SECONDARY SCHOOLS 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 $= \dfrac{\text{base x height}}{2}$ area of trapezium $=$ $\dfrac{h}{2}$ (sum of parallel sides)

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

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

heat energy $=$ mass x specific heat capacity x temperature change

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

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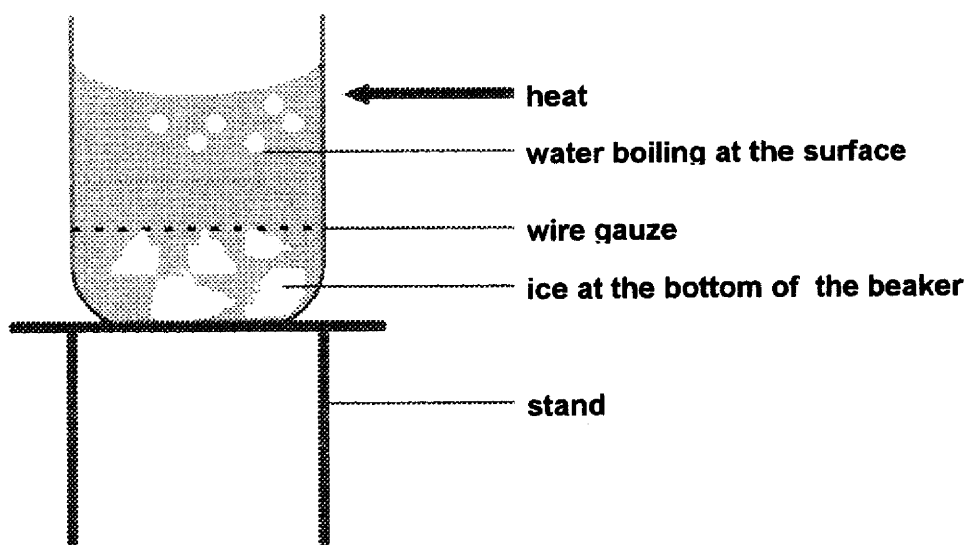
   i. Why is the wire gauze inside the beaker required?
       Explain your answer.

       ....

       ....

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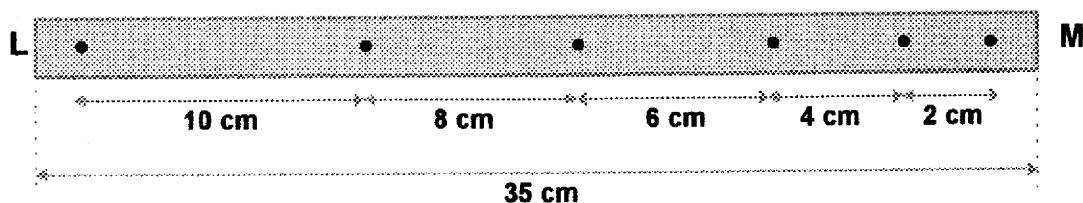
3. a. A ticker-timer has an operating frequency of 50 Hz. This means that:

    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.

L   10 cm   8 cm   6 cm   4 cm   2 cm   M

35 cm

    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   **[1]**
positively and negatively charged objects.

