SECONDARY SCHOOL ANNUAL EXAMINATIONS 2004

Educational Assessment Unit – Education Division

FORM 5 **PHYSICS** **TIME: 1h 45min**

Name: _____ **Class:** _____

Answer all questions.
All working must be shown. The use of a calculator is allowed.

Where necessary take acceleration due to gravity g=10m/s^2.

SECTION A: Answer all questions in the spaces provided.
This section carries 55 marks.

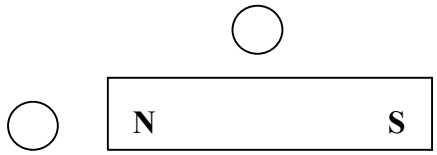
You may find some of these formulae useful.

Area of a triangle = ½ base x height

v = s/t **v = u + at** **s = (u + v)t/2** **w = mg** **p=F/A or F=pA**

refractive index of glass = speed of light in air / speed of light in glass

1. a The diagram shows a permanent bar magnet.



(i) Name: a metal which is magnetic. _____
a metal which is non-magnetic. _____ 2 marks

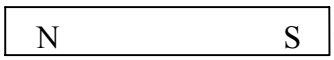
(ii) What is meant by permanent magnetism?

_____

_____ 1mark

(iii) Draw the position of the plotting compass needles in the diagram above. 2 marks

b (i) Draw the shape and show the direction using arrows, of the magnetic field around the bar magnet. 2 marks



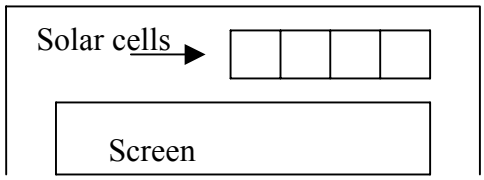
(i) What are the lines showing the magnetic field called?

_____ 1 mark

(iii) Draw the shape and show the direction of the field between these poles:

2 marks

2 A student bought a calculator which can work using solar cells (solar power) or a pencil battery.



a Write down the energy change when the calculator works on:

(i) solar cells: from _____ to _____ 2 marks

(ii) pencil battery: from _____ to _____ 2 marks

b What do you understand by:

(i) Renewable energy source _____ 1 mark

(ii) Non-renewable energy source _____ 1 mark

c When is the calculator unable to work using solar cells?

_____ 1 mark

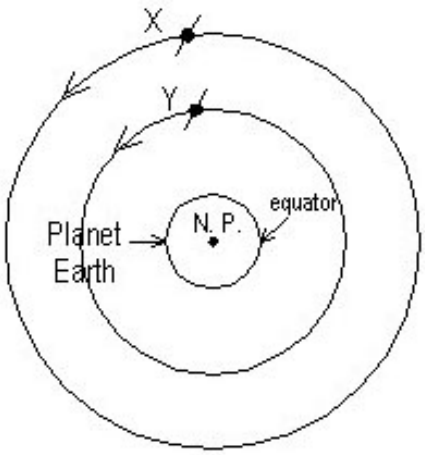
d (i) Rechargeable batteries are more environmentally friendly. Why? _____

_____ 2 marks

(ii) How would you dispose of (throw away) used batteries?

_____ 1 mark

3 Satellites **X** and **Y** are orbiting the earth above the Equator.



N.P. = North pole

a (i) Name the force which the Earth exerts on each satellite. _____ 1 mark

(ii) Draw an arrow on satellite Y to show the direction of this force. 1 mark

(iii) Give a reason why this force acting on each satellite is different .

_____

_____ 1 mark

(iv) On which satellite is this force greater?

_____ 1 mark

b Satellites **X** and **Y** are in a geostationary orbit.

(i) What do you understand by 'a geostationary orbit'? _____

_____ 1 mark

(ii) On the above diagram (on page 2) draw the orbit of a third satellite **Z** which is in a polar orbit. 1 mark

