MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2016 SESSION

SUBJECT:	**Physics**
PAPER NUMBER:	I
DATE:	23rd April 2016
TIME:	9:00 a.m. to 11:05 a.m.

Answer all Questions.
You are requested to show your working and to write the units where necessary.
When necessary, take g, acceleration due to gravity, as 10 m/s².

Density	$m = \rho V$		
Pressure	$F = p A$	$p = \rho g h$	
Moments	$\text{Moment} = F \times \text{perpendicular distance}$		
Energy and Work	$PE = m g h$	$KE = \frac{1}{2} m v^2$	$W = F s$
	$\text{Work Done} = \text{energy converted}$		$E = P t$
Force and Motion	$m a = \text{unbalanced force}$	$W = m g$	$v = u + a t$
	$\text{average speed} = \frac{\text{total distance}}{\text{total time}}$		$s = (u + v) \frac{t}{2}$
	$v^2 = u^2 + 2 a s$	$s = u t + \frac{1}{2} a t^2$	$\text{momentum} = m v$
Waves	$\eta = \frac{\text{speed of light in air}}{\text{speed of light in medium}}$		$v = f \lambda$
	$\eta = \frac{\text{real depth}}{\text{apparent depth}}$	$\text{Magnification} = \frac{\text{image distance}}{\text{object distance}}$	
	$\text{Magnification} = \frac{\text{image height}}{\text{object height}}$		$T = \frac{1}{f}$
Electricity	$Q = I t$	$V = I R$	$E = Q V$
	$P = I V$	$R \propto \frac{1}{A}$	$E = I V t$
	$R_{total} = R_1 + R_2 + R_3$	$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2}$	
Electromagnetism	$\frac{N_p}{N_s} = \frac{V_p}{V_s}$	$V_p I_p = V_s I_s$	
Heat	$Q = m c \Delta\theta$		
Radioactivity	$A = Z + N$		
Other equations	$\text{Area of a triangle} = \frac{1}{2} b h$	$\text{Area of a trapezium} = \frac{1}{2}(a + b) h$	
	$\text{Area of a circle} = \pi r^2$		

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1. John had a small column in his house entrance and wanted to buy a statue to place on it.

a. He went to his local shop and found that the statue he liked most was available in two different materials. This is the information that he was given from the shop attendant.

	Statue A	**Statue B**
Material	Bronze	Marble
Density	8900 kg/m^3	2560 kg/m^3
Volume	0.027 m^3	0.027 m^3

i. What does the value of density represent?

[2 marks]

ii. Calculate the weight of statue B.

[2 marks]

b. John did not know if the column could support such weights, so he went back home to do some research. He found out that the maximum pressure that it can withstand without breaking is 27500 Pa.

i. The base of the statue is circular and has a radius of 0.15 m. Calculate the area of contact of the statue with the column.

[1 mark]

ii. Calculate the maximum weight of such a statue that the column can hold without breaking.

[2 marks]

iii. Based on your answer to b(ii), which statue should John buy in order not to damage the column?

[1 mark]

c. John bought another small statue to place in his fish tank as a decoration. Calculate the pressure acting on the statue due to a water column of 1.20 m. The density of water is the fish tank is 1022 kg/m^3.

[2 marks]

2a. A crane, powered by an electric motor, has a bucket that weighs 460 N when empty. The crane uses the bucket to lift 700 N of concrete up 85 m on a building site.

i. Calculate the work done by the crane's motor.

[2 marks]

ii. Electrical energy in the motor is being converted into other forms of energy as the bucket is lifted upwards (include energy loss). Name these other forms of energy.

[2 marks]

b. A brick falls from the top of the building site and lands vertically 85 m on the ground below in 4.2 s.

i. Calculate the final speed of the brick as it hits the ground.

[2 marks]

ii. Calculate the average speed of the brick whilst it falls to the ground.

[2 marks]

iii. Describe the energy changes that take place as the brick falls and hits the ground.

[2 marks]

10

3. This question is about the Earth and the Universe.

a. State whether the solar system is part of the Sun, the Milky Way or Proxima Centauri.

[1 mark]

b. Mention **ONE** difference between a *planet* and a *dwarf planet*. Give **ONE** example of each.

[3 marks]

c. Give the name of the closest and furthest planet from the sun.

Closest planet	
Furthest planet	

[2 marks]

d. What is keeping the planets orbiting around the sun?

[1 mark]

e. Why is it impossible to see all the planets every day?

[3 marks]

10

4. Carla wanted to replace the old three pin plug of her metal electric kettle.

a. Complete the following table for wiring the plug.

Wire colour	Function
	Live
Yellow/green	
Blue	

[3 marks]

b. If the kettle is rated at 1200 W, 230 V, suggest a suitable value from 4 A, 7 A and 13 A, for the fuse in the three pin plug. [Show all your working]

____

____

____

[2 marks]

c. If the kettle is used for an average of 15 minutes every day, calculate how much energy in Joules does it use in one week.

____

____

____

[2 marks]

d. How many units of electricity does this amount of energy represent?

____

____

[2 marks]

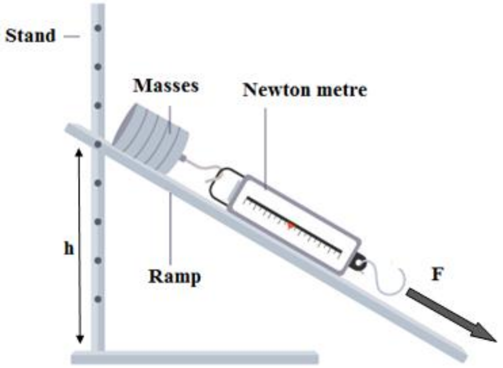
e. Give **ONE** reason why some appliances do not need to be earthed.

____

[1 mark]

10

5. Alan wanted to investigate the frictional forces acting on a mass being pulled down a ramp, inclined at different gradients.



(Diagram a*dapted from http://www.bbc.co.uk/education/guides/zttfyrd/revision/5)*

He used a stand to hold the ramp inclined at a vertical height, h, as shown in the diagram above. He then placed the masses at rest at the top of the ramp, and attached a Newton metre to the masses. He recorded the force F needed to start moving the masses at different values of h. The following results were obtained.

Vertical height h (m)	0.05	0.15	0.20	0.25	0.30	0.35
Force F (N)	23.0	18.5	16.0	13.5	10.5	8.5

a. Draw an arrow on the diagram above to show the direction of the force of friction acting on the masses. Label this arrow as '**friction**'. [1 mark]

b. Plot a graph of **force F** on the y-axis against **height h** on the x-axis. [4 marks]

c. What can you conclude about the relationship between the vertical height of the ramp and the force required to start the mass moving?