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

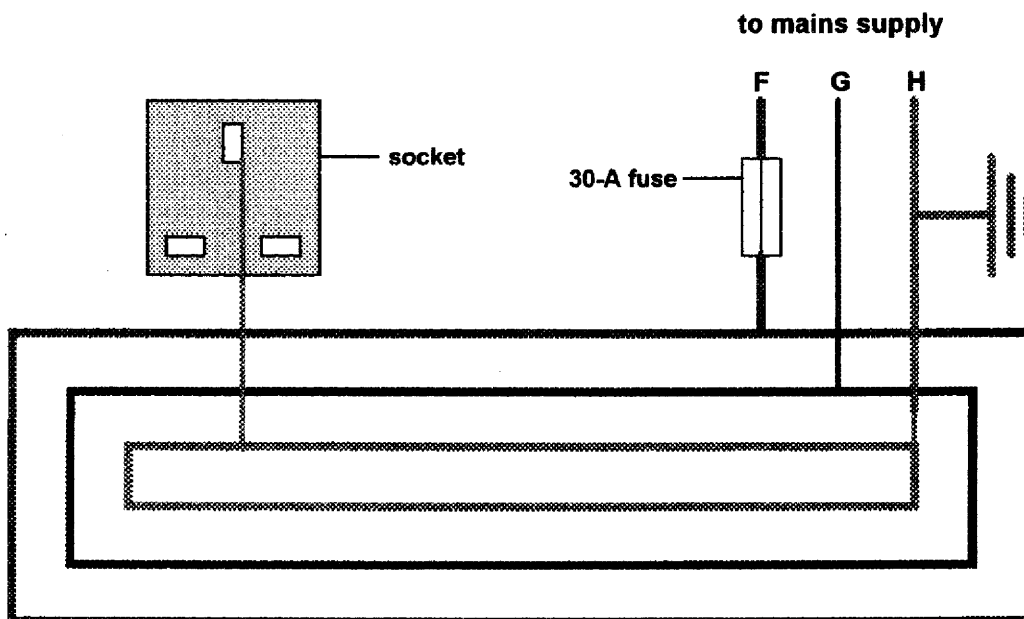   i. _____

      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.**

Lift

Q

Engine force

P
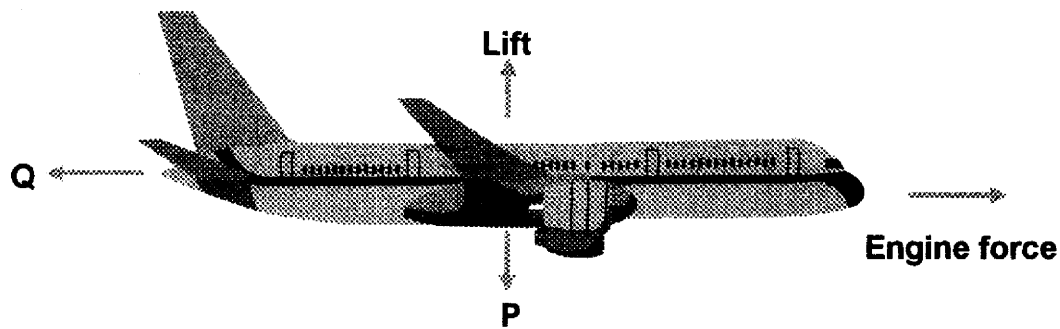
a. What are the forces labelled P and Q ?

[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.
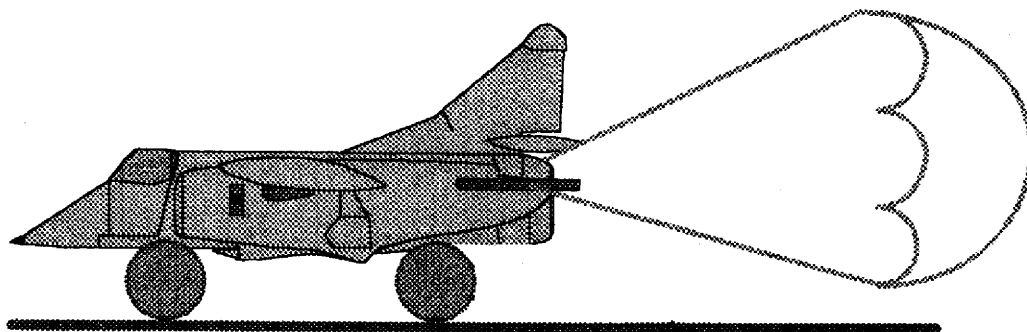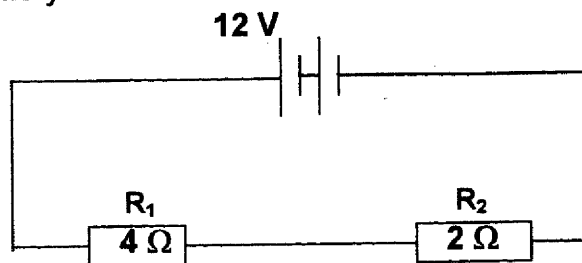
Which force does this parachute increase to help to slow down the aircraft?

[1]

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. Resistors R_1 and R_2 are connected in _____.   **[1]**

   b. Is the current flowing through R_2 bigger, smaller or equal to the current flowing through R_1?

