of an electric kettle

Diagram 5

You are required to give suggestions to design the electric kettle that can work efficiently and easy to carry. Using your knowledge, explain the suggestion based on the following aspects;

(i)   the material to make the handle and the body of the kettle
(ii)   the design and the material of the heating filament
(iii)   the safety precaution

[10 marks]

QUESTION 6 [ELECTROMAGNETS]

Diagram 6 shows a cross section of a simple seismometer which is used to detect the earth motion and then convert it into the electrical signals.
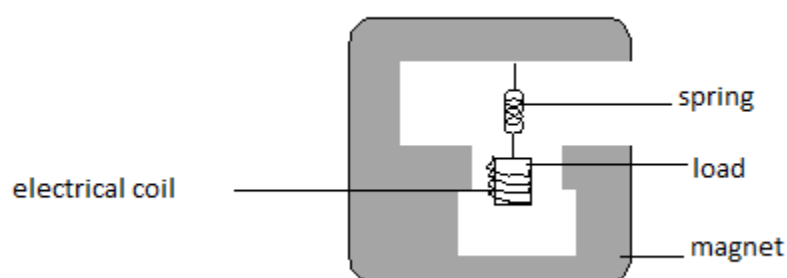

Diagram 6

You are required to give suggestions to design the seismometer which can work efficiently. Using your knowledge, explain the suggestion based on the following aspects;

(i)   the stiffness of the spring
(ii)   density of the load
(iii)   the shape of the magnet
(iv)   the type of the electrical coil
(v)   how it is used to detect small motion

[10 marks]

QUESTION 7 [ELECTROMAGNETISM]

Diagram 7 shows a cross section of a moving coil microphone. A microphone converts one form of energy into another.   .
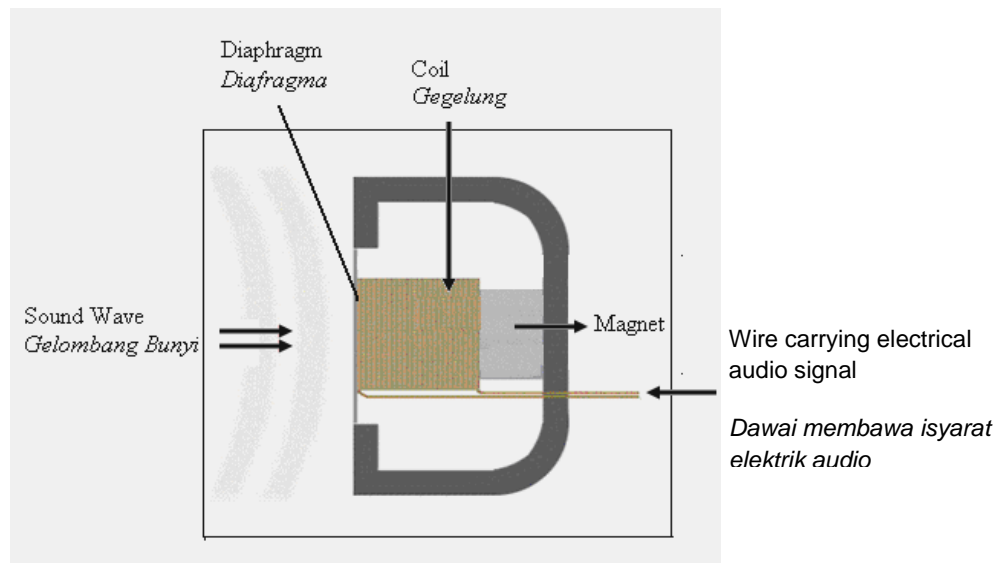
Diagram 7

When the diaphragm moves in response to sound, the attached coil moves in the magnetic field and generates a very small current in the wire of the coil.

Using an appropriate concept in physics, suggest and explain suitable modifications or ways to enable the microphone to detect sound effectively and generate bigger current based on the following aspect:
(i)   thickness of diaphragm
(ii)   strength of the material for diaphragm
(iii)   number of turns of coil
(iv)   diameter of the wire of coil
(v)   strength of magnet

[*10 marks*]

Question 8 [Electronics]

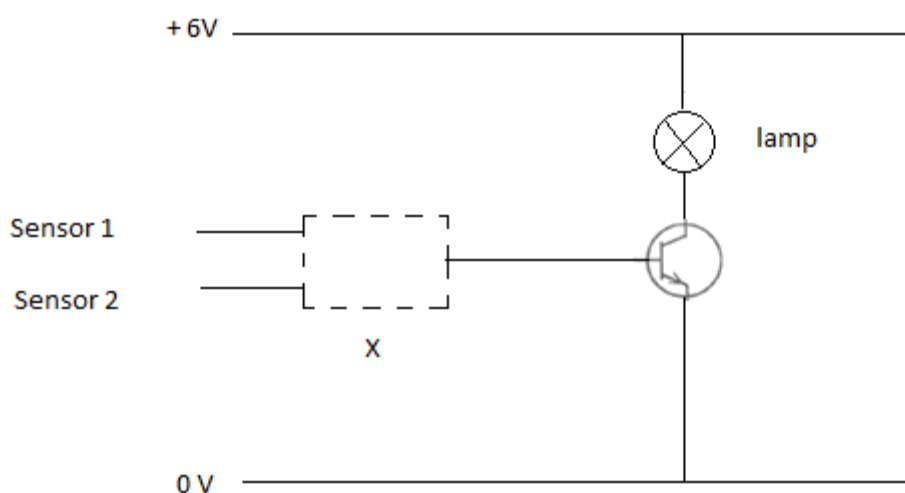Diagram 8 shows a control circuit for a simple fire alarm system.