____

[1 mark]

d. How is the force of friction changing as the vertical height is increased? Explain your answer.

____

____

[2 marks]

e. What force is required to start the mass moving when the ramp is at a vertical height of 0.10m?

____

[1 mark]

f. What can Alan do, other than changing the value of h, to reduce the frictional force acting in this situation?

____

[1 mark]

10

DO NOT WRITE ABOVE THIS LINE

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6. Archimedes of Syracuse (287 BC – 212 BC) was a Greek mathematician, astronomer, physicist, inventor and engineer. He is well known for his work on levers. In fact he used to state that if given **a lever long enough** and a fulcrum on which to place it, he could move the world.

a. Why did Archimedes state that the lever has to be long enough?

[1 mark]

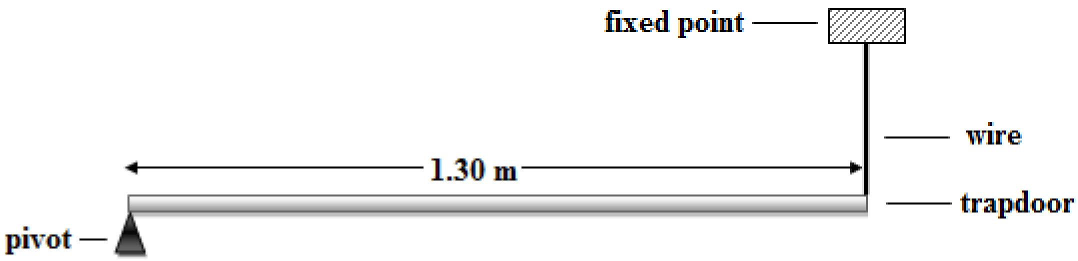
b. Define the term *moment of a force*.

[2 marks]

c. State **ONE** condition for an object to be in equilibrium.

[1 mark]

d. The diagram below shows a uniform 1.30 m trapdoor of mass 3.00 kg, held horizontally by a wire attached to a fixed point.



i. On the diagram draw arrows to show **TWO** forces acting on the trap door apart from the reaction at the pivot. Label these forces . [2 marks]

ii. Calculate the force that the wire should produce in order to keep the trapdoor horizontal.

[2 marks]

iii. A dog of mass 8.00 kg steps on the trapdoor and sits on it at a distance x metres from the pivot. The trapdoor remains horizontal if the wire produces a force of 76.6 N. Calculate the distance x in metres.

[2 marks]

10

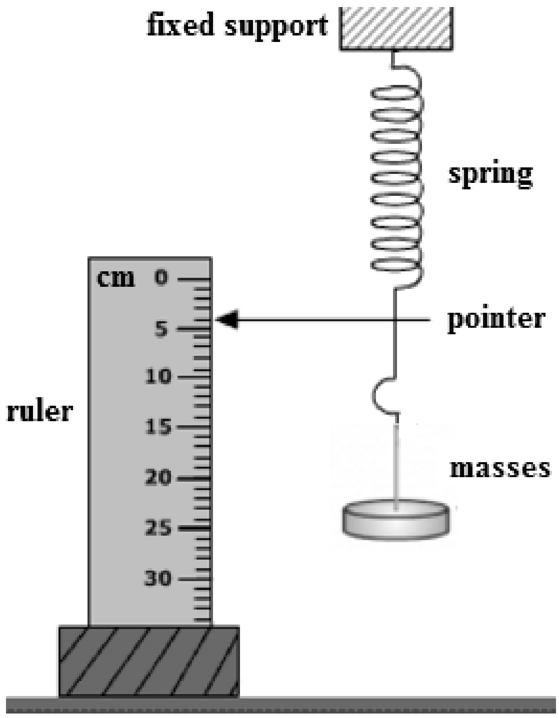
7a. State Hooke's law.

____

____

[2 marks]

b. The spring shown below is loaded with a mass of 1.00 kg, and the pointer moves from the 0 mark to the position shown.



i. Read the extension of the spring from the ruler and give your answer **in metres**.

____

[1 mark]

ii. Provided the elastic limit is not reached, where would the position of the pointer on the ruler be if the mass is tripled?

____

[1 mark]

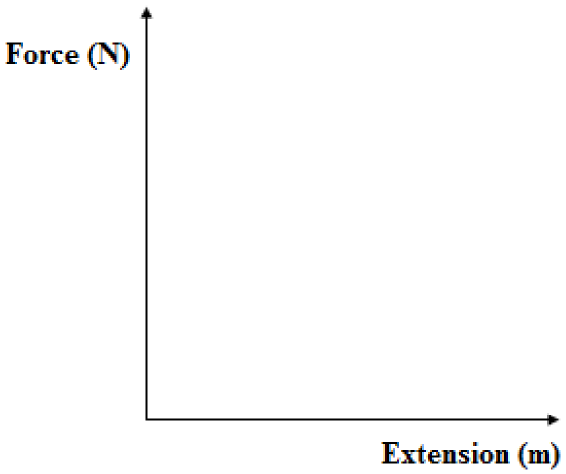
iii. Calculate the **force** required to obtain an extension of 15 cm.

____

____

____

[2 marks]



c. Sketch the shape of the graph obtained when loading the spring beyond the elastic limit. On your graph show clearly the elastic limit with an **X**. [3 marks]

d. Explain what will happen to the spring as the elastic limit is exceeded.

____

[1 mark]

10

8. The following are two possible isotopes of Carbon, ${}^{13}_{6}C$ and ${}^{14}_{6}C$.

a. Define the term isotopes?

____

____

[2 marks]

b. Complete the following table to show the number of protons and neutrons for each isotope.

Isotope	Number of protons	Number of neutrons
${}^{13}_{6}C$		
${}^{14}_{6}C$		

[2 marks]

c. An unknown source may be radioactive. Fill in the missing words:

The source is suspected to emit alpha particles. These are helium __________________, have a __________________ charge and are relatively __________________. Possibly, it is also emitting __________________ particles which are electrons, carry a __________________ charge and have a __________________ mass.

[3 marks]

d. The source is said to have a short half-life. Explain.

____

[1 mark]

e. Mention **TWO** useful applications of radioactivity in industry.

____

____

[2 marks]

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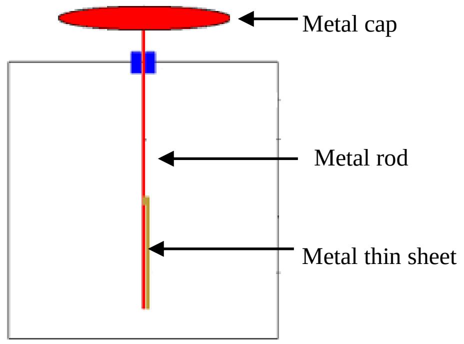
9. John assembled the setup shown in the diagram. John assumed that the setup is electrically neutral.



a. What is the meaning of electrically neutral?

