INDEX NUMBER: ____________________ SEC24/1.12m

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2012 SESSION

SUBJECT:	**Physics**
PAPER NUMBER:	I
DATE:	30th April 2012
TIME:	4:00 p.m. to 6:00 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 10m/s^2.

Density	$m = \rho V$		
Pressure	$F = p A$	$p = \rho g h$	
Moments	Moment = F × perpendicular distance		
Energy and Work	$PE = m g h$	$KE = \frac{1}{2} m v^2$	$W = F s$
	Work Done = energy converted		$E = P t$
Force and Motion	$m a =$ unbalanced force	$W = m g$	$v = u + a t$
	average speed $= \frac{\text{total distance}}{\text{total time}}$		$s = (u + v) \frac{t}{2}$
	$v^2 = u^2 + 2 a s$	$s = u t + \frac{1}{2} a t^2$	momentum = m v
Waves	$\eta = \frac{\text{speed of light in air}}{\text{speed of light in medium}}$		$v = f \lambda$
	$\eta = \frac{\text{real depth}}{\text{apparent depth}}$	Magnification $= \frac{\text{image distance}}{\text{object distance}}$	
	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	Area of a triangle $= \frac{1}{2} b h$	Area of a trapezium $= \frac{1}{2}(a + b) h$	
	Area of a circle $= \pi r^2$		

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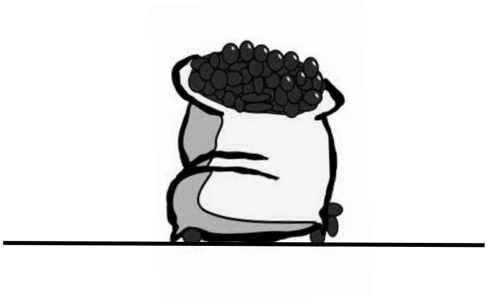
1. Jane bought a bag of coffee beans and placed it on a table.

a. Mark on the picture below the forces present.



[2]

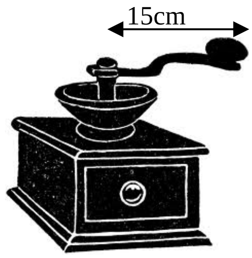
b. The total mass of the coffee beans is 200 g. Calculate the weight of the coffee beans.

____

____

[2]

c. Jane used a coffee grinder, like the one in the picture below. She put the beans in the coffee grinder and started to grind by turning the handle.



i. Mention the two factors which determine the turning effect of the force.

____

____

[2]

ii. Work out the moment of the force if Jane exerts a force of 210 N at the edge of the handle.

____

____

[3]

iii. Give a reason why Jane found it more difficult when she rotated the handle from a point closer to the centre.

____

[1]

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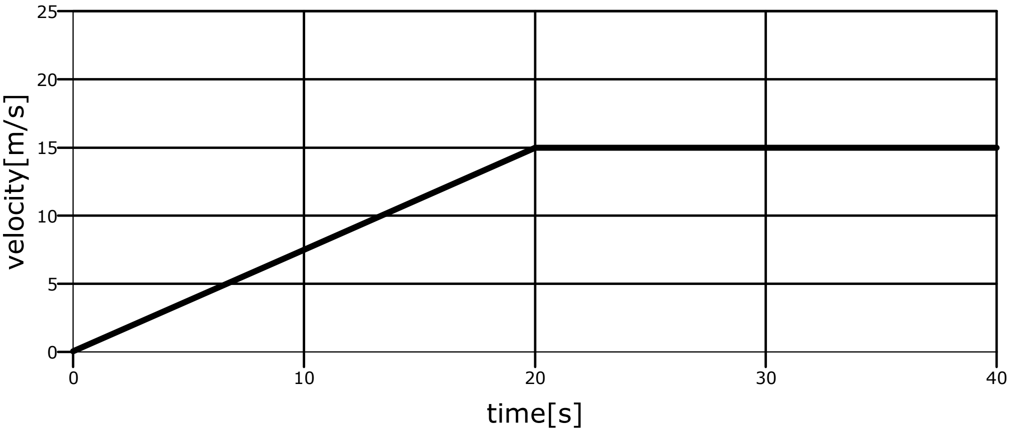
2. The graph below represents the motion of an athlete jogging along a road.



a. Describe the motion of the athlete between the 20 s and 40 s mark.

____

____ [1]

b. What is the total distance travelled in the 40 s shown on the graph?

____

____ [2]

c. From the graph calculate the acceleration of the athlete for the first 20 s.

____

____ [3]

d. The athlete came to a crossroad. A car stopped so that the athlete can cross the road.

i. Continue the statement below:

Stopping Distance = ________________distance + ________________distance. [2]

ii. Mention two factors that may have an effect on the stopping distance.

____

____ [2]

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3. Sir Humphry Davy devised a safety lamp in 1815 to be used in coal mines. The lamp indicated to the miners if there was a poor level of oxygen inside the mine. If unusual levels of carbon dioxide were present, the lamp flame would be extinguished.

a. Carbon dioxide is denser than air. State and explain if the miners should place the Davy lamp close to the ceiling or close to the ground of the mine.

____

____

[2]

b. If flammable gas mixtures were present, the flame of the Davy lamp turned blue from yellow. A blue flame indicates that the flame has a higher temperature.

i. State the relationship between the internal energy of the gas and its temperature for a fixed volume of gas.

____

[1]

ii. Explain, what happens to the gas particles if the temperature of the gas increases.

____

[1]

iii. State the units of:

internal energy; ____

temperature. ____

[2]

c. During a science lesson, a teacher gave the students a 500 cm^3 closed container filled with carbon dioxide gas.

i. Given that the density of carbon dioxide is 0.0018 g/cm^3 calculate the mass of the gas in the container. **Give your answer in kg.**

____

____

____

[3]

ii. The teacher gave the students an identical closed container with no air inside. Explain how the students can now check that the answer to the calculation above is correct.