Diagram 8

You are required to give suggestions to design the circuit so that it can switch on the transistor and sound an alarm when either one of the sensors gets hot. State and explain the suggestions based on the following aspects:
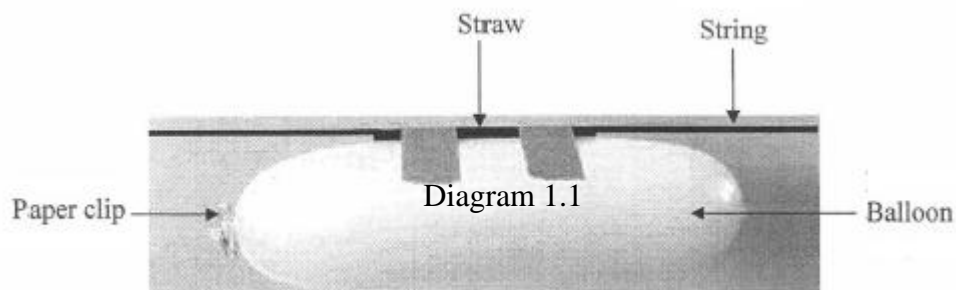i.   The type of gate X
ii.   The input of gate X
iii.   The use of extra components in the circuit and the positions of the components

Question 1 : Forces and Motion

Diagram 1.1 shows a balloon taped to a straw.

Diagram 1.1

The balloon moves with an initial velocity of 4 ms^{-1}. Then, it decelerates for 2 seconds and finally stops.
 (a) Calculate the deceleration of the balloon.
(b) Calculate the distance travelled.

[4 marks]

Question 2 : Forces and Motion

In a game, a 50 g white ball of speed 0.8 m s^{-1} hits a 30 g red ball at rest . If the white ball stops after the collision, calculate;
(a) the velocity of the red ball after the elastic collision.
(b) the change of the momentum of the white ball.
 (c) the impulsive force acting on the white ball during the collision if it is stopped in 0.05 seconds.

[*5 marks*]

Question 3 : Forces and Motion

Diagram 3.1 shows a catapult used to project an object. Force F pulls back the object, creating tension in the rubber cords.
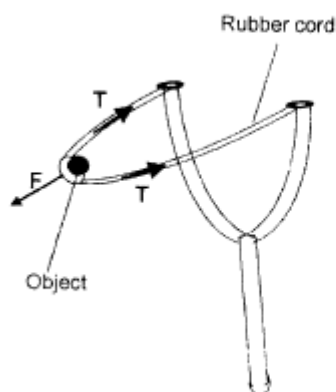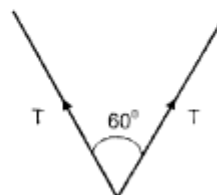

Diagram 3.1   Diagram 3.2

The tension force in each rubber cord is 20 N and the two cords are at 60^0. To each other as shown in Diagram 3.2. Determine the magnitude and direction of the resultant force of these tension forces using parallelogram of forces method.

[Use the scale 1 cm : 2.5 N]

[4 marks]

Question 4 :   Forces and Pressure

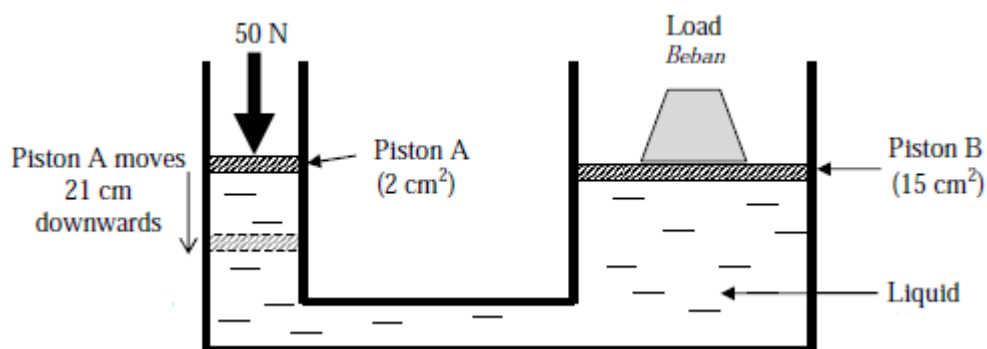Diagram 4 shows a hydraulic system used to raise a load.

Diagram 4

A force of 50 N is applied on piston A of cross-sectional area 2 cm^2. A load is placed
on piston B of cross-sectional area 15 cm^2.
(a) Calculate the force acting on piston B.

[2 marks]

(b) Calculate the distance moved by piston B if the distance moved by piston A is 21 cm.

[2 marks]

Question 5 :   Forces and Pressure

Diagram 5.1 shows an aeroplane. Diagram 5.2 shows a cross section of the aeroplane's wing. An aeroplane's wing has a mass of 900 kg and area of wing 50 m^2.

Diagram 5.1   Diagram 5.2

 (a)   If the pressure below the wing is more than the air pressure above the wing by 400 Nm^{-2},
calculate the force that exerted from below of the wing.

[2 marks]

(b)   Determine the resultant force and its direction that exerted to the wing of the aeroplane.

[3 marks]

Question 6 : Forces and Pressure

Diagram 6 shows a balloon which contains helium. The volume of the balloon is 1.2 m^3. Density of helium gas is 0.169 kg m^{-3}.

Diagram 6

(a) By neglecting the mass of the balloon, calculate the mass of helium gas in the balloon.

[2 marks]

(b) Calculate the buoyant force which acts on the balloon.
(Density of air is 1.3 kg m^{-3})

[3 marks]

Question 7 : Forces and Pressure

Diagram 7 shows oil drum floats stationary in water. The density of water is 1000 kg m^{-3}.