____

[1 mark]

b. John took a plastic ruler and started rubbing it vigorously with a piece of cloth.

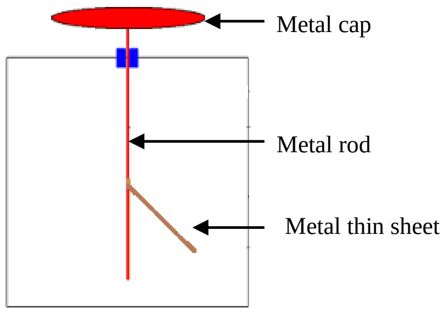
i. What happens to the ruler and cloth?

____

____

[2 marks]

ii. When John placed the ruler close to but NOT touching the metal cap, he noticed that the very thin sheet of metal moved up. Explain why this happens.



____

____

____

[3 marks]

iii. With reference to electric charges, what will happen to this sheet metal when John removes the ruler? Explain your answer.

____

____

[2 marks]

c. Plastic is classified as an insulator. Mention **TWO** differences between conductors and insulators.

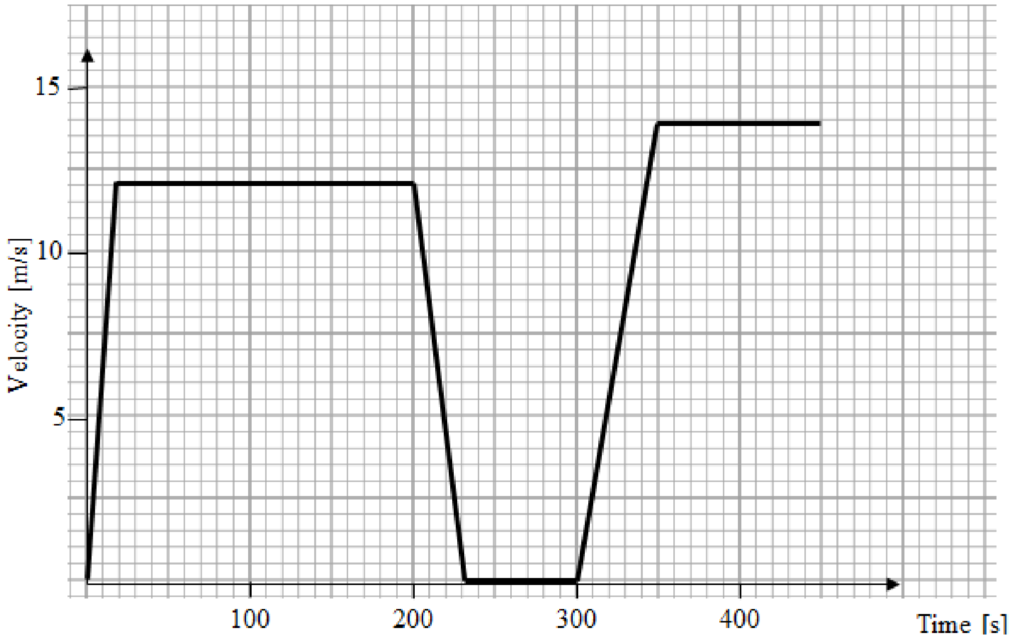
____

____

[2 marks]

10

10. The velocity time graph shows part of the journey of a bus.



a. Calculate the distance travelled by the bus between the 200 s and 230 s.

[2 marks]

b. Using the graph, calculate the deceleration of the bus. (Clearly show all working.)

[3 marks]

c. Between the 300th and 450th second the bus travelled a total distance of 1750 m. Calculate the average speed between 0 s and 450 s.

[3 marks]

d. In reality the stopping distance is greater than that calculated in part (a) above. Explain.

[2 marks]

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MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2016 SESSION

SUBJECT:	**Physics**
PAPER NUMBER:	IIA
DATE:	23rd April 2016
TIME:	4:00 p.m. to 6:05 p.m.

Answer all Questions.
You are requested to show your working and to write the units where necessary.
When necessary, take g, acceleration due to gravity, as $10 m/s^2$.

Density	$m = \rho V$		
Pressure	$F = p A$	$p = \rho g h$	
Moments	$\text{Moment} = F \times \text{perpendicular distance}$		
Energy and Work	$PE = m g h$	$KE = \frac{1}{2} m v^2$	$W = F s$
	$\text{Work Done} = \text{energy converted}$		$E = P t$
Force and Motion	$m a = \text{unbalanced force}$	$W = m g$	$v = u + a t$
	$\text{average speed} = \frac{\text{total distance}}{\text{total time}}$		$s = (u + v) \frac{t}{2}$
	$v^2 = u^2 + 2 a s$	$s = u t + \frac{1}{2} a t^2$	$\text{momentum} = m v$
Waves	$\eta = \frac{\text{speed of light in air}}{\text{speed of light in medium}}$		$v = f \lambda$
	$\eta = \frac{\text{real depth}}{\text{apparent depth}}$	$\text{Magnification} = \frac{\text{image distance}}{\text{object distance}}$	
	$\text{Magnification} = \frac{\text{image height}}{\text{object height}}$		$T = \frac{1}{f}$
Electricity	$Q = I t$	$V = I R$	$E = Q V$
	$P = I V$	$R \propto \frac{1}{A}$	$E = I V t$
	$R_{total} = R_1 + R_2 + R_3$	$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2}$	
Electromagnetism	$\frac{N_p}{N_s} = \frac{V_p}{V_s}$	$V_p I_p = V_s I_s$	
Heat	$Q = m c \Delta\theta$		
Radioactivity	$A = Z + N$		
Other equations	$\text{Area of a triangle} = \frac{1}{2} b h$	$\text{Area of a trapezium} = \frac{1}{2}(a + b) h$	
	$\text{Area of a circle} = \pi r^2$		

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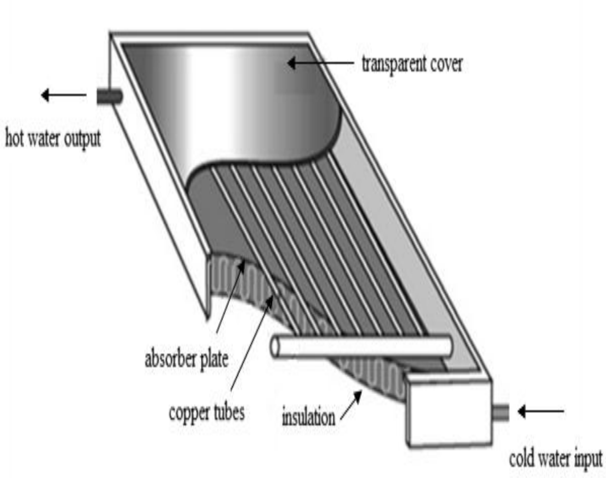
1. ***This question is about heat energy.***

a. The picture shows one type of solar water heater. Cold water from a tank is slowly pumped through copper tubes inside the solar flat plate collector, which consists of a flat plate absorber, a transparent cover and an insulated backing.



i. How is the energy from the Sun transferred to the flat plate collector?