____

____

[1]

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4. Computers, electrical devices and appliances may contain many electrical conductors, semiconductors and insulators.

a. With reference to atoms and electrons briefly explain how conductors are different from insulators.

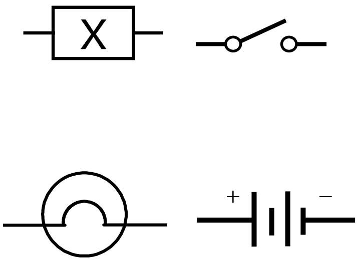
____

____

____

[2]

b. i. Using the circuit components illustrated below, in the space provided draw a circuit to check whether component X is a conductor or insulator. Label each component.



[2]

ii. How can one find whether component X is a conductor when using this circuit?

____

[1]

c. Give **one** example of a commonly used solid:

i. conductor; ____________________________________

ii. semiconductor; ____________________________________

iii. insulator. ____________________________________

[3]

d. Two sets of charged balloons hang as shown below. Draw the charge on each balloon.

[2]

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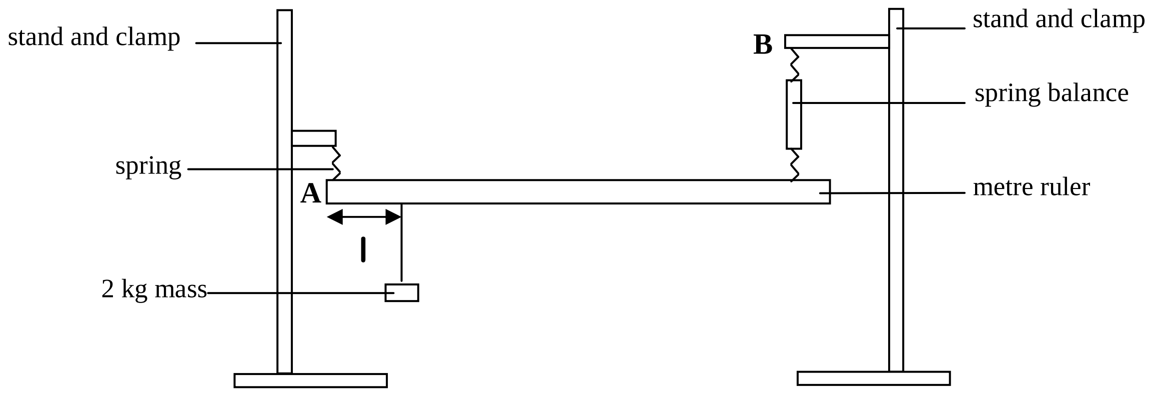
5. Charles and Mary performed an experiment to determine the mass of a metre ruler using the principle of moments. A 2 kg mass was suspended from a point at a distance **l**, from edge A. The height of clamp B was adjusted so that the ruler was horizontal. The reading of the Force **F**, was read from the spring balance. The mass was then moved at different distances from A, each time making the ruler horizontal. For each distance **l**, the values of Force **F**, were recorded in the table below.



l/m	0.085	0.185	0.285	0.385	0.485	0.585
F/N	1.8	3.8	5.8	7.8	9.8	11.8

a. Plot a graph of F/N against l/m. (Start both axis from the origin). [4]

b. What would be the reading on the spring balance if the 2 kg mass was placed 0.35 m away from end A?

____

[1]

c. Calculate the gradient of the graph.

____

____

[2]

d. What is the value of F/N when l = 0 m?

____

[1]

e. If the value obtained in part (d) above is half the weight of the ruler, what is the mass of the ruler in grams?

____

____

[2]

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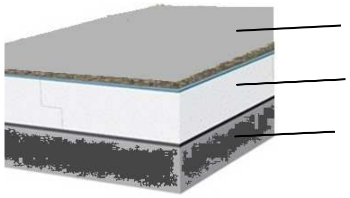
6. A number of students were given an assignment to find ways of reducing the energy consumption in a house. They came up with the following suggestions:

a. *using expanded polystyrene in roofs and painting the roof with shiny silver paint;*

State and explain how these **two** measures will decrease the energy consumption of the house.



[4]

b. *changing filament bulbs to energy saving bulbs.*

The following values in the table below show typical values of the two types of bulbs.

	Energy Saving	Filament
Voltage (V)	230	230
Current (A)		0.17
Power (W)	8	
Energy used in 1 minute (J)		

i. Complete the table by filling the missing values. [2]

ii. Suggest one reason why the filament bulb is considered as inefficient.

[2]

c. Suggest two other ways of reducing further the energy consumption in a house.

[2]

10

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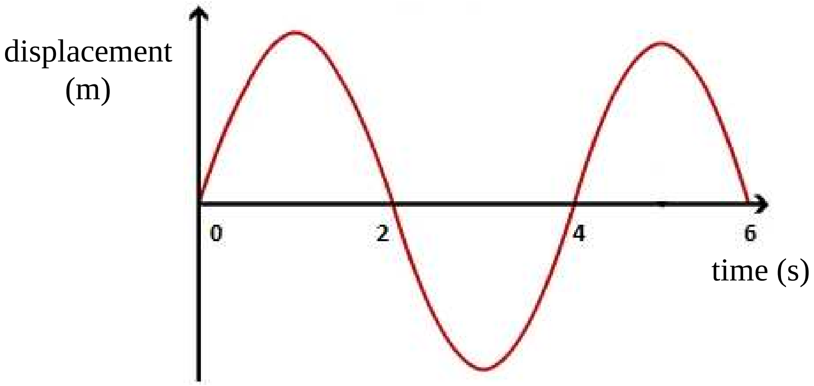
7. The movement of the Earth's crust has been recorded on a seismometer (data recorder) at the University of Malta since the beginning of the twentieth century.

a. The following displacement-time graph is an example of the recorded data.



i. On the above diagram label one position of a crest with a letter '**C**' and a trough with a letter '**T**'. [2]

ii. Mark clearly on the above graph, the amplitude of the wave. [1]

iii. Calculate the frequency of the wave.