Surface area= 0.2 m^2
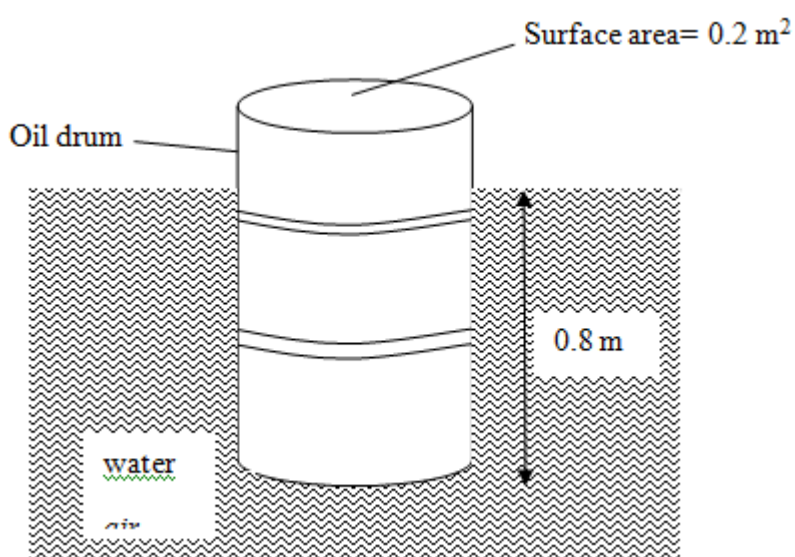
Oil drum

0.8 m

water

Diagram 7

Calculate
(a) The volume of the oil drum immersed in water.

[2 marks]

(b) The buoyant force acting on the oil drum
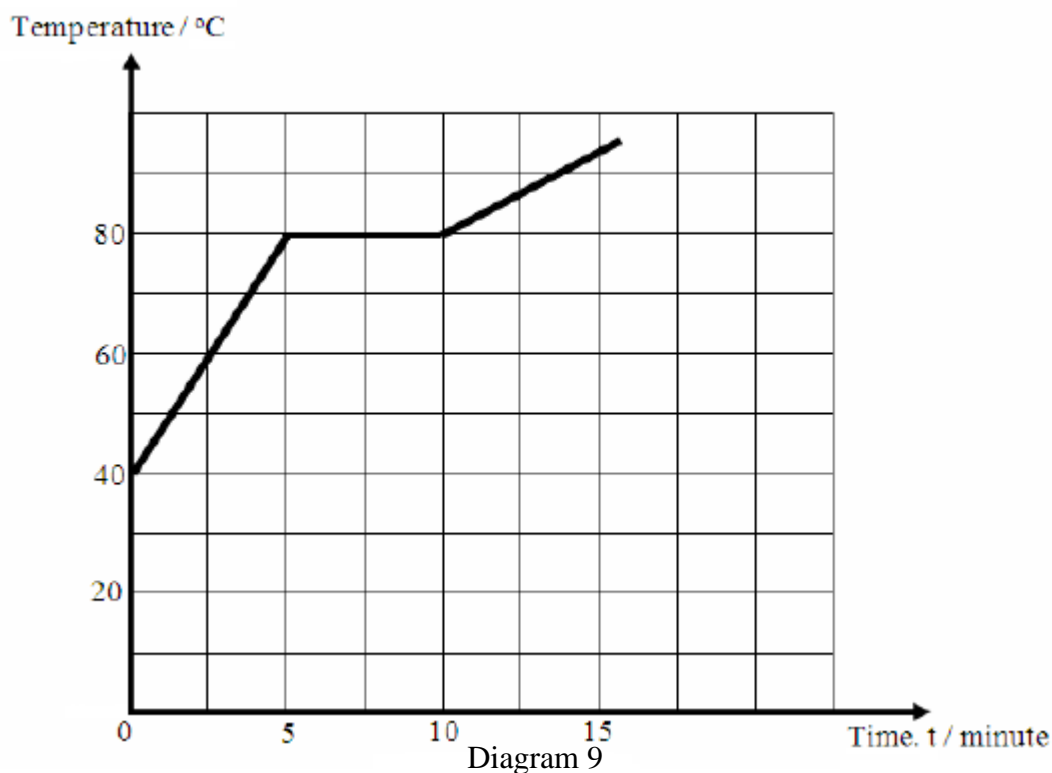
[2 marks]

(c) The mass of the oil drum.

[1 mark]

Question 8 : Heat

A thermometer which is not calibrated has a mercury column of length 5.0 cm when the temperature is 0^0C and 25.0 cm when the temperature is 100^0C. The mercury column is 12.0 cm when put in liquid X.
Determine the temperature of liquid X in Kelvin.

[4 *marks*]

Question 9 : Heat

Diagram 9 shows a graph of temperature against time taken for heating 500 g of a liquid using an immersion heater of 48 W.

Diagram 9

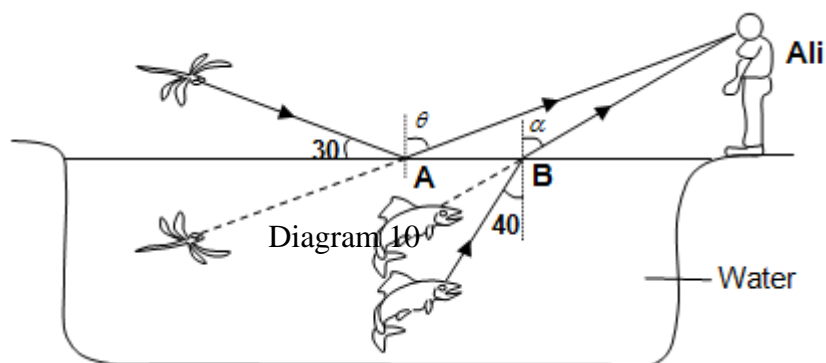(a) Calculate the specific heat capacity of the liquid

[3 marks]

(b) After 5 minutes of heating, the liquid is poured into beaker that contains 1 kg of water at temperature of 25^oC. Determine the final temperature of the mixture.