[1 mark]

ii. Suggest a colour for the absorber plate located underneath the copper tubes? Explain your answer.

[2 marks]

iii. State how heat is transferred from the copper tube to the water. Explain why copper is chosen for manufacturing the tubes through which the water flows.

[2 marks]

iv. Explain why the transparent cover increases the efficiency of the solar heater.

[2 marks]

v. What is the purpose of the insulation at the bottom of the flat plate collector?

[1 mark]

b. In Malta, on average a person uses 30 kg of hot water per day. In order to kill bacteria, the water going into the tank at 20 ℃ must be heated to 60 ℃. The specific heat capacity of water is 4200 J/kg℃.

i. Calculate the energy needed to increase the temperature of the water consumed to 60 ℃.

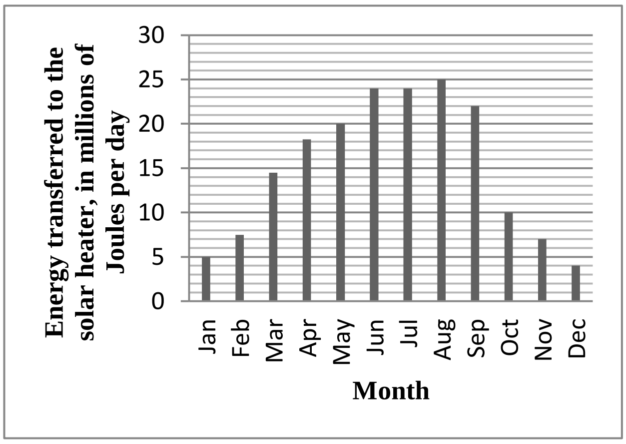
[2 marks]

ii. Calculate the energy required per day for a household consisting of **four** people.

____

[1 mark]

iii. The bar graph shows the average energy transferred to the solar heater, in millions of Joules, per day for every month of the year.
State in how many months of the year all the energy required by the solar heater of a household of **four** people, can be entirely provided by the sun.



____

____

[1 mark]

c. During those months when the solar energy is not enough to heat the water in the tank, an electric heater at the bottom of the tank has to be switched on, until the temperature rises to the necessary value.

i. State the name of the process by which the water is being heated inside the tank.

____

[1 mark]

ii. Explain clearly how this process is taking place in terms of the water molecules.

____

____

[3 marks]

iii. Should the inside walls of the tank be made of a matt black or a shiny silver coloured material? Explain your answer.

____

____

[3 marks]

iv. State the name of any other object used in our households which should have the same interior, for the same purpose stated in (c iii).

____

[1 mark]

20

2. ***This question is about moving bodies.***

a. Explain the difference between a scalar and a vector quantity giving one example of each type of quantity.

[3 marks]

b. A speedboat starts from rest and reaches a velocity of 20 m/s in 12 s. It continues at this velocity for a further 10 s. The speedboat then comes to a stop in the next 6 s. Use the equations of motion to calculate the:

i. acceleration of the speedboat in the first 12 s.

[2 marks]

ii. deceleration of the speedboat in the last 6 s.

[2 marks]

iii. total distance covered by the speedboat.

[2 marks]

iv. average speed of the speedboat.

[2 marks]

c. i. State the principle of conservation of momentum.

[1 mark]

ii. A rocket is launched by expelling gas from its engines. Use the principle of conservation of momentum to explain why the rocket rises.

____

____

[2 marks]

d. The diagram shows two shopping trolleys each of mass 12 kg on a smooth level floor. Trolley A moving at 3.5 m/s hits trolley B, which is at rest. After the collision both trolleys move together in the same direction.

Trolley A moving at 3.5 m/s

Trolley B at rest

Calculate:

i. the initial momentum of trolley A

____

____

[2 marks]

ii. the common velocity of the trolleys after the collision.

____

____

[2 marks]

iii. the frictional force that brings the trolleys to a stop in 3 seconds.

____

____

[2 marks]

20

3. ***This question is about electricity.***

a. Gillian wanted to investigate how the resistance of an LDR varies with light intensity. What do the letters LDR represent?

[1 mark]

b. She got a flash light, an ammeter, voltmeter, a switch, connecting wire, a cardboard tube and a power supply to carry out the investigation.

i. What additional equipment would she require?

[1 mark]

ii. After connecting the circuit she placed the flashlight just outside one end of the cardboard tube, whilst the LDR was placed at a distance from the flashlight inside the cardboard tube. State the purpose of the cardboard tube.

[1 mark]

iii. Draw a diagram of the setup to be used for the investigation.

[3 marks]

iv. Describe how using the setup in (iii), Gillian can carry out this investigation.

[4 marks]

v. If the relationship between resistance and distance from the light source is directly proportional, sketch a graph of the results you would expect to obtain from this experiment.

[2 marks]

vi. Why is it advisable to perform this investigation in a dark room?

[1 mark]

c. Gillian's friend Jake had two 5 Ω resistors. He connected them in series with a 3V battery.

i. What is the current flowing through each resistor?

[3 marks]

ii. What is the p.d. across each resistor?

[1 mark]

d. Jake now connects the resistors in parallel across the 3 V battery.

i. What is the p.d across each resistor?

[1 mark]

ii. What is the current in each resistor?

[2 marks]

20

4. ***This question is about light.***

a. Sunlight is made up of different colours and invisible radiations.

i. Describe a simple experiment to show the presence of the different colours in light. (Include a diagram).

[3 marks]

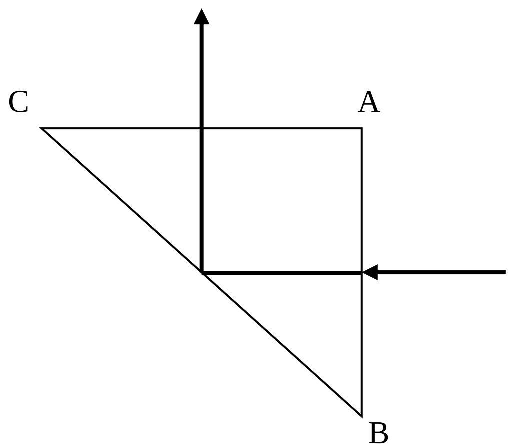
ii. Name **TWO** radiations in sunlight that the eye cannot detect.