Give one use for a satellite in

(iii) geostationary orbit _____ 1 mark

(iv) polar orbit _____ 1 mark

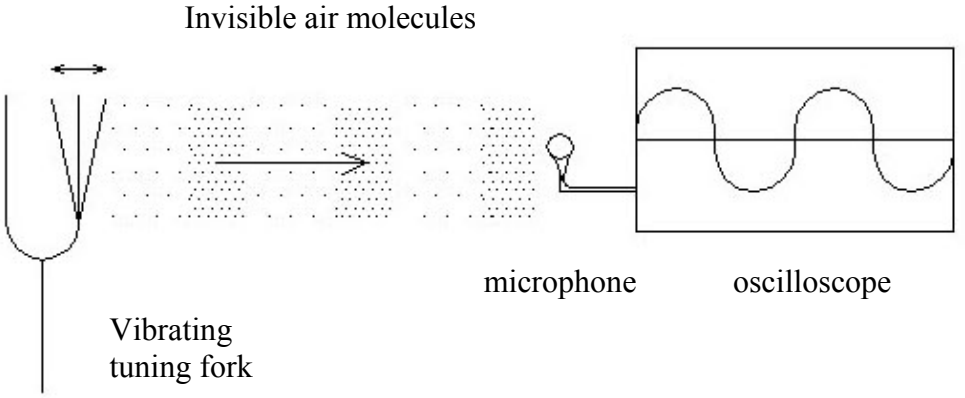
c Earth stations communicate with the 3 satellites. Give one reason why sound waves are never used for satellite communication. _____

_____ 1 mark

d The geostationary orbit of satellite **Y** is 42000km. Calculate its speed (velocity) in kilometres per hour (km/h). _____

_____ 1 mark

4.



As the tuning fork vibrates it sends longitudinal sound waves in air. As the sound wave reaches the microphone, a transverse wave appears on the oscilloscope.

a Mark on the above diagram:

(i) C to show a compression of air molecules 1 mark

(ii) R to show a rarefaction of air molecules. 1 mark

b On the transverse wave on the oscilloscope:

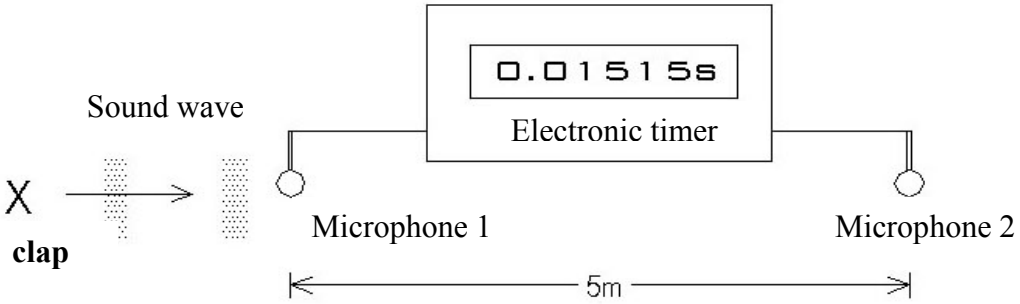
(i) Draw a line labelled **a** to show the amplitude of the wave. 1 mark

(ii) Draw a line labelled **λ** to show the wave length of the wave. 1 mark

c The same tuning fork is banged harder producing a louder note.
Draw the wave now seen on the same oscilloscope screen in the rectangle below.

2 marks

d Two microphones are now connected to an electronic timer as shown.



(ii) The timer starts as the sound reaches microphone 1, and stops as the same sound reaches microphone 2. If the readings are as shown above, calculate the speed of sound in air.

_____

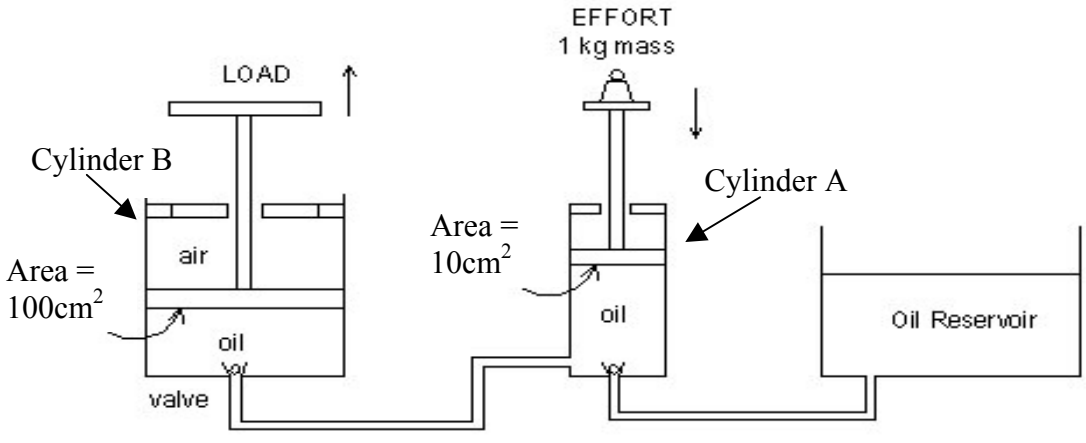
_____ 2 marks

(ii) Give **two** reasons why you consider this method a more accurate one than that using a starting pistol and a stop clock held by two students standing 200m away from each other.