____

____

[2]

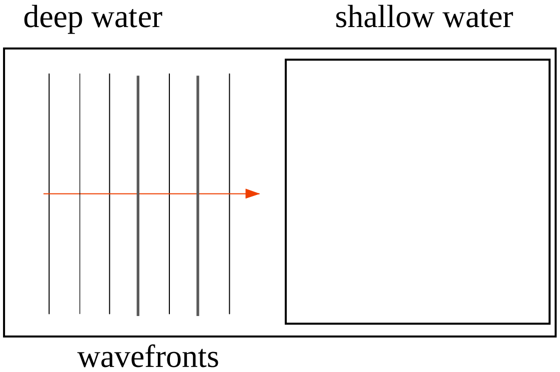
iv. As the wave travels away from the source, its amplitude decreases. Explain why.

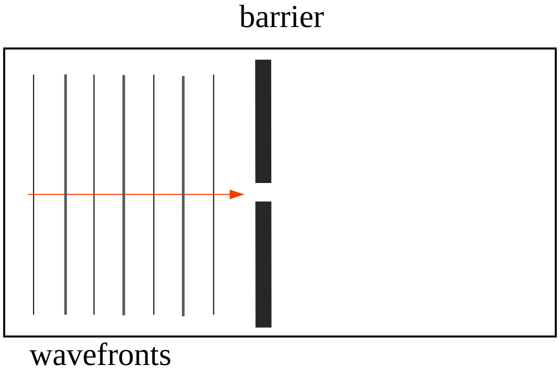
____

____

[1]

b. A student investigates the movement of water waves in a ripple tank. Complete the diagrams below. [4]





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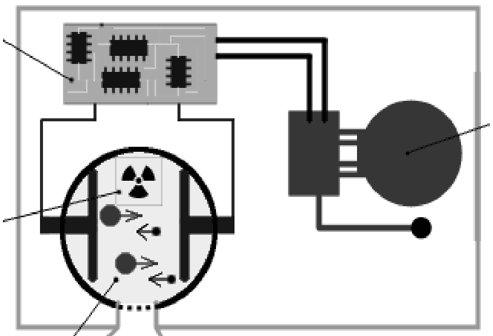
8. The smoke detector shown uses an alpha radioactive source to ionise the air within the chamber. The ionisation of air by the radioactive particles causes a very small flow of electrical current. When smoke from a fire enters the chamber, its presence causes a reduction in the current's flow. The circuit senses the reduced flow of current and sets off the alarm.



a. What is meant by ionisation?

____

____

[2]

b. Apart from being more penetrating and dangerous, why is gamma radiation not used in such a smoke detector?

____

[1]

c. Should the alpha radiation source, have a short or long half-life? Explain.

____

____

[2]

d. These smoke detectors are attached to the ceiling. State whether they should not be considered as dangerous to human beings. Explain.

____

____

[2]

e. A typical alpha source is the isotope Americium 241 ($^{241}_{95}Am$).

i. Circle the isotope of Americium 241from the list below.

$^{243}_{95}X$ $\qquad$ $^{243}_{97}X$ $\qquad$ $^{95}_{243}X$

[1]

ii. What is the number of protons and neutrons in Americium 241?

Protons : ____________________ Neutrons : ____________________

[2]

10

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9. Sir Isaac Newton is well known for his Laws of Motion. Even though centuries have passed, we still make use of them today.

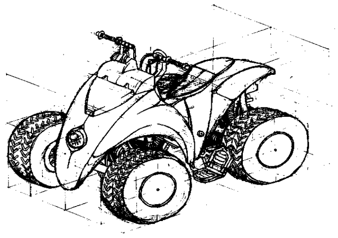
a. State Newton's second law of motion.

____

____

[2]

b. A quad bike is a vehicle with four wheels.



i. What is the value of the acceleration of the quad bike when the resultant force acting on it is zero?

____

[1]

ii. The mass of the quad bike is 300 kg and the mass of the driver is 70 kg. The quad bike is moving with a velocity of 25 km/hr, what is the **total** momentum in kg m/s?

____

____

[3]

iii. Calculate the resultant force acting, when the quad bike accelerates at 2.2 m/s^2,

____

____

[2]

c. i. What is the value of the upward reaction of the seat on the driver? (Assume that the seat is in a horizontal position)

____

[1]

ii. What principle did you use to come to the above conclusion?

____

[1]

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10. Lodestone is a naturally magnetized material which was discovered and used by ancient people. One of its uses was as a magnetic compass.

a. Explain how one could identify the poles of lodestone.

___

___

___

[3]

b. One method of producing a magnet requires a magnetic material.

i. State the type of material needed to produce a permanent magnet using this method?

___

[1]

ii. With the help of a simple sketch or otherwise, show how a bar magnet may be used to turn a piece of magnetic material into a magnet.

[2]

iii. Briefly explain why the bar magnet is required in this method.

___

___

[2]

c. In the space below, draw the magnetic field around a bar magnet. Mark clearly the magnetic poles and the direction of the field.

10

[2]

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2012 SESSION

SUBJECT:	**Physics**
PAPER NUMBER:	IIA
DATE:	2nd May 2012
TIME:	4:00 p.m. to 6:00 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 10m/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 the resistance of electrical conductors.***

a. An electrician connected the circuit of an electric cooker directly to the mains supply using the **shortest possible length** of a **thick wire**. Explain in terms of resistance and current why:

i. the shortest possible length of wire was used;

____

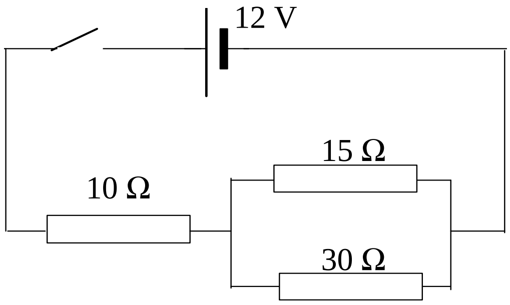
[1]

ii. a thick wire was used.