[2 marks]

iii. Give **ONE** use for each of these radiations.

[2 marks]

b. A right angled isosceles glass prism is used to deviate a ray of light through 90^o as shown in diagram.



i. Give **TWO** reasons why the ray changes direction on side BC, as shown in the diagram.

[2 marks]

ii. State **ONE** practical use of a glass prism of this type.

[1 mark]

iii. Explain why the ray of light passes undeviated from air to glass, on side AB of the prism, as shown in the diagram.

[2 marks]

c. A convex lens has a focal length f, of 40 mm. An object of height 10 mm is placed 30 mm away from the lens.

i. Draw a ray diagram (to scale) showing how the image is formed. [4 marks]

ii. State whether the image formed is real or virtual.

[1 mark]

iii. Measure the image distance from the lens.

[1 mark]

iv. Use your diagram or otherwise, calculate the magnification of the lens.

[2 marks]

20

5. ***This question is about magnetism.***

a. A magnet can be produced using the stroking method.

i. Explain how this method is done.

____

[1 mark]

ii. What is the difference between magnetic and non magnetic materials?

____

____

[2 marks]

Diagram 1

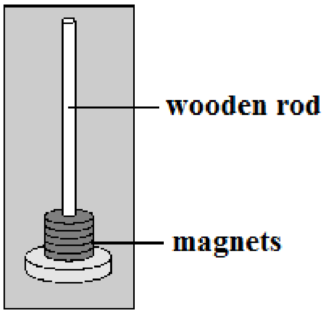
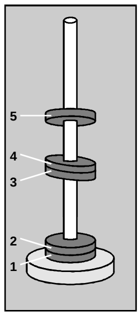


Diagram 2



b. Diagram 1 shows five magnets stacked on top of each other on a wooden rod. A student then takes the magnets off the rod, turns some of them over and puts them all back on the rod. Some of the magnets 'float' as shown as shown in Diagram 2.

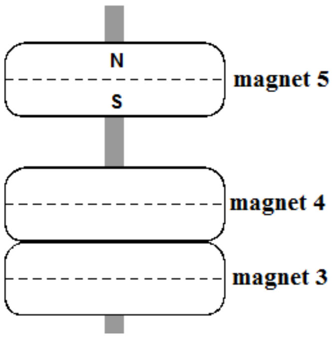
i. Why does magnet 5 'float' above magnet 4?

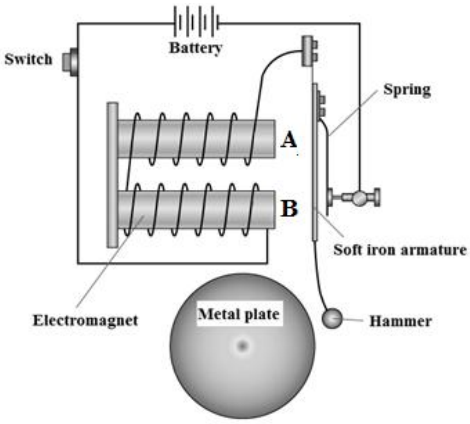
____

____

[2 marks]

ii. The diagram shows magnets 3, 4 and 5 as they float above magnets 1 and 2. The North (N) and South (S) poles on magnet 5 are labelled. Complete the diagram on the right by inserting the North (N) and South (S) poles of magnets 3 and 4. [2 marks]





(Diagram adapted from http://physics503.one-school.net/2008/06/uses-of-electromagnet-electric-bell.html)

c. Another way how a magnet can be produced is through electromagnetism. The diagram on the left shows how this concept is used in electric bells.

i. Explain clearly what makes the hammer hit the metal plate continuously when the switch is pressed.

[4 marks]

ii. State the polarity acquired by ends A and B, when the circuit is switched on.

A: ______________________ B: ________________________

[2 marks]

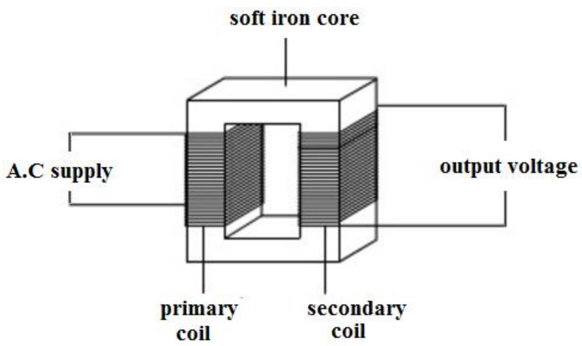
iii. The armature supporting the hammer is made of **soft iron**. Explain what is meant by the term **soft.**

[1 mark]

iv. Give **ONE** reason why soft iron is used in this case.

[1 mark]

d. The diagram shows an ideal transformer. It operates on the principle of electromagnetic induction.



i. Explain what is meant by **electromagnetic induction**.

[1 mark]

ii. This transformer has 1200 turns in the primary coil and 60 turns in the secondary coil. What type of transformer is it?

[1 mark]

iii. If the output voltage is 12 V, calculate the voltage across the primary coil.

[2 marks]

iv. State what happens to the output voltage if the A.C supply in the primary coil is substituted by a D.C supply.

[1 mark]

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Index No:________________ SEC24/2B.16m

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2016 SESSION

SUBJECT:	**Physics**
PAPER NUMBER:	IIB
DATE:	23rd April 2016
TIME:	4:00 p.m. to 6:05 p.m.

Answer all Questions.
You are requested to show your working and to write the units where necessary.
When necessary, take g, acceleration due to gravity, as 10 m/s^2.

Density	$m = \rho V$		
Pressure	$F = p A$	$p = \rho g h$	
Moments	$\text{Moment} = F \times \text{perpendicular distance}$		
Energy and Work	$PE = m g h$	$KE = \frac{1}{2} m v^2$	$W = F s$
	$\text{Work Done} = \text{energy converted}$		$E = P t$
Force and Motion	$m a = \text{unbalanced force}$	$W = m g$	$v = u + a t$
	$\text{average speed} = \frac{\text{total distance}}{\text{total time}}$		$s = (u + v) \frac{t}{2}$
	$v^2 = u^2 + 2 a s$	$s = u t + \frac{1}{2} a t^2$	$\text{momentum} = m v$
Waves	$\eta = \frac{\text{speed of light in air}}{\text{speed of light in medium}}$		$v = f \lambda$
	$\eta = \frac{\text{real depth}}{\text{apparent depth}}$	$\text{Magnification} = \frac{\text{image distance}}{\text{object distance}}$	
	$\text{Magnification} = \frac{\text{image height}}{\text{object height}}$		$T = \frac{1}{f}$
Electricity	$Q = I t$	$V = I R$	$E = Q V$
	$P = I V$	$R \propto \frac{1}{A}$	$E = I V t$
	$R_{total} = R_1 + R_2 + R_3$	$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2}$	
Electromagnetism	$\frac{N_p}{N_s} = \frac{V_p}{V_s}$	$V_p I_p = V_s I_s$	
Heat	$Q = m c \Delta\theta$		
Radioactivity	$A = Z + N$		
Other equations	$\text{Area of a triangle} = \frac{1}{2} b h$	$\text{Area of a trapezium} = \frac{1}{2}(a + b) h$	
	$\text{Area of a circle} = \pi r^2$		