   _____   **[1]**

   c. i. What meter do you require to find the current flowing through the circuit?   **[2]**

   _____

   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.   **[2]**

   d. i. What meter do you require to find the potential difference across R_1?   **[2]**

   _____

   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.   **[2]**

   iii. The potential difference across R_1 is 8 V. Therefore, the potential difference across R_2 is _____ V.   **[2]**

   e. Calculate:

   i. The **total resistance** of the above circuit.   **[1]**

   _____

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

   _____   **[2]**

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

Maria carries out an experiment to compare the temperature rise of a mass of water using five immersion heaters of power ratings: 10 W, 20 W, 30 W, 40 W and 50 W.
Maria records the rise in temperature of the water caused by each heater when switched on for 3 minutes.

a. Fill in the missing labels in the diagram of the experimental set-up used by Maria.

[1]

[1]

[1]
[1]

[1]
[1]
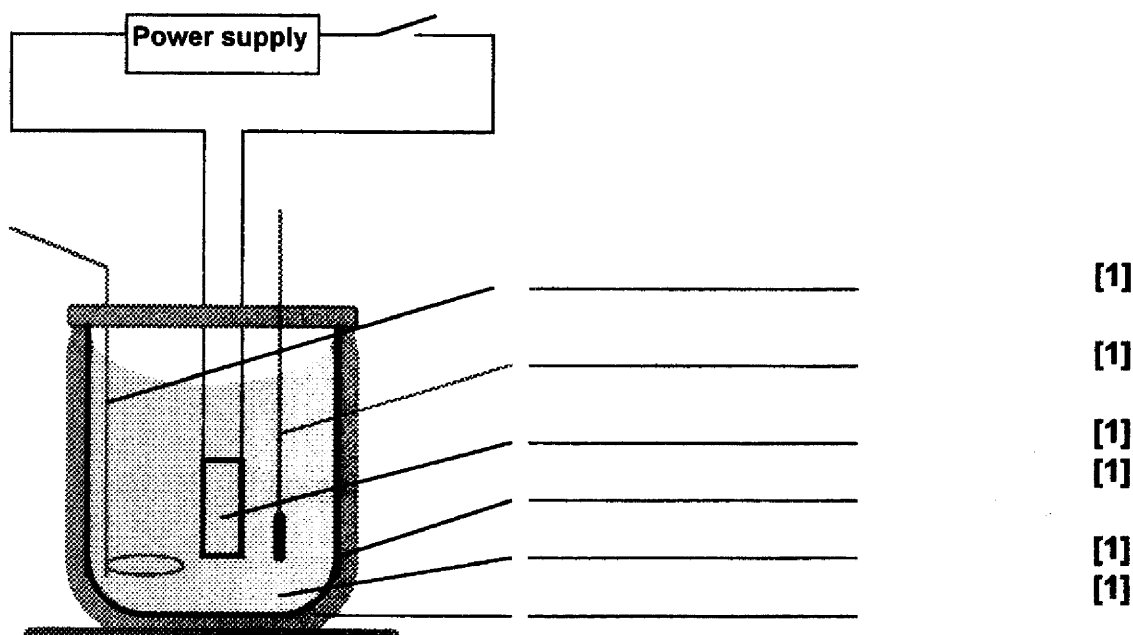
b. i. Lagging the beaker reduces _____ loss to the _____. **[2]**

    ii. If θ_1 is the temperature of the water before heating, and θ_2 is the temperature after each heater is switched on for 3 minutes, then the rise in temperature of the water can be found from _____ - _____. **[2]**

c. Complete the **headings** in the following table:

Heater power in _____	10	20	30	40	50
Rise in _____ in °C					

[2]

d. During all her experiments Maria does not change the :

    i. mass of the _____ in the beaker, . **[1]**

    ii. the initial _____ of the water in the beaker, **[1]**

    iii. the _____ during which each heater is switched on. **[1]**

3. This question is about force and acceleration.

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

Force /N	0	2	4	6	8
acceleration /m/s^2	0	2.5	5.0	7.5	10.0

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, ⸻⸻⸻ **[2]**

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

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

   i. Do you agree with this conclusion? **[2]**
   ⸻⸻⸻⸻⸻⸻⸻

   ii. Give a reason for your answer.

   ⸻⸻⸻⸻⸻⸻⸻⸻⸻

   ⸻⸻⸻⸻⸻⸻⸻⸻⸻

   ⸻⸻⸻⸻⸻⸻⸻⸻⸻ **[2]**