____

[1]

b. Roberta and James set up an electric circuit in the school laboratory. It consists of three resistors connected as shown in the diagram below. They then close the switch in the circuit.



Calculate:

i. the total resistance of the resistors connected in parallel;

____

____

[2]

ii. the total current flowing in the circuit;

____

____

[2]

iii. the power dissipated by the 10 Ω resistor;

____

____

[2]

iv. the current flowing through the 15 Ω resistor.

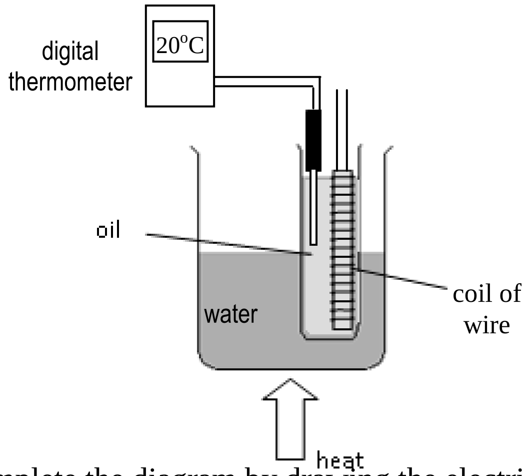
____

____

[2]

------------------------------------ Do not write in the above space ----------------------------------

c. Roberta and James then investigated how the resistance of a coil made from copper wire varies with temperature. They set up the apparatus shown below.



i. Complete the diagram by drawing the electrical circuit required to perform the investigation. [2]

ii. The values of current and voltage at a certain temperature were 5 A and 2 V. Calculate the energy dissipated in 1 minute.

____

____ [2]

iii. Give a brief description of the method used to carry out the investigation.

____

____

____ [3]

iv. Draw a table required to present the results.

[1]

v. Name one precaution required to obtain reliable results.

____ [1]

vi. Predict how the resistance of the copper wire will change with an increase in temperature.

____ [1]

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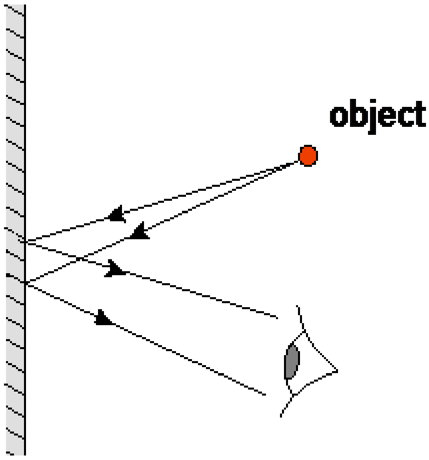
2. ***This question is about light rays***.

a. The diagram below represents an object in front of a plane mirror.



i. Complete the above ray diagram to show the position of the image. Mark the image with the letter 'I'. [2]

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

____

____ [2]

iii. The image obtained is **laterally inverted**. Explain the term in bold.

____

____ [1]

iv. On the above diagram mark an angle of incidence as 'i' and an angle of reflection as 'r'. [2]

v. Comment about the object and the image distance from the mirror.

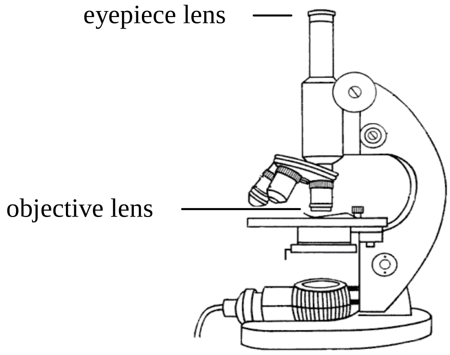
____ [1]

b. Sketch in the space below ray diagrams to describe the action on a parallel beam of light when it passes through:

i. a thin converging lens; ii. a thin diverging lens.

[2]

c. Zacharias Janssen, a Dutch spectacle maker, is considered as the inventor of the compound microscope, around the year 1590. A compound microscope uses an eyepiece and an objective lens together with light to enlarge the object and produce a visible image. Both lenses are **converging** lenses.



An object O is 1.2 cm high and stands 4.0 cm from the centre of the objective lens of focal length 2.5 cm. An image I is produced.

i. In the space provided above, draw a ray diagram, to scale, to show how the image I is formed. [3]

ii. Use your diagram to calculate the magnification of the objective lens.

____

____ [2]

iii. Give three characteristics to describe features of the image obtained.

____

____ [3]

iv. The image produced in the objective lens becomes the object for the eyepiece lens. This object is positioned between the focal point and the eyepiece lens. Give two characteristics of the final image produced.

____

____ [2]

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3. ***This question is about pressure.***

a. Mr. Galea, an art teacher decided to hang the drawings of his students on the corridor notice board. He exerted a force of 15 N on a drawing pin's circular head of diameter 0.8 cm. By doing so the drawing pin is pushed through the paper and the board.

i. Define pressure.

____

____

[2]

ii. Calculate the area of the pin's head.

____

____

[2]

iii. Calculate the pressure between the thumb and the drawing pin.

____

____

[2]

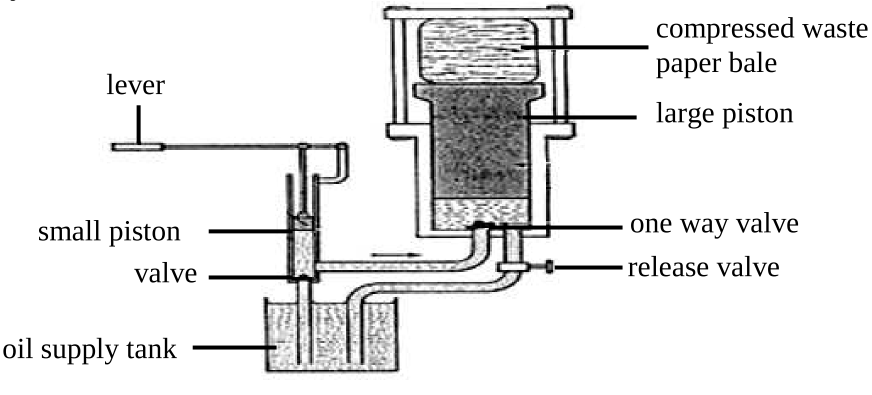
iv. What is the advantage of having a drawing pin with a pointed end rather than a flat one?