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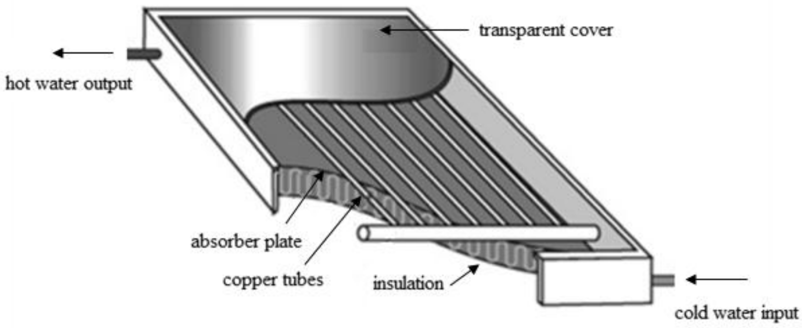
1. ***This question is about heat energy.***

a. The picture below shows one type of solar water heater. Cold water from a tank is slowly pumped through copper tubes inside the solar flat plate collector, which consists of a flat plate absorber, a transparent cover and an insulated backing.



i. How is the energy from the Sun transferred to the flat plate collector?

[1 mark]

ii. Should the absorber plate located underneath the copper tubes, be made of a matt black or a shiny silvery material? Explain your answer.

[2 marks]

iii. State the name of the process through which heat is transferred from the copper tubes to the water.

[1 mark]

iv. Give **ONE** reason why copper is chosen for manufacturing these tubes.

[1 mark]

v. The transparent cover creates a greenhouse effect. Explain how this increases the efficiency of the solar heater.

[2 marks]

vi. What is the purpose of the insulation at the bottom of the flat plate collector?

[1 mark]

b. In Malta, each day an average of 30 kg of hot water is consumed per person. To kill bacteria, the water going into the tank at 20 °C must be heated to 60 °C. The specific heat capacity of water is 4200 J/kg°C.

i. Calculate the energy needed to increase the temperature of the water consumed to 60 °C.

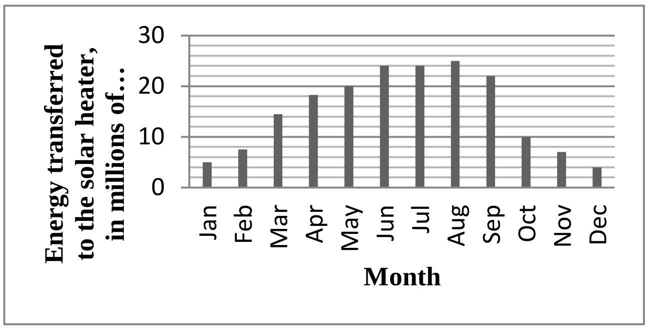
[2 marks]

ii. Calculate the energy required per day for a household consisting of **four** people.

____

[1 mark]

iii. The bar graph shows the average energy transferred to the solar heater, in millions of Joules, per day for every month of the year. State in how many months of the year all the energy required by the solar heater of a household of **four** people, can be entirely provided by the sun.



____

[1 mark]

c. During those months when the solar energy is not enough to heat the water in the tank, an electric heater inside the bottom of the tank has to be switched on, until the temperature rises to the necessary temperature.

i. State the name of the process by which the water is being heated.

____

[1 mark]

ii. Fill in the blanks using the given words, to explain clearly how this process is taking place.

sinks **expand** **temperature** **decreases** **energy** **higher**

As the water molecules closer to the heater gain ____________________, they start moving about more vigorously and the water ____________________ in the process. The density of this section of water ____________________and this causes it to rise to the upper part of the tank. The colder water at the top part of the tank ____________________ due to a ____________________ density, and the process is repeated until all the water molecules are at the same ____________________.

[3 marks]

iii. Should the inside walls of the tank be made of a matt black or a shiny silver material? Explain your answer.

____

____

[3 marks]

iv. State the name of any other object used in our households which should have the same interior, for the same purpose stated in (c iii).

____

[1 mark]

20

2. ***This question is about moving bodies.***

a. Complete the table below by placing each of the following quantity under the correct heading

Mass Force Velocity Speed Displacement Distance

Scalar	**Vector**

[3 marks]

b. A speedboat starts from rest and reaches a velocity of 20 m/s in 12 s.

i. State which quantity the following letters represent.

u = ____

v = ____

t = ____ [3 marks]

ii. The speedboat continues to travel at 20 m/s for a further 10 s. Is the speedboat accelerating? Explain.

____

____

[2 marks]

iii. The speedboat then comes to a stop in the next 6 s. Calculate the deceleration of the speedboat.

____

____

[3 marks]

c. Complete the following:

The law of conservation of momentum states that total momentum ______________________ a collision is equal to total momentum after a collision provided that no external ______________________ acts upon the system. [1 mark]

d. The diagram shows two shopping trolleys each of mass 12 kg on a smooth level floor. Trolley A moving at 3.5 m/s hits trolley B, which is at rest. After the collision both trolleys move together in the same direction.

Trolley A moving at 3.5 m/s

Trolley B at rest

i. Calculate the initial momentum of trolley A.

[2 marks]

ii. What is the initial momentum of trolley B?

[1 mark]

iii. What is the total momentum of trolleys A and B together, after collision?

[1 mark]

iv. Calculate the velocity of both trolleys A and B moving together, after the collision.

[2 marks]

v. What will happen to trolleys A and B after a few seconds? Explain.