[2 marks]

Question 10 :   Light

Diagram 10 shows Ali standing at the side of a pond. Ali can see the image of the fish and the image of the dragon-fly in the water as shown by the ray diagram.

Diagram 10

Calculate the angle θ and α .[Refractive index of water is 1.33]

[4 marks]

Question 11: Light

A camera has a convex lens of focal length 5 cm is used to capture an object of 1 m in height and 4 m from the camera.

(a)   determine the image distance from the camera

[2marks]

 (b)   Calculate the height of image produced in the camera

[2marks]

Question 12: Electricity

The power rating of Lamp P is 200 W, 240 V. Calculate the electric current and resistance for the lamp P.
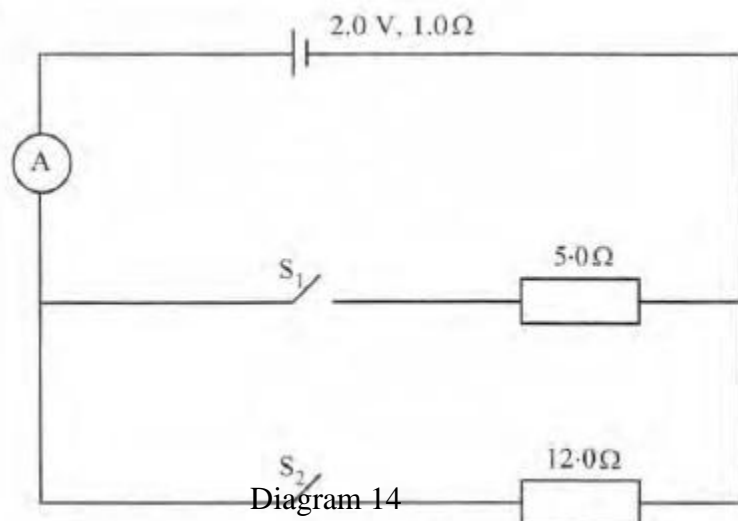
[4 marks]

Question 13: Electricity

An electric toaster has a heating element of resistance 26. 7 Ω. The current flowing through it while in use is 9A

(a) State the suitable fuse for the toaster.

 (b) Calculate
      (i) the supplied voltage
      (ii) the power dissipated by the toaster

[5 *marks*]

Question 14: Electricity
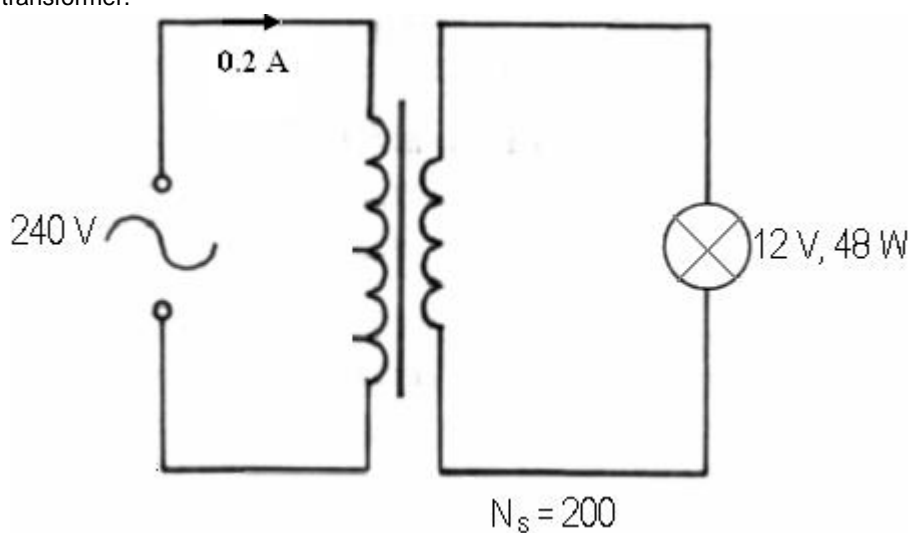
Diagram 14 shows an electric circuit.

Diagram 14

The emf of the cell is 2·0 V and its internal resistance is 1.0 Ω. Calculate the reading of the ammeter when
(a) only switch S_1 is on,
(b) both switches. S_1 and S_2 are on.

[5 marks]

Question 15: Electromagnet

Diagram 15 shows a 12V, 48W bulb lights up with normal brightness when it is   connected to a 240V main supply through a transformer.
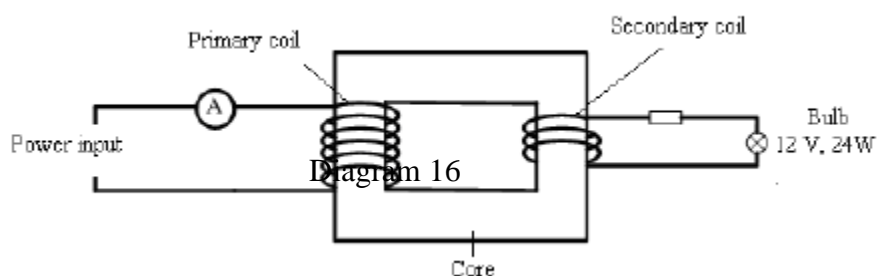

Diagram 15

(a)   Determine the output voltage of the transformer
(b)   Calculate the number of turns of the primary coil
(c)   Calculate the efficiency of the transformer .

[5 marks]

Question 16: Electromagnet

Diagram 16 shows a bulb labelled 12 V, 24 W is connected to the output of a transformer. The efficiency of the transformer is 40%.

Diagram 16

Calculate
(a) the current flow in the secondary coil.
(b) power input in the primary coil.

