JUNIOR LYCEUMS ANNUAL EXAMINATIONS 2000
Educational Assessment Unit - Education Division

FORM 4 **PHYSICS** **TIME: 1 hr 30 min**

NAME: _____ **CLASS:** ____

Answer **ALL** questions in the spaces provided on the Examination Paper .
All working must be shown. The use of a calculator is allowed.

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

You may find some of these formulae useful.

area of triangle $= \frac{\text{base x height}}{2}$ area of trapezium $= \frac{h}{2}$ (sum of parallel sides)

$v = \frac{s}{t}$ $v = u + at$ $s = \frac{at^2}{2}$ $W = mg$ $F = ma$

momentum = mass x velocity Pressure $= \frac{\text{Force}}{\text{area}}$ $P = h\rho g$

heat energy = mass x specific heat capacity x temperature change

$V = IR$ $P = VI = I^2R$ $R = R_1 + R_2 + R_3$ $R = \frac{R_1 R_2}{R_1 + R_2}$

Section A. Answer All Questions. This Section carries 55 marks.

1. A sofa weighs 700 N and **each** of its four legs is 0.1 m long, 0.1 m wide and 0.2 m high.

   a. Calculate the cross-sectional area of one leg.

   ..... **[2]**

   b. What is the **total area** of the sofa in contact with the floor?

   ..... **[2]**

   c. What is the total weight acting on the floor when David, who weighs 500 N, sits on the sofa?

   ..... **[2]**

   d. The size of the pressure caused by the sofa on the floor depends on:
   i. .....

   ii. ..... **[2]**

   e. Calculate the pressure exerted on the floor of the room when David is sitting on the sofa.

   .....

   ..... **[2]**

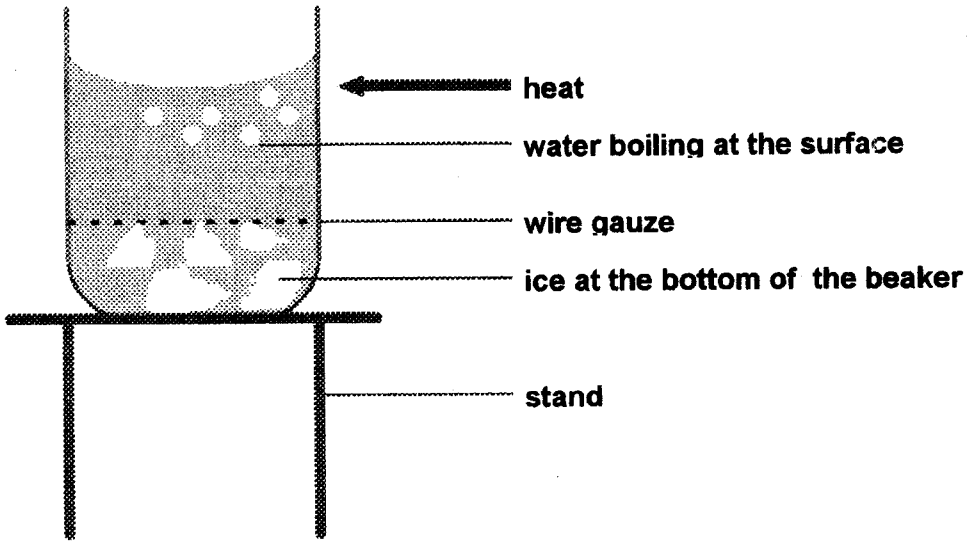
2. a. The temperature of some water in a beaker is measured by a _____. [1]

b. The temperature at which pure water normally boils is _____°C. [1]

c. The heat energy required to change ice at 0°C to water at 0°C is called _____ [2]

d. Heat energy travels through water by a process called _____. [1]

e. The diagram shows heat being supplied at the top of the beaker containing an ice-water mixture.



i. Why is the wire gauze inside the beaker required?
Explain your answer.

_____

_____

_____ [2]

ii. Explain why the ice trapped at the bottom of the tube takes a long time to melt although the water at the top is boiling.