____

____

[2]

b. The hydraulic press shown was given to a secondary school so that waste paper could be compressed into bales. Angelo and Raymond were asked to write a report for their school science magazine about it. The press uses a one way valve which lets the fluid to pass in one direction only.



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i. Write the points that Angelo and Raymond should mention in their report to explain how the waste paper is compressed using this hydraulic press.

____

____

____

____

____

____

[4]

ii. What is the function of the release valve in the hydraulic press?

____

____

[2]

iii. Calculate the force exerted on the waste paper if a force of 30 N is exerted on the small piston of area 7×10^{-4} m^2 .The area of the large piston is 0.36 m^2.

____

____

____

____

[3]

iv. State one advantage of having such a system.

____

____

[2]

v. Some air was trapped in the oil between the pistons. Explain what effect this will have on the hydraulic press.

____

[1]

20

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4. ***This question is about energy.***

a. Students were asked to investigate two models of wind turbines for their efficiency to generate electricity. Apart from the two turbines shown in the diagram, they were supplied with a small generator, some wires and other equipment.

i. State any piece of additional apparatus the students require to perform this investigation.

____

____

[2]

ii. Describe how the students investigate which type of turbine is better to generate electricity.

____

____

____

____

____

____

[4]

iii. State any two precautions the students need to take.

____

____

[2]

b. Sephora and David play with a tennis ball. She throws the ball vertically upwards and David catches it when it falls.

i. If the ball has a mass of 55 g and rises 8 m, what is the maximum gravitational potential energy of the ball?

____

____

____

[2]

ii. Calculate the velocity of the ball when it is half way down its fall.

[2]

iii. What are the values of the gravitational potential energy and kinetic energy of the ball **just before** it hits the ground?

[2]

iv. State the principle which you used to work out questions (ii) and (iii).

[2]

c. The use of renewable sources of energy is increasing while the use of non-renewable sources of energy is discouraged.

i. Distinguish between renewable and non-renewable sources of energy.

[2]

ii. State one example of a renewable source and another one of a non-renewable source of energy and for each give an advantage for using it.

[2]

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5. ***This question is on electromagnetism.***

Heinrich Lenz, also called Emil Khristianovich (1804-1865) was a Russian physicist mostly remembered for Lenz's Law.

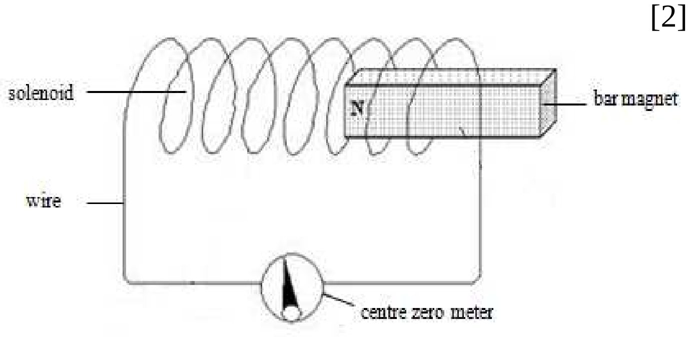
a. State Lenz's Law.

____

____

[2]

b. A magnet is placed close to a coil which is connected to a centre zero meter as shown in the diagram. Briefly explain what happens if the magnet is:



i. pushed into the coil;

______________________________ [1]

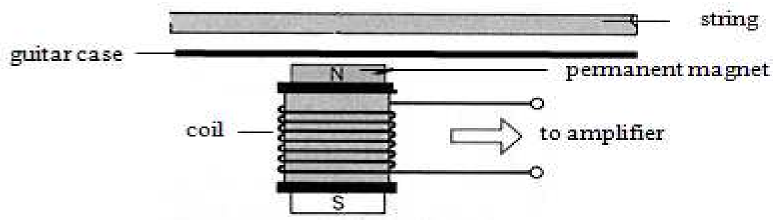
ii. left inside the coil; ______________________________ [1]

iii. pulled out of the coil; ______________________________ [1]

iv. pushed into the coil at a faster rate. ______________________________ [1]

c. The diagram shows a simplified cross section diagram of a part of an electric guitar. Small bar magnets are placed under the steel strings of an electric guitar, as shown. Each magnet is placed inside a coil.

Side View



i. Explain why the strings of an electric guitar should be made of steel and not nylon.

____

[1]

ii. Briefly describe how a current is induced in the coil when a string is plucked.

____

____

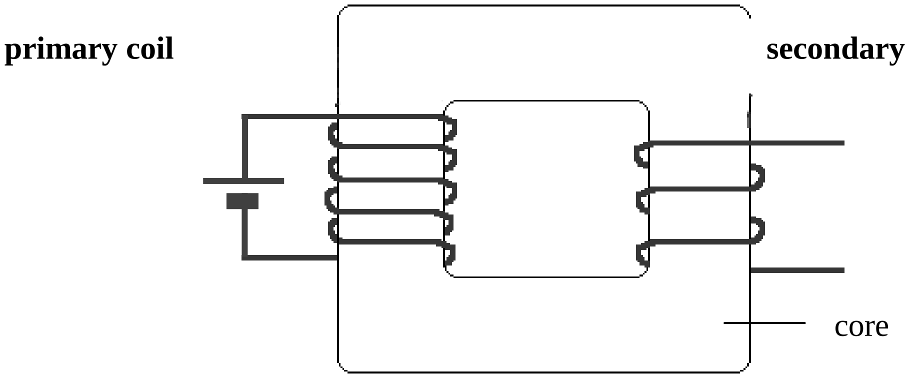
[2]

------------------------------------ Do not write in the above space ----------------------------------

iii. State whether the current induced is alternating or direct.