[5 marks]

Question 17: Electronic

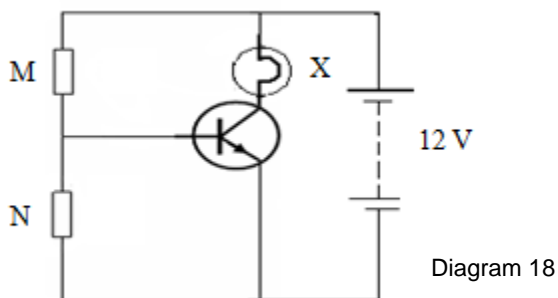An extra high voltage (EHT) supply gives 4 kV across the anode and the cathode of a vacuum tube.
Calculate the velocity of the electron when it reaches the anode tube.
[mass of electron , $m = 9.1 \times 10^{-31}$ kg, charge of electron, $e = 1.6 \times 10^{-19}$ C]

[3 marks]

Question 18: Electronic

Diagram 18 shows a transistor circuit M and N are fixed resistors. Bulb X will light up when the potential difference across N is at least 1 V.

Diagram 18

(a)   When the resistance of M is 12 kΩ and N is 500 Ω, determine the potential difference   across   N.   What happen to bulb X?

[3 marks]

(b)   Resistor T is used to replaced resistor M. Determine the maximum resistance of resistor T that enables bulb X to light up..

[2 marks]

Question 19: Radioactive

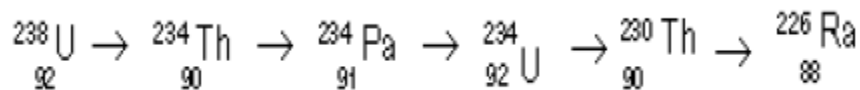Diagram 19 shows part of Uranium-238 radioactive decay series.

$$^{238}_{92}U \rightarrow \ ^{234}_{90}Th \ \rightarrow \ ^{234}_{91}Pa \ \rightarrow \ ^{234}_{92}U \ \rightarrow \ ^{230}_{90}Th \ \rightarrow \ ^{226}_{88}Ra$$

Diagram 19

Based on Diagram 19;
(a)   Uranium $^{238}_{92}U$ decays to Thorium $^{234}_{90}Th$. Write an equation to show the decaying process.
(b)   Determine the number of alpha particles and beta particles produced by the radioactive decaying series shown in Diagram 19.

[2 *marks*]

(c)   The half life of $^{234}_{92}U$ is 6.7 hours and initially has a mass 32 g. What is the mass of Pa-234 after 33.5 hours?

[2 marks]

Question 20: Radioactive

Diagram 20 shows part of Thorium-230 radioactive decay .

$$^{230}_{90}Th \ \longrightarrow \ ^{226}_{88}Ra + \ ^{4}_{2}He + Energy$$

Mass of Th-23 0 = 230.0331 u
Mass of Ra-226 = 226.0254 u
Mass of He-4 = 4.0026 u
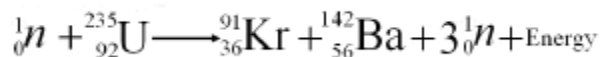[1 u = 1.66 x 10^{-27} kg]
[speed of light, c = 3 x 10^8 m s^{-1}]

(a)   Calculate the mass defect in kg.

[2 *marks*]

(b)   Calculate the energy released.

[2 marks]

Question 22: Radioactive

The following equation shows a fission reaction of Uranium-235.

$$^{1}_{0}n + \ ^{235}_{92}U \longrightarrow \ ^{91}_{36}Kr + \ ^{142}_{56}Ba + 3 \ ^{1}_{0}n + Energy$$

The nuclear energy produced in the fission reaction of uranium-235 is 2.9 x 10^{-11} J in 1.5 ms.
(a) Calculate the total lost of mass in the reaction. [c = 3.0 x 10^8 ms^{-1}]

[2 *marks*]

(b) the power generated by this reaction.

[2 *marks*]

SECTION VI – EXPERIMENT
(Paper 3 Section A)

1. A student carries out an experiment to study the relationship between the acceleration of a trolley, *a* and the height of the trolley on the inclined plane from the surface, h. The arrangement of apparatus is shown in Diagram 1.1. The frequency of the ticker timer is 50 Hz.
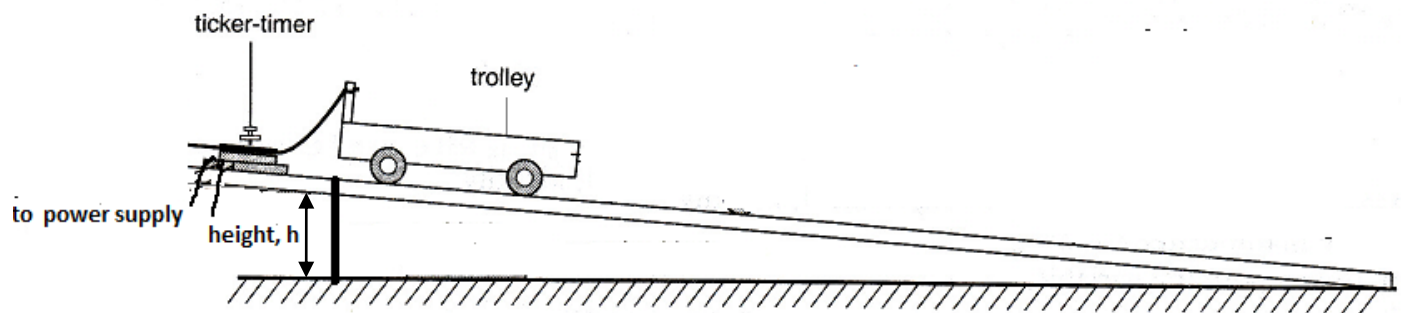

ticker-timer

trolley

to power supply

height, h

Diagram 1.1

At the beginning of the experiment, the height is started with h = 20.0 cm. 2 strips of 5 ticks of ticker tape are chosen to make a ticker tape chart to calculate the acceleration.

The experiment is repeated by varying the values of *h* to be 30.0 cm, 40.0 cm, 50.0 cm and 60.0 cm.