[2 marks]

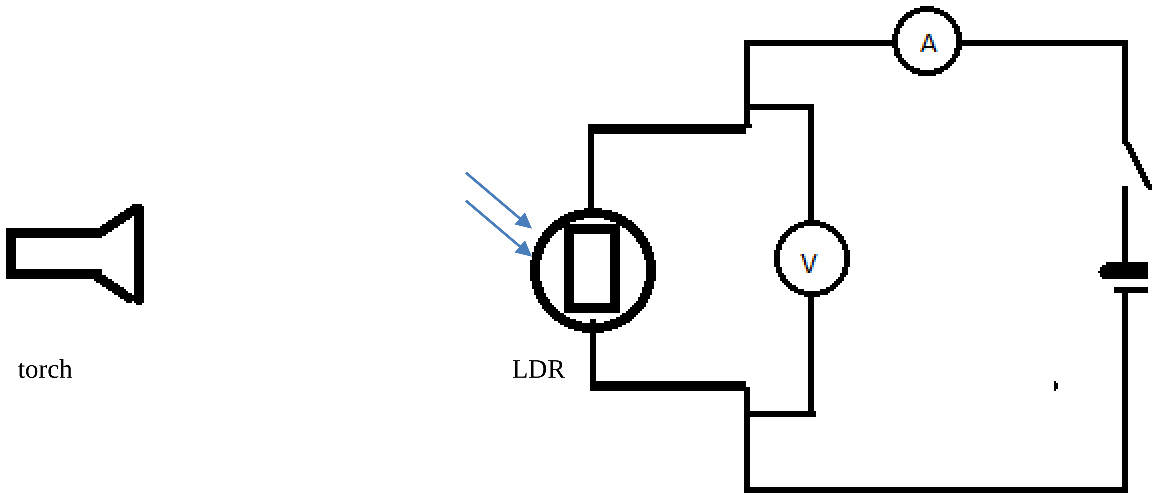
20

3. ***This question is about electricity.***

a. Gillian wanted to investigate how the resistance of an LDR varies with distance from the light source. What do the letters LDR represent?

[2 marks]

b. She set up the following circuit.



On the diagram, label each of the components used. [4 marks]

c. What additional equipment would she require?

[1 mark]

d. The following is the procedure Gillian used. Indicate the proper order of the procedure to be used.

Move the flash light away from the LDR and measure the distance between them, V and I.	
Tabulate the results and plot a graph.	
Measure distance between flash light and LDR, switch on the LDR circuit and read V and I.	
Switch on the flash light and place it close to the LDR.	

[4 marks]

e. Sketch a graph of resistance against distance from the light source you would expect to obtain from the experiment if the relationship between the two quantities is directly proportional.

[2 marks]

f. Give **ONE** reason why it is important to perform this experiment in a dark room.

____

____

[1 mark]

g. Gillian's friend Jake had two 5 Ω resistors. He connected them in series with a 3 V battery.

i. What is the total resistance of the two resistors?

____

____

[2 marks]

ii. What is the current flowing through the circuit?

____

____

[2 marks]

iii. What is the p.d. across one resistor?

____

[1 mark]

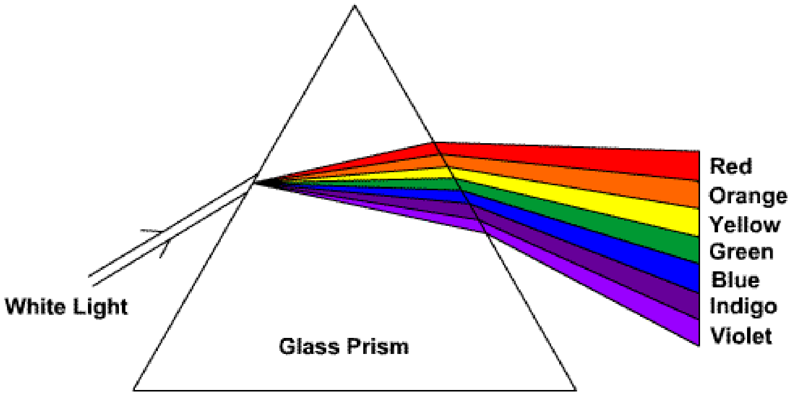
iv. Would the current in the circuit be more or less if the resistors were connected in parallel?

____

[1 mark]

20

4. ***This question is about light.***



a. White light is made up of different colours. Dispersion occurs when a ray of white light passes through a glass prism.

i. Define dispersion.

____

[1 mark]

ii. Explain why white light is dispersed when it passes through the prism.

____

____

[2 marks]

iii. White light is part of the electromagnetic spectrum. Name **TWO** other types of radiations which also form part of the electromagnetic spectrum.

____

____

[2 marks]

iv. Give **ONE** use for each of the two type of radiation mentioned in (iii) above.

____

____

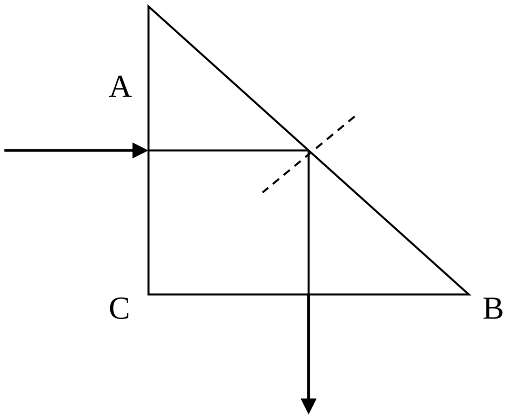
[2 marks]

b. A right angled isosceles glass prism is used to deviate a ray of light as shown in the diagram below.

i. On the diagram label the Normal with 'N'. [1 mark]

ii. On the same diagram label the angle of incidence with 'i' and the angle of reflection with 'r'. [2 marks]

iii. Explain why the ray of light passes undeviated from air to glass, on side AC of the prism, as shown in the diagram.