_____

_____ 2 marks

5 This diagram shows a simple hydraulic machine.



a (i) What is the weight of the 1kg mass in newtons? _____ 1 mark

(ii) Using the details shown for cylinder A, calculate the pressure in N per cm^2.

_____

_____ 2 marks

The pressure created in cylinder A is transferred to cylinder B.

(iii) Give one property of liquids which causes the pressure created in A to pass to B.

_____

_____ 2 marks

(iv) What is the value of the pressure in B in N/cm^2? _____ 1 mark

b (i) Calculate the maximum load (force) in newtons that can be raised in cylinder B.

_____

_____ 2 marks

(ii) A pressure of $1N/cm^2 = 10^4 N/m^2$ $(10\,000 N/m^2)$
Calculate the pressure in B in Pascals.

_____

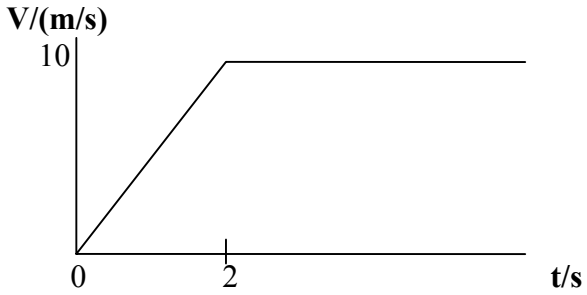
_____ 1 mark

(iii) Why is the reservoir necessary if the load is to be lifted to the top?

_____

_____ 1 mark

6 This graph shows the motion of a sprint runner in a 100m race.



Starting from rest she reaches a maximum speed of 10 m/s in 2s.

(i) Calculate the acceleration of the sprinter.

_____

_____ 1 mark

(ii) What distance does she travel in the first 2 seconds?

_____

_____ 1 mark

(iii) What distance does she travel at constant speed?

_____ 1 mark

(iv) What is the total time she takes to finish the 100m race?

_____

_____ 1 mark

(v) What is her average speed during the race?

_____

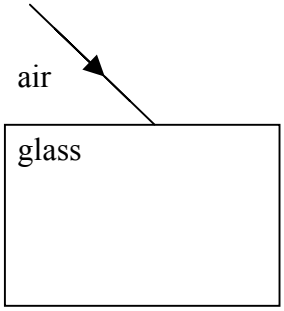
_____ 1 mark

SECTION B: Answer all questions. This section carries 45 marks.

7 This question is about refraction and total internal reflection of light.

a Complete the ray diagram by drawing and labelling:

- the normal,
- the refracted ray,
- the angle of incidence,
- the angle of refraction.



4 marks

b Mario wants to show his classmates total internal reflection. He uses a 45º-90º-45º glass prism of critical angle 42º and directs a ray of light as shown in the figures below.

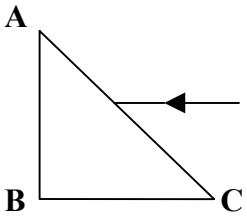


Fig. 1

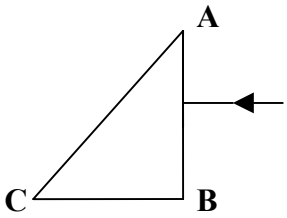


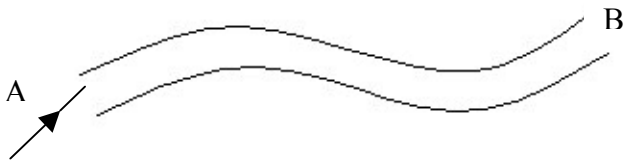
Fig. 2

(i) Complete the path of the ray of light through and out of each prism. 4 marks

(ii) Which figure shows: Total Internal Reflection? _____
Refraction? _____ 2 marks

(iii) Mark with an **X** on the diagram the point where total internal reflection occurs. 1 mark

c Total internal reflection is used in optical fibres.