The ticker tape charts obtained are as shown in Diagram 1.2.

(a) For the experiment described, identify,

(i) The manipulated variable,

....

[*1 mark*]

(ii) The responding variable

....

[*1 mark*]

(iii) A fixed variable,

....

[*1 mark*]
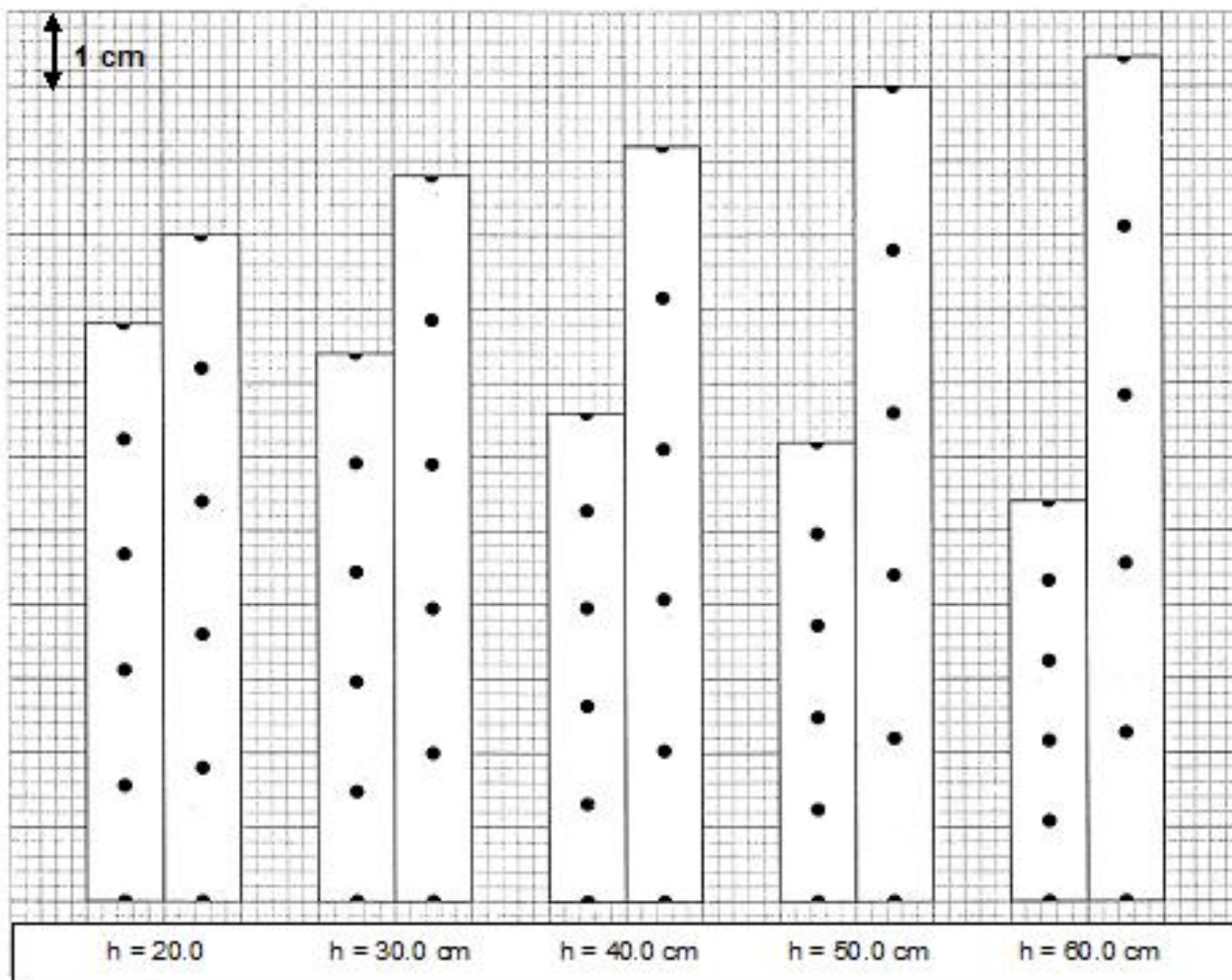
Diagram 1.2

(b)   From each ticker tape in Diagram 1.2, calculate the acceleration using the formula below:

Acceleration, a   =   Final velocity, v – initial velocity, u

Time

Tabulate your results for **h, um v** and **a** in the space below.

[*6 marks*]

(c)   On the graph paper on page 5, draw a graph of a against h.

.

[*5 mark*]