[1]

d. A step down transformer of 1200 turns on the primary coil connected to a 240 V source will produce 2 V in the secondary coil.



i. On the diagram draw the magnetic field pattern at any instant when the transformer is switched on. [2]

ii. Explain why the transformer will not work with a d.c. supply.

[2]

iii. Suggest a suitable material for the core of the transformer.

[1]

iv. Calculate the number of turns in the secondary.

[2]

e. In practice the transformer was found to be 60% efficient.

i. Calculate the power output if the current in the primary coil 0.5 A.

[2]

ii. Give one reason why the transformer is never 100% efficient.

-

[1]

20

INDEX NUMBER: ____________________ SEC24/2B.12m

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

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2012 SESSION

SUBJECT:	**Physics**
PAPER NUMBER:	IIB
DATE:	2nd May 2012
TIME:	4:00 p.m. to 6:00 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 10m/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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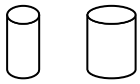
1. ***This question is about the resistance of electrical conductors.***

a. An electrician sets up the circuit of an electric cooker. The electrician uses wires of **least resistance** to connect this cooker to the mains supply.



i. Should the electrician use a thin or a thick electric wire?

____

[1]

ii. Give **one** reason for your answer.

____

[1]

iii. The current in the electric cooker is 28 A. Circle a suitable fuse value from the list below.

28 A 25 A 30 A 45 A

[1]

iv. Give **one** reason for your answer.

____

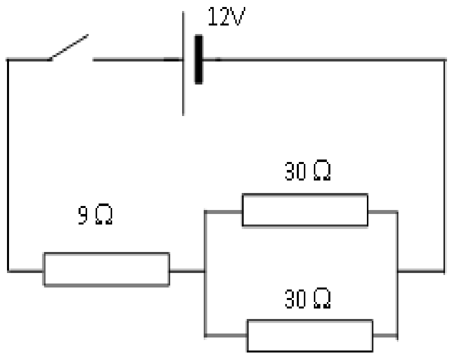
[1]

v. What is the relationship between the resistance and the flow of current in an electric wire?

____

[2]

b. Roberta and James set up an electric circuit in the school laboratory. They connect three resistors as shown in the diagram below.



i. State how the two 30 Ω resistors are connected.

____

[1]

When the switch is closed, the total resistance of the two 30 Ω resistors is 15 Ω. Calculate:

ii. the total resistance in the circuit;

____

[1]

iii. the current flowing in the circuit;

____

____

[2]

------------------------------------ Do not write in the above space ----------------------------------

iv. the potential difference across the 9 Ω resistor;

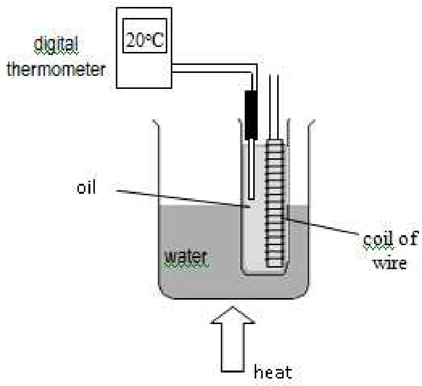
[2]

v. the potential difference across the other two resistors.

[1]

c. Roberta and James investigate how the resistance of a coil of copper wire varies with temperature. They set up the apparatus shown below.

i. A battery, a switch and an ammeter are connected in series with the coil of wire. A voltmeter is connected across the coil of wire. Using these electrical components, draw the electrical circuit required to perform the investigation.



[2]

ii. The readings of the voltmeter and the ammeter are used to calculate the resistance of the copper wire. Explain how this is done.

[2]

iii. Insert the correct units for current and voltage in the table below.

Temperature (^{o}C)	Current ( )	Voltage ( )

[1]

iv. Name **one** precaution required to obtain reliable results.

[1]

v. Predict how the resistance of the copper wire will change with an increase in temperature.

[1]

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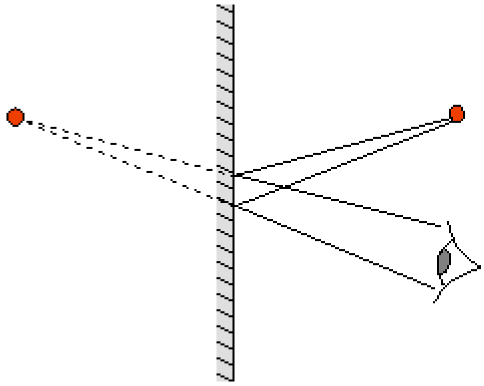
2. ***This question is about light rays***.



a. The diagram represents an object O in front of a plane mirror.

i. Label on the diagram,

- the mirror
- the position of the object 'O'
- the position of the image 'I'.

[3]

ii. State whether the image is *real* or *virtual*. Explain.

____

____

[2]

iii. Draw arrows on the diagram to show the direction of the light rays. Label an incident ray and a reflected ray.

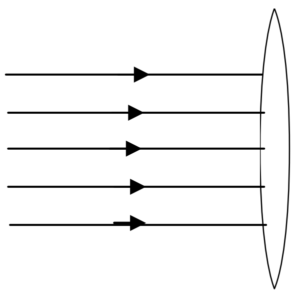
[2]

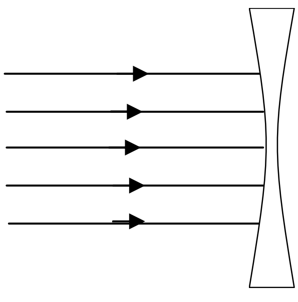
iv. An object stands 14 cm in front of the mirror. How far behind the mirror does the image stand?