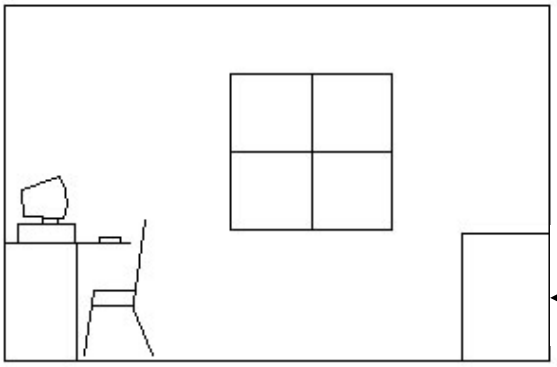
(i) Draw the path taken by the light ray entering end A to reach end B. 2 marks

(ii) State one practical application of optical fibres.

_____

_____ 2 marks

8 This question is about heat transfer and heat losses.



Joan heats her room using a gas convection heater.

a (i) Complete: The gas heater changes _____ energy into_____ energy. 2 marks

(ii) Which part of the room heats up first? _____1 mark

(iii) Explain why. _____

_____

_____2 marks

b Joan finds that her room gets cold during the night when the heater is turned off. She placed two thermometers, one inside her room and the other outdoors. She measured the two temperatures every hour during the night.

The following are her observations:

Indoor temperature θ_1 /°C	25	24	23	22	21	19	17
Outdoor temperature θ_2 /°C	25	22	19	16	13	9	5
Temperature difference (θ_1 - θ_2) /°C	0			6			12
Heat energy loss W/(J/s)	0	15	30	45	60	75	90

(i) Complete the table above. 2 marks

(ii) Plot a graph of energy loss (y-axis) against temperature difference (x-axis). 6 marks

(iii) By extending your graph find the heat energy loss when the temperature difference is 13°C. _____1 mark

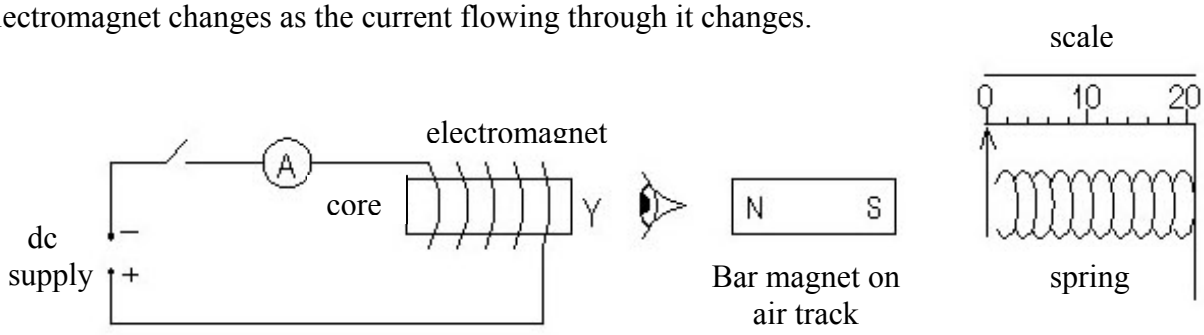
c State one way how Joan can reduce the heat losses from her room.

_____

_____1 mark

9 This question is about electromagnetism and an investigation.

Lisa and Karl set up the following apparatus to investigate how the magnetic force of an electromagnet changes as the current flowing through it changes.



When switched on, the electromagnet is expected to repel the bar magnet which lies on a frictionless air track. The repelled magnet then bumps into and compresses a spring. The compression of the spring is directly proportional to the force and can be read on the scale above it.

a (i) What material is suitable for the core of the electromagnet?_____ 1 mark

(ii) Which pole must be present at end Y of the electromagnet to repel the bar magnet?

_____1 mark

(iii) By mistake they set the supply as shown. Look carefully at the supply and draw arrows on the turns of the electromagnet to show the current flow. 1 mark

(iv) By looking at end **Y**, is the current flowing clockwise or anticlockwise?

_____1 mark

A rheostat or variable resistor is used to change the current in the electromagnet.

(v) Draw its symbol here. 1 mark

(vi) When switched on they notice that the electromagnet attracts the bar magnet. They realise that end **Y** is a South pole. What must they do **to the bar magnet** to be repelled by the electromagnet? _____ 1 mark

b They want to show that when the current in the electromagnet is increased, the force of repulsion on the bar magnet increases.

(i) Explain briefly how they can carry out their investigation.

_____

_____

_____

_____ 5 marks

(ii) What readings must they take? _____

_____2 marks

(iv) Name one precaution they should take for an accurate result.

_____

_____ 2 marks