_____

_____

_____ [2]

iii. Mark on the diagram using the letter **H,** the correct position of the burner such that all the ice-water mixture in the beaker boils. [1]

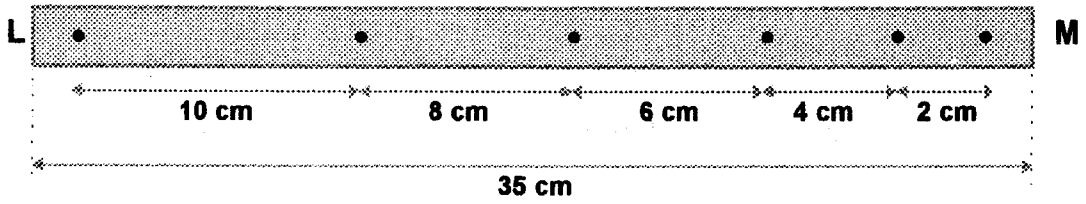
3. a. A ticker-timer has an operating frequency of 50 Hz. This means that:

i. The timer makes 50 spaces in ___ s [1]

ii. The time in seconds represented by one space = _____s. [1]

iii. The time in seconds represented by 10 spaces = _____ s. [2]

b. The diagram below represents a section of tape obtained when a trolley **accelerates** down an inclined runway.



i. The tape is attached to the trolley from end _____. [1]

ii. The total distance between the first dot and the last dot is _____ cm. [1]

iii. Calculate the total time in seconds to cover this distance.

.....

..... [2]

iv. Calculate the average velocity of the trolley in cm/s as it travels down the runway.

.....

..... [2]

4. a. i. Two similarly charged objects _____ each other . [1]

ii. Two _____ charged objects attract each other. [1]

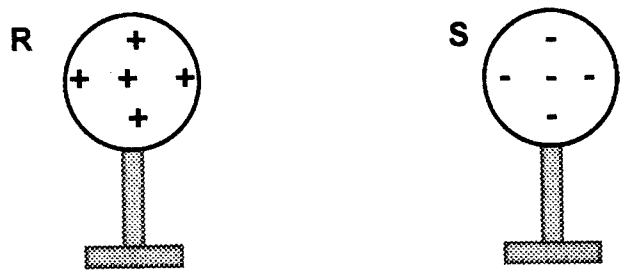
iii. Neutral [or uncharged] objects are _____ by both positively and negatively charged objects. [1]

iv. The size [magnitude] of the force of attraction or repulsion between two charged objects depends on:

i. .....

ii. ..... [2]

4. b. Two metal spheres R and S on insulating stands are charged as shown.



i. Spheres R and S are **equally** but _____ charged. **[1]**

ii. Charge Q is measured in _____. **[1]**

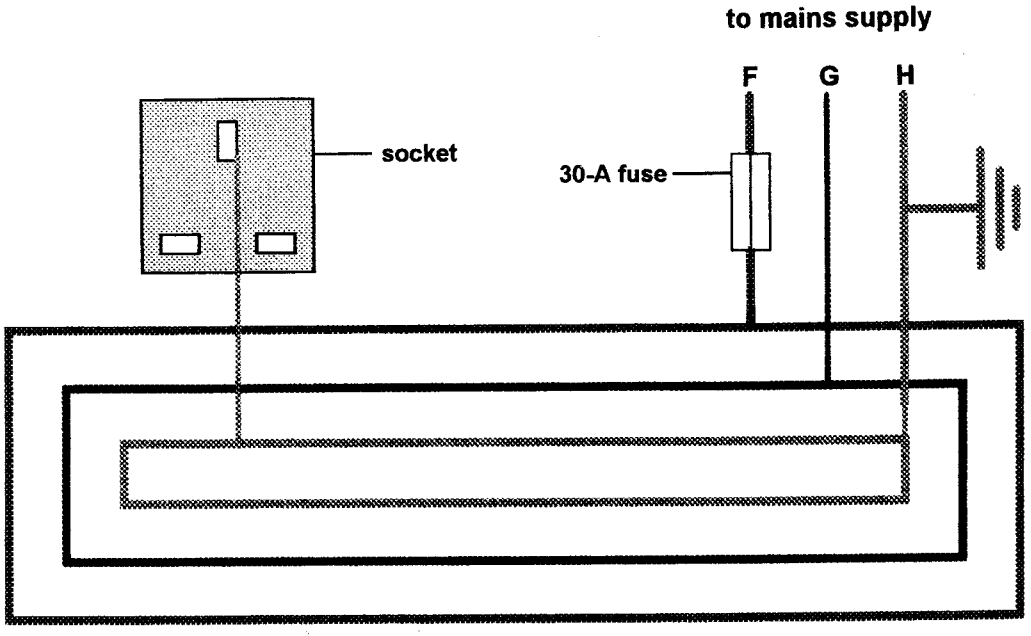
iii. What happens **in terms of electron flow** when sphere R is connected to earth?