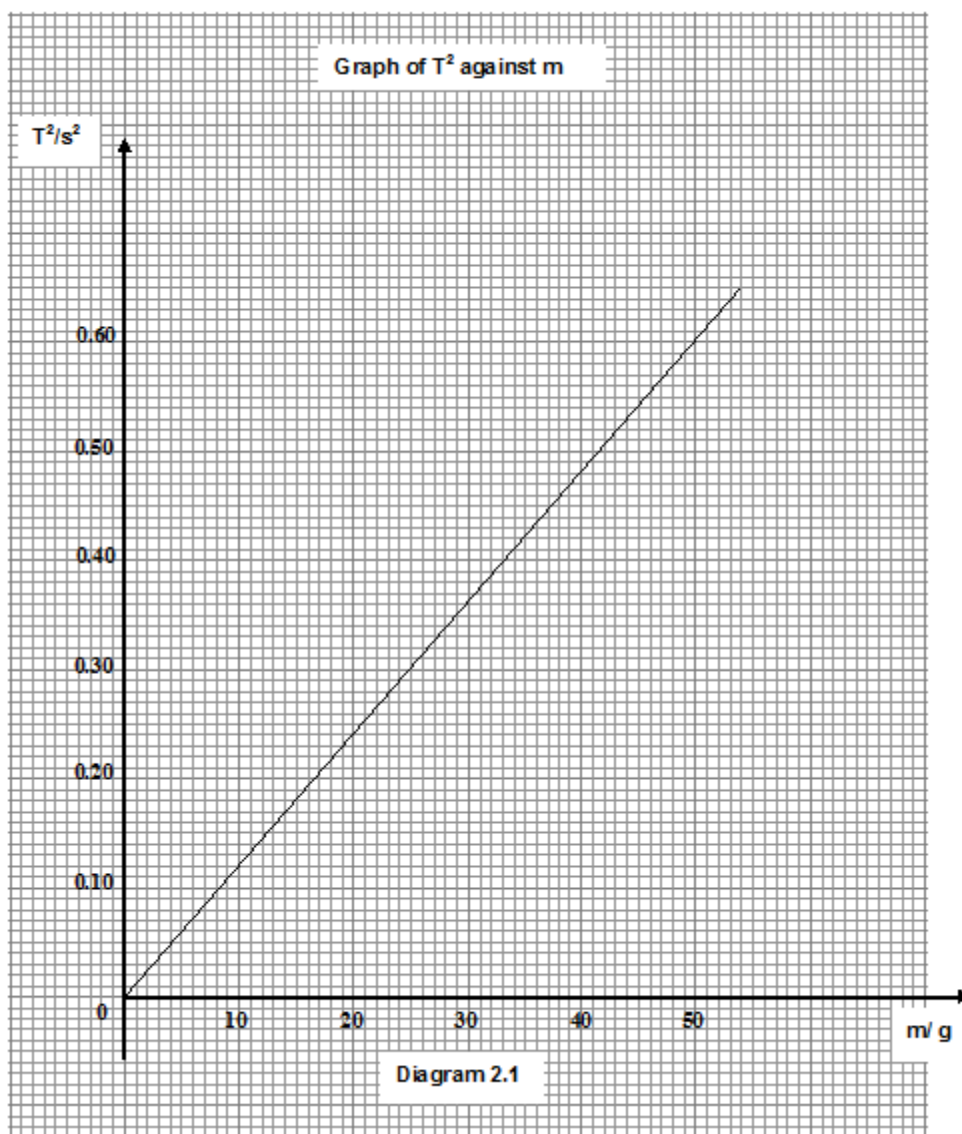(d)   Based on the graph on page 5, state the relationship between a and h.

....……………………………....

[*1 mark*]

(e)   State **one** precaution in this experiment.

....…………………………………………………

…………………………………………………………………………………………………....

[*1 mark*]

2   A student carried out an experiment to study the relationship between the period of oscillation, T and mass, m for the oscillation of a loaded hacksaw blade. The results of the experiment are shown in the graph of T^2 against m as in Diagram 2.1

Graph of T^2 against m

Diagram 2.1

(a) State the relationship between T^2 and m.

....

[1 mark]

(b)   Based on the graph in Diagram 2.1 on page 6,

(i)   Determine the value of T when m = 25 g. Show on the graph how you determine the value of T.

                                                                    [2 marks]

(ii)   Determine the value of m when T^2 = 0.75 s^2. Show on the graph how you, determine the value of m.

                                                                    [2 marks]

(c)   The stiffness of the hacksaw blade, k is given by the formula

                    k = $\underline{39.45\ m}$

                            T^2

(i)   Calculate the gradient of graph T^2 against m. Show how you determine the gradient.

                                                                    [3 marks]

(ii)   By using the formula k = $\underline{39.45\ m}$ and the value obtained in (c)(i),

                                    T^2

        calculate the stiffness of hacksaw blade, k.

                                                                    [3 marks]

(e) State **one** precaution that should be taken during this experiment.

………………………………………………………………………………..

[1 mark]

3 A student carries out an experiment to investigate the relationship between displacement, d and time, t of an
   object. The result of the experiment is shown in the graph of d against t, as in Diagram 3.1.

   (a) Based on the graph in Diagram 3.1,

        (i)   state the relationship between **d** and **t**

                …………………........................………...……………………………………..

                                                                                                              [1 *mark*]

        (ii)   determine the value of **d** when **t** = 0.4 s. Show on the graph, how you determine the value of **d**.

                d = ……………………………………………

                                                                                                              [2 marks]

   (b) The acceleration, **a**, of the object and time, **t**, are linked mathematically by the equation

$$a = \frac{2\,m}{t}$$

   where m is the gradient of the graph.

        (i) Calculate the gradient, m, when t = 0.5 s. Show on the graph how you determine m.

                m = ……………………………………………

                                                                                                              [4 marks]

        (ii) Calculate the value of **a** when the time t = 0.5 s.

                a = ……………………………………………

                                                                                                              [2 marks]

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Graph of d against t

Diagram 5.1

(c)   The gradient of the graph, m, represents one physical quantity.

        (i)   Name the physical quantity that represents the value of m

                ....…………..………………………………..……………………………………..

                                                                                [1 mark]

        (ii)   State how the physical quantity in (c) (i) varies with time.

                …………………………………….............………………………………………....

                                                                                [1 mark]

(d)   State **one** precaution that should be taken to improve the results of this experiment.

        ………………….........................………..……………………………………………..

        …………………….........................………..……………………………………………..

        …………………….........................………..……………………………………………..

                                                                                [1 mark]

Based on the diagrams in Questions 1- 15,

(a)   make **one** suitable inference   .

(b)   state **one** appropriate hypothesis that could be investigated.