____

[1]

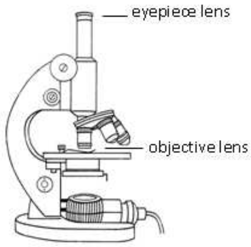
b. Complete the ray diagrams to show how a parallel beam of light will pass through different types of lenses.





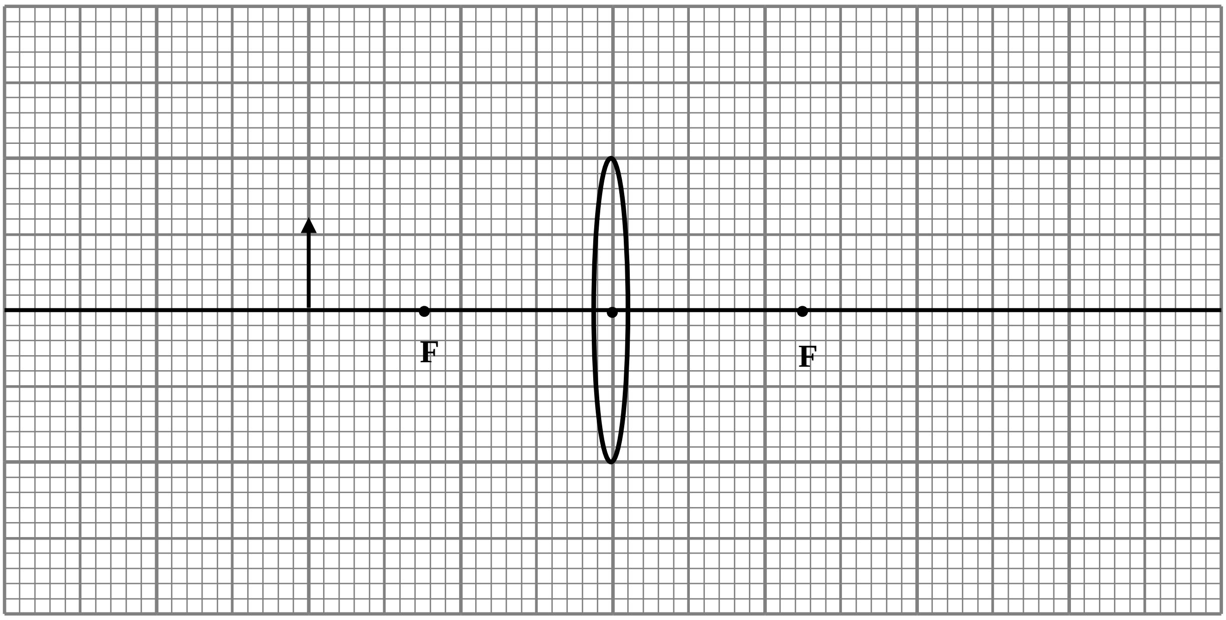
[2]

c. Zacharias Janssen, a Dutch spectacle maker, is considered as the inventor of the compound microscope, around the year 1590. A compound microscope uses an eyepiece and an objective lens together with light to enlarge the object and produce a visible image.



An object O is 1.2 cm high and stands 4.0 cm from the centre of a lens of focal length 2.5 cm.

i. On the graph below complete the diagram by drawing two rays from the top of the object. Label the image formed as ‘I’.



[3]

ii. Use your diagram to calculate the magnification of the lens.

____

____

[2]

iii. Circle the correct property of the image in each of the following.

real or virtual	upright or inverted	magnified or diminished

[3]

iv. State two properties of the image obtained if the object is placed closer to the lens, between the lens and the focal point.

____

____

[2]

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3. ***This question is about pressure.***

a. Mr. Galea, the art teacher decided to hang the drawings of his students on the corridor notice board. To do this, he exerted a force of 15 N on each pin's head of radius 0.004 m to push them through the paper and the board.
(Area of a circle = πr^2)

i. Fill in with the correct words.

Pressure is defined as the ____________________ per unit _____________________.

The S.I. unit if pressure is ____________________. [3]

ii. Calculate the area of the pin's head.

____

____

[2]

iii. Calculate the pressure exerted by the thumb on the drawing pin.

____

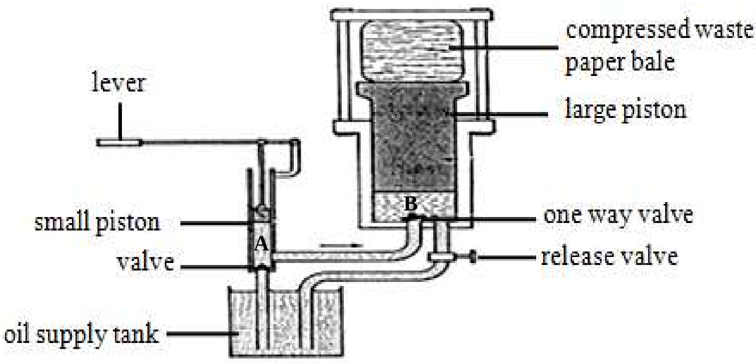
____

[2]

iv. Circle the correct word in the brackets.

The pin is easily pushed in if the pressure is **(large/small)**. This is created if the area of the point touching the notice board is **(large/small)** and the force pushing the pin is **(large/small)**. [3]

b.



The hydraulic press shown was given to a secondary school so that waste papers could be compressed into bales. Angelo and Raymond were asked to write how this hydraulic press works.

------------------------------------ Do not write in the above space -----------------------------------

i. What happens to the small piston as the lever is pushed down?

[1]

ii. Angelo exerts a force of 30N on the small piston of area 7×10^{-4} m^2. Find the pressure at A.

[2]

iii. Comment on the size of the pressure at A and B. Explain.

[2]

iv. If the area of the large piston is 0.36 m^2, calculate the force exerted by the large piston on the waste paper.

[2]

v. Explain what happens to the large piston as the small piston is pushed downwards.