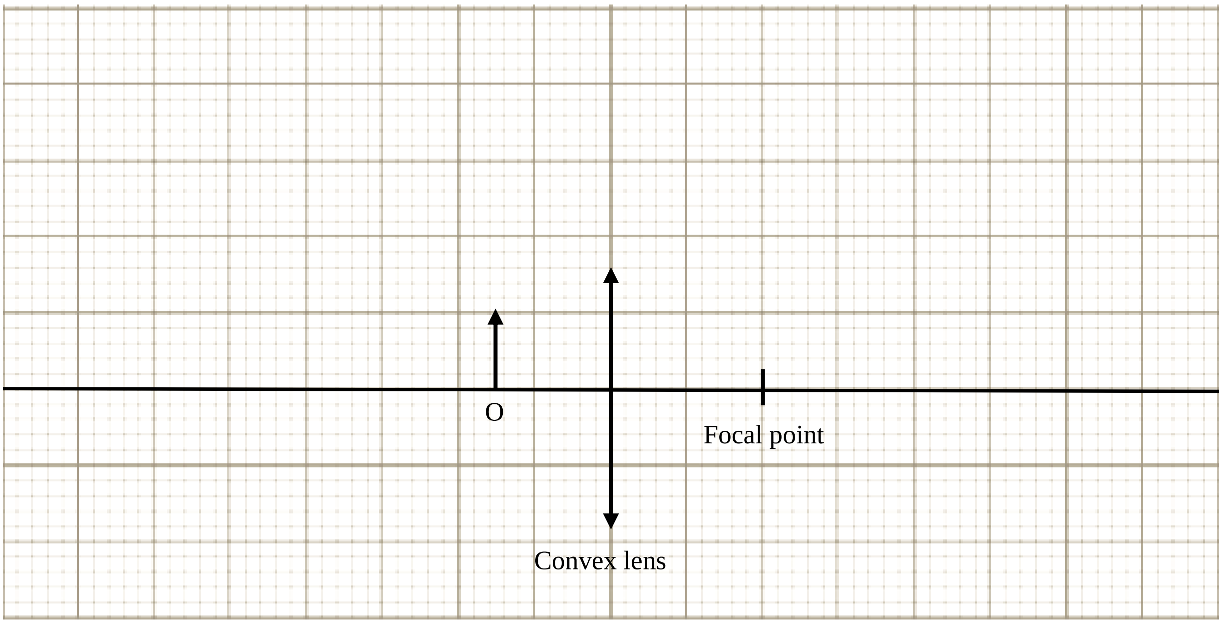
____

____

____

[2 marks]

c. A convex lens has a focal length, f, of 40 mm. An object, O of height 10 mm is placed 30 mm away from the lens.



i. Complete the diagram to show how the image is formed. [4 marks]

ii. Is the image formed real or virtual?

____

[1 mark]

iii. Calculate the image distance from the lens.

____

[2 marks]

iv. Use your diagram or otherwise, calculate the magnification of the lens.

____

[1 mark]

20

5. ***This question is about magnetism***.

a. A magnet can be produced using the stroking method.

i. Explain how this method is done.

____

[1 mark]

ii. What is the difference between magnetic and non magnetic materials?

Magnetic: ____

Non magnetic: ____

[2 marks]

b. Diagram 1 shows five magnets stacked on top of each other on a wooden rod. A student then takes the magnets off the rod, turns some of them over and puts them all back on the rod. Some of the magnets float as shown as shown in Diagram 2.

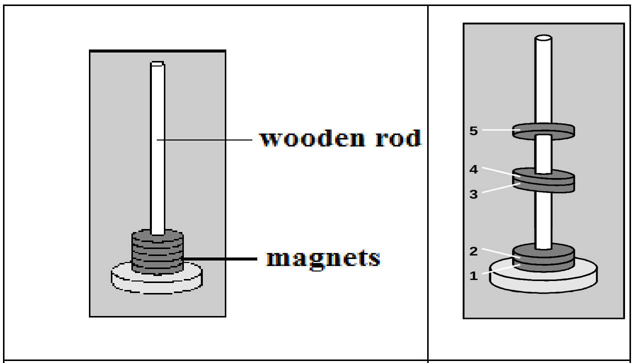


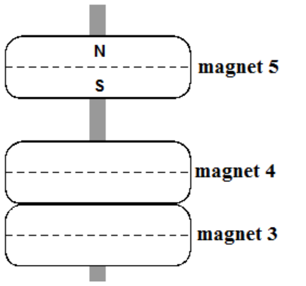
Diagram 1 | **Diagram 2**

i. Write the correct word from the words in brackets, in order to explain why magnet 5 floats above magnet 4.

*Magnet 4 ________________ (**attracts/repels**) magnet 5. Therefore the top part of magnet 4 and the lower part of magnet 5 must have ________________ (**like/unlike**) poles.*

[2 marks]

ii. The diagram shows magnets 3, 4 and 5 as they float above magnets 1 and 2. The North (N) and South (S) poles on magnet 5 are labelled. Complete the diagram by inserting the North (N) and South (S) poles of magnets 3 and 4.



[2 marks]

c. Another way how a magnet can be produced is through electromagnetism. The diagram below shows how this concept is used in electric bells.

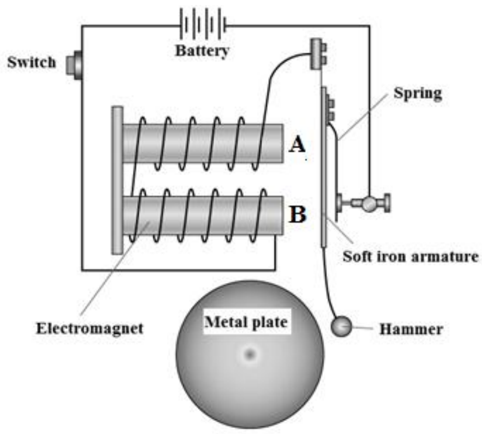


Diagram adapted from http://physics503.one-school.net/2008/06/uses-of-electromagnet-electric-bell.html

i. Number the following steps in order to describe what makes the hammer hit the metal plate continuously when the switch is pressed. The first one is done for you.

The hammer returns to its original position and the circuit closes again to restart the process.	
The hammer hits the metal plate and opens the circuit as it moves away from the contact point of the spring.	
Ends A and B become magnetised and attract the soft iron armature.	
The switch is pressed and current flows through the circuit.	**1**
Ends A and B demagnetise as current is no longer flowing through the circuit.	

[4 marks]

ii. State the polarity acquired by ends A and B, when the circuit is switched on.

A: ______________________________ B: ________________________________

[2 marks]

iii. The armature supporting the hammer is made of **soft iron**. Give the name of a material that is considered as a **hard magnetic material**.

____

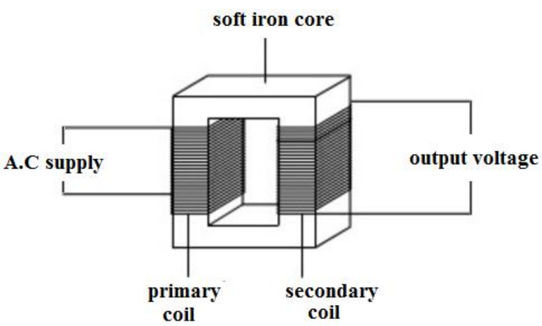
[1 mark]

iv. Give **ONE** reason why soft iron is used in this case.

____

[1 mark]

d. The diagram below shows an ideal transformer. It operates on the principle of electromagnetic induction.



i. Complete the sentence.
Electromagnetic induction is a process through which a voltage is induced across the secondary coil when:

____

[1 mark]

ii. This transformer has 1200 turns in the primary coil and 60 turns in the secondary coil. Is the transformer step-up or step-down?

____

[1 mark]

iii. If the output voltage is 12 V, calculate the voltage across the primary coil.

____

[2 marks]

iv. If the A.C supply in the primary coil is substituted by a D.C supply, what would happen to the output voltage?

____

[1 mark]

20

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