_____ **[2]**

iv. What happens when sphere S is connected to earth?

_____ **[1]**

5. The diagram shows a power ring circuit diagram and an unconnected 13-A socket.

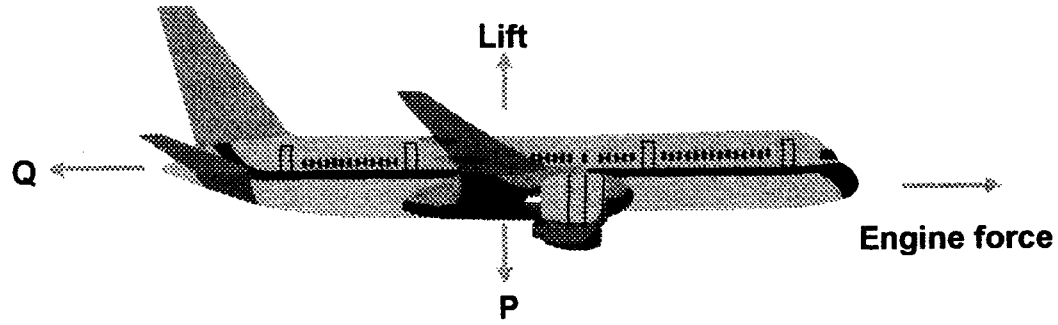


a. i. Wire _____ is the live wire and its colour is _____. **[2]**

ii Wire H is the _____ wire and its colour is yellow-green. **[1]**

b. Complete the circuit diagram by completing the missing socket connections to the circuit. **[2]**

6. The diagram below shows the forces acting on an aeroplane of mass 80 000 kg which is flying **at a constant height.**



a. What are the forces labelled P and Q ? **[2]**

.....

b. What can be said about the **size** of the engine force and the force Q when the aeroplane needs to **accelerate forward?** **[1]**

.....

c. What is the weight of the aeroplane in newtons?

.....

..... **[2]**

d. What is the size of the lift force when the aeroplane is travelling at constant height? Explain your answer.

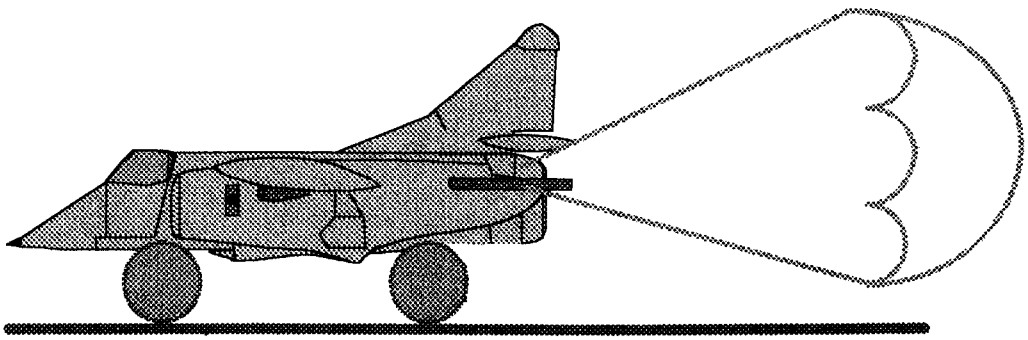
.....