[1]

vi. Calculate the amount of times the force is magnified in this hydraulic press.

[1]

vii. Some air bubbles were trapped in the oil between the pistons. State why the small piston has to be pushed further in to compress the paper.

[1]

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4. ***This question is about energy.***

a. Students were asked to investigate two models of wind turbines for their efficiency to generate electricity. Apart from the two turbines shown in the diagram, they were supplied with a small generator, some wires, a fan and other equipment.

i. Write down the proper sequence of steps taken by writing down the step number in the right hand column. [5]

Step taken	No.
Place the set up opposite the switched on fan and measure the current every 1 minute for 5 minutes.	
The one which gives the highest average current should be used.	
Replace the turbine with the other type and repeat the experiment.	
Calculate the average current.	
Connect one type of turbine to the generator and ammeter.	

ii. State any two precautions the students need to take.

____

____ [2]

b. Sephora and David play with a tennis ball. She throws the ball vertically upwards and David catches it when it falls.

i. If the ball has a mass of 55 g and rises 8 m , calculate the gravitational potential energy of the ball at this height.

____

____ [2]

------------------------------------ Do not write in the above space ----------------------------------

ii. What is the gravitational potential energy of the ball 4 m above the ground?

[2]

iii. What is the kinetic energy of the ball 4 m above the ground?

[2]

iv. What happens to the energy when the ball hits the ground?

[2]

c. Maltese power stations use fossil fuels to generate electricity.

i. State whether fossil fuels are a renewable or a non-renewable source of energy.

[1]

ii. Mention two advantages of using fossil fuels to generate electricity.

[2]

iii. Sikka l-bajda was one of the proposed locations for an offshore (away from the coast) wind farm. State two disadvantages if this source of energy had to be used.

[2]

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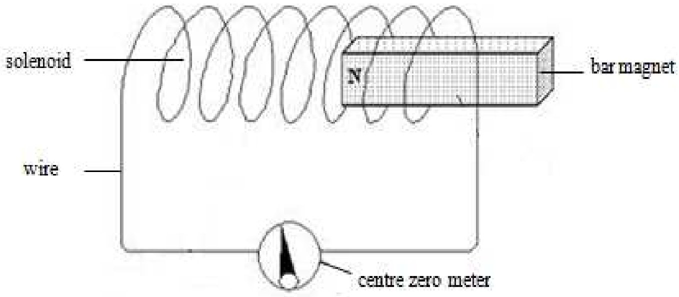
5. ***This question is on electromagnetism.***

Heinrich Lenz (1804-1865) was a Russian physicist mostly remembered for Lenz's Law.

a. Lenz's law states that the induced ______________________ occurs in such a way that it

will try to ______________________what is causing it. [2]

b. A magnet is placed close to a coil which is connected to an electric meter as shown in the diagram below. In each case explain what happens to the pointer of the meter.

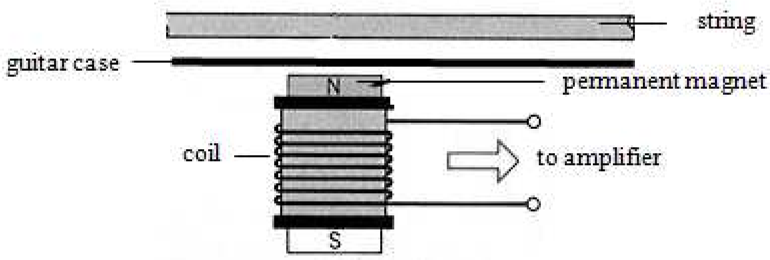


	ACTION	REACTION OF POINTER
1	Magnet is pushed into the coil	
2	Magnet is pushed into the coil at a faster speed	
3	Magnet is left inside the coil	
4	Magnet is pulled out of the coil	

[4]

c. The diagram shows a simplified cross section diagram of a part of an electric guitar. Small bar magnets are placed under the steel strings of an electric guitar, as shown. Each magnet is placed inside a coil.

Side View



i. Explain why the strings of an electric guitar should be made of steel and not nylon.

____

[1]

------------------------------------ Do not write in the above space ----------------------------------

ii. State the **two** requirements to induce a current in the coil.

____

____

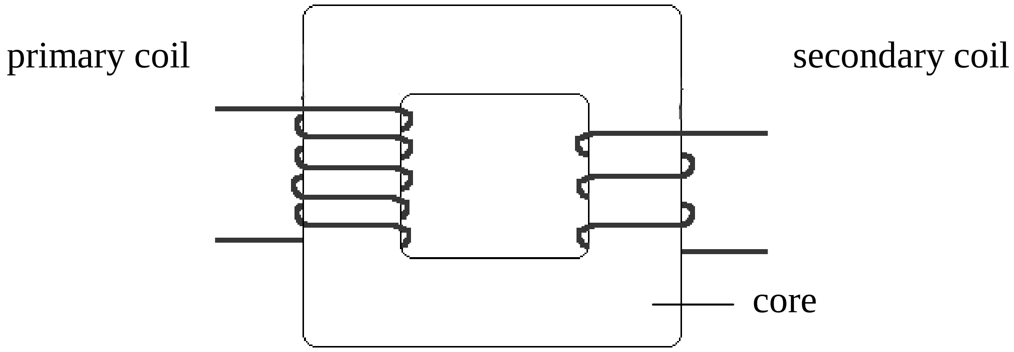
[2]

iii. State whether the induced current is alternating or direct.

____

[1]

d. A step down transformer of 1200 turns on the primary coil connected to a 240V will produce 2V in the secondary coil.



i. On the diagram draw the magnetic field pattern when the transformer is switched on. The direction of the field is not required. [2]

ii. State whether the current in the primary should be direct or alternating.

____

[1]

iii. Calculate the number of turns in the secondary.

____

____

[3]

e. If the transformer is 100% efficient calculate the power output if the current in the primary coil 0.5 A.

____

[2]

i. Give two possible reasons why in practice the transformer is never 100% efficient.

____

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