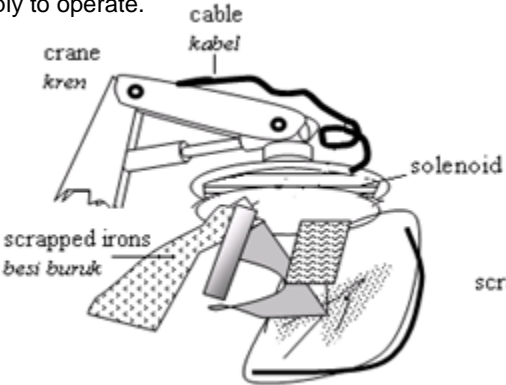(c)   describe how you would design an experiment to test your hypothesis
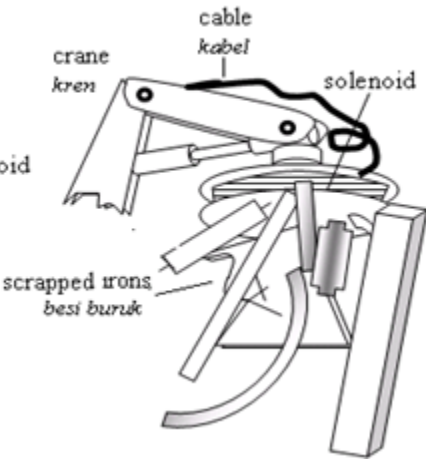
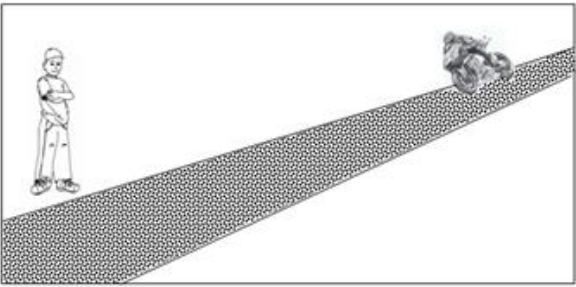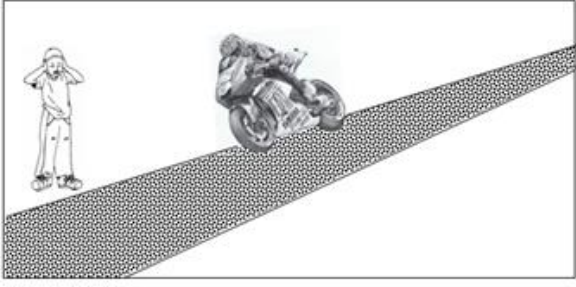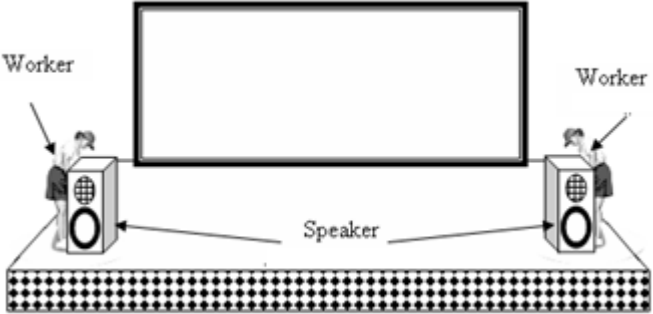   In your explanation, state clearly the following :

(i)   The aim of the experiment
(ii)   The variables in the experiment
(iii)   The list of apparatus and materials
(iv)   The arrangement of the apparatus
(v)   the procedures of the experiment, which includes the method   of controlling the   manipulated variable and the method of measuring the responding variable
(vi)   the way you would tabulate the data
(vii)   the way you would analyse the data

No.	Situation
Q1	Diagram 1.1 and Diagram 1.2 show two slides P and Q of different heights in a playground. A boy going and sliding down from the top of both slides P and Q found that he reaches the ground at different speeds. Slide P Diagram 1.1 Slide Q Diagram 1.2

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No.	Situation
Q2	Diagram 2 shows two different situations of a skier by wearing ordinary shoes and then wearing snow hoes. The mass of ordinary shoes and the snow shoes are the same. Diagram 2
Q3	The diagram 3.1 and 3.2 show a diver swimming in the sea and in fresh water. The diver experiences more discomfort to his body and ear in Diagram 3.2. Diagram 3.1 Diagram 3.2
Q4	Diagram 4.1 and 4.2 show two pots of different size filled with boiling water. It is observed that the temperature of the water in Diagram 4.1 drops at a faster rate than in Diagram 4.2. Diagram 4.1 Diagram 4.2

No.	Situation
Q5	Diagram 5.1 shows a balloon during cool day. During hot day the balloon becomes bigger as shown in diagram 5.2. Cool balloon Hot balloon Diagram 5.1 Diagram 5.2
Q6	Diagram 6.1 shows an image of a kitten snapped from a short distance. Diagram 6.2 shows the image of the kitten snapped from far. Diagram 6.1 Diagram 6.2

No.	Situation
Q7	Diagram 7.1 shows Aminah ironing her school uniform. After the iron is switched on for a while, there are still wrinkles on the uniform. Diagram 7.2 shows that the wrinkles are gone when the temperature control knob as shown in figure 7.3 on the iron is turned. Diagram 7.1 Diagram 7.2 Diagram 7.3
Q8	Diagram 8.1 and Diagram 8.2 show two cranes transferring different loads of scrapped irons. The solenoid used in the crane in Diagram 8.1 has fewer coils than the crane in Diagram 8.2. Both using the same magnitude of current supply to operate. Diagram 8.1 Diagram 8.2

No.	Situation
Q9	Diagram 9.1 shows a boy standing beside the road and a motorcycle moving towards the boy from a far distance. Diagram 9.2 shows that the boy has to close his ears when the motorcycle has come nearer to him. Diagram 9.1 Diagram 9.2
Q10	Diagram 10 shows two audio technicians is going to set a close hall so that the audient can enjoy the sound perform by a singer clearly. When the workers bring the two speakers closely to another, the distance beside two chairs must be set further apart so that the sound effect is good enough. The works can be illustrated as shown in the Diagram 10. Diagram 10

End of the Module

"tacke physics without fear...."