..... **[2]**

e. What is the **total** resultant force acting on the aeroplane when it is travelling at constant velocity at constant height?. **[2]**

.....

f. The diagram below shows a fast military aircraft using a braking parachute on landing to help it slow down on the runway.



Which force does this parachute increase to help to slow down the aircraft? **[1]**

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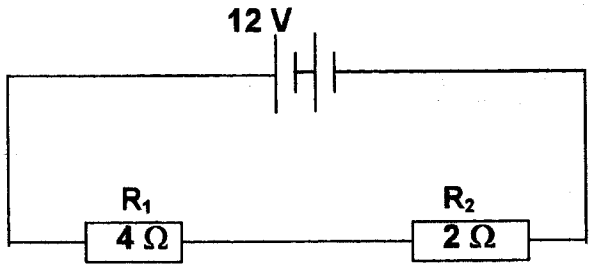
Section B. Answer All Questions. This Section carries 45 marks.

1. This question is about electric circuits .

The circuit diagram below shows two resistors R_1 and R_2 connected to a 12-volt battery.



a. i. Is the current flowing through R_2 bigger, smaller or equal to the current flowing through R_1? **[1]**

.....

ii. Give a reason for your answer.

..... **[1]**

b. i. What meter do you require to find the current flowing through the circuit? **[1]**

.....

ii. Using the appropriate symbol, draw on the circuit diagram above, the position of this meter in order to find the current flowing through the circuit. **[1]**

iii. What can you say about the size of the resistance of this meter? Give a reason for your answer.

..... **[1]**

..... **[1]**

c. i. What meter do you require to find the potential difference across R_1?

..... **[1]**

ii. Using the appropriate symbol, draw on the circuit diagram above, the position of this meter in order to find the potential difference across R_1. **[1]**

iii. What can you say about the size of the resistance of this meter? Give a reason for your answer.

..... **[2]**

.....

1. d. Calculate:

i. The **total resistance** of the above circuit .

.....

.....

[1]

ii. The **current** flowing through the circuit.

.....

.....

[2]

iii. The **power** of the circuit.

.....

.....

[2]

2 **This question is about the design of an experiment.**

Answer this question on the foolscap provided.

Describe an experiment to show, that the temperature rise of 1 kg of water heated for 5 minutes, depends on the electrical power of the immersion heater.

You are supplied with the following apparatus:
five immersion heaters of power ratings:10 W, 20 W, 30 W, 40 W, and 50 W; an appropriate electrical power supply; a thermometer; a stop-watch, and a lagged container containing 1 kg of water.

Your answer should include :

a. a labelled diagram of the experimental set-up, **[4]**
b. a **brief** account of how you would carry out the experiment, **[4]**
c. a table of results to record the list of observations made, **[4]**
d. the additional apparatus you would need to ensure even heat distribution, **[1]**
e. the result you expect from your investigation. **[2]**

PLEASE TURN OVER FOR QUESTION 3.

3. This question is about force and acceleration.

Two students set up an experiment using a trolley and a runway to show how the acceleration of the trolley depends on the applied force.
They obtain the following results.

Force /N	0	2	4	6	8	10	12	14
acceleration /m/s^2	0	2.5	5.0	7.5	10.0	12.5	15	17.5

a. Plot a graph of acceleration [y-axis] against the applied force [x-axis] on the graph paper provided. **[7]**

b. From the graph find:

i. the acceleration produced when the applied force is 5 N, _____ **[1]**

ii. the force required to produce an acceleration of 3.5 m/s^2. _____ **[1]**

c. From the graph or otherwise, find the mass of the trolley.

_____

_____

_____ **[3]**

d. The two students conclude that the acceleration produced is directly proportional to the applied force.

i. Do you agree with this conclusion? _____ **[1]**

ii. Give a reason for your answer.

_____

_____ **[2]**