# JUNIOR LYCEUM ANNUAL EXAMINATIONS 2007

Educational Assessment Unit – Education Division

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

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**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$^2$.**

**You might find the following list of formulae useful.**

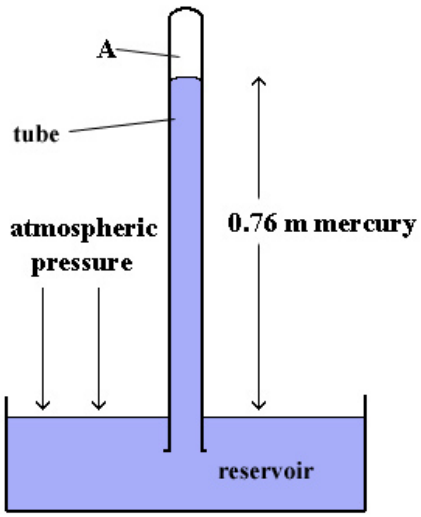
| | | |
|---|---|---|
| **Pressure** | $p = \rho gh$ | $F = pA$ |
| | | |
| **Force** | $F = ma$ | $W = mg$ |
| | | |
| **Motion** | Momentum = mv | $s = \frac{1}{2} at^2$ |
| | Impulse = Change in Momentum | |
| | | |
| **Electricity** | $Q = It$ | $W = QV$ |
| | $V = IR$ | $R = R_1 + R_2 + R_3$ |
| | $P = IV = I^2R = \frac{V^2}{R}$ | $R \alpha \frac{1}{A}$ $R \alpha L$ |
| | | |
| **Heat** | $H = mc\Delta\theta$ | $E = Pt$ |

| **Number** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **Total** |
|---|---|---|---|---|---|---|---|---|---|
| **Max Mark** | **8** | **8** | **8** | **8** | **8** | **15** | **15** | **15** | **85** |
| **Actual Mark** | | | | | | | | | |

| | **Total Theory** | **Total Practical** | **Final Mark** |
|---|---|---|---|
| **Actual Mark** | | | |
| **Maximum Mark** | 85 | 15 | 100 |

**SECTION A: Answer all questions in the spaces provided. This section carries 40 marks.**

1.




a) A mercury _____ is used to measure atmospheric pressure (1 mark)

b) The space labelled A is a _____ (1 mark)

c) The height of the column of mercury is measured by using a _____ (1 mark)

d) If the atmospheric pressure **increases**,
   - the level of mercury in the tube _____ (1 mark)
   - the level of mercury in the reservoir _____ (1 mark)

e) The atmospheric pressure on top of a mountain is _____ than the pressure at sea level (1 mark)

f) Find the atmospheric pressure if the height of mercury in the tube is 0.76m and the density of mercury is 13600kg/$m^3$ (2 marks)

_____

_____

_____

2 Francesca jumps out of a boat which is **at rest**.

a) What is the momentum of the boat **before** Francesca jumps off? _____ (1 mark)

b) Calculate the momentum of Francesca whose mass is 50kg, if she jumps off the boat with a velocity of 2m/s. (2 marks)

_____

c) What is the momentum of the boat just **after** Francesca jumps off? _____ (1 mark)

d) Find the recoil velocity of the boat if its mass is 400kg (2 marks)

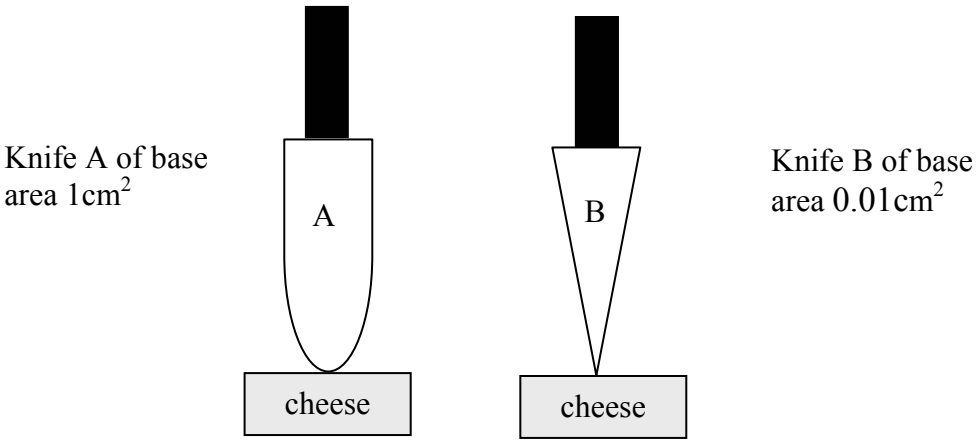
_____

_____

_____

e) When Francesca jumps off, the boat moves backwards since according to Newton's third law, for every _____ there is an equal and _____ reaction. (2 marks)

3. a) The diagram below shows two knives, A and B.




i) Gabriel makes a force of 10N to cut through cheese using knife A of base area $1cm^2$. Find the pressure exerted on the cheese in $N/cm^2$. (2 marks)

_____

_____

ii) If the base area of knife B is $0.01cm^2$, find the force Gabriel needs to make to cut through the cheese with knife B using the same pressure. (2 marks)

_____

_____

_____

iii) Why is it easier to cut something using a sharp knife rather than a blunt one? (1 mark)

_____

b) Gabriel lies on two different mattresses as shown in the diagrams below.

Diagram 1

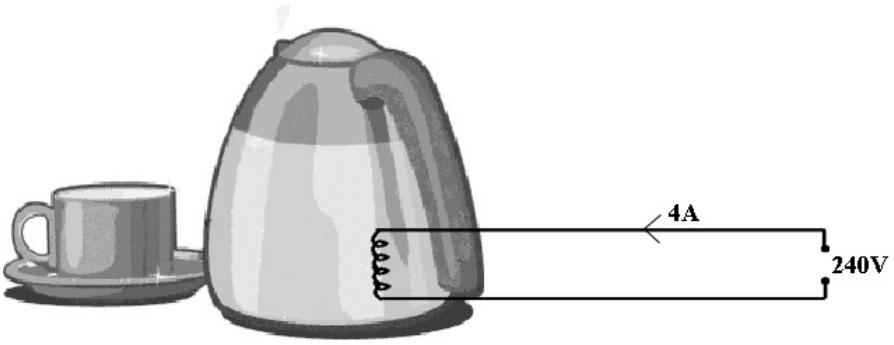
Diagram 2

i) The pressure exerted is **larger** in diagram ____ (1 mark)

ii) The _____ the contact area, the **larger** the pressure (1 mark)

iii) Which mattress is most comfortable? Diagram _____ (1 mark)

4. Sarah heats 0.5kg of water in a small electric kettle to make some tea. The temperature of the water rises from 20°C to 80°C.




a) What is the rise in temperature? _____ (1 mark)

b) Given that the specific heat capacity of water is 4200J/kg°C find the heat energy needed to heat the 0.5kg of water from 20°C to 80°C. (2 marks)

_____

_____

_____

c) If the current in the circuit is 4A and the voltage is 240V, find the power of the kettle. (2 marks)

_____

_____

_____

d) Choose a fuse suitable for this circuit from the box below _____ (1 mark)

| 3A, 5A or 13A |
|---|

e) Using your answers in b) and c) find the time taken to heat the water from 20°C to 80°C. (1 mark)

_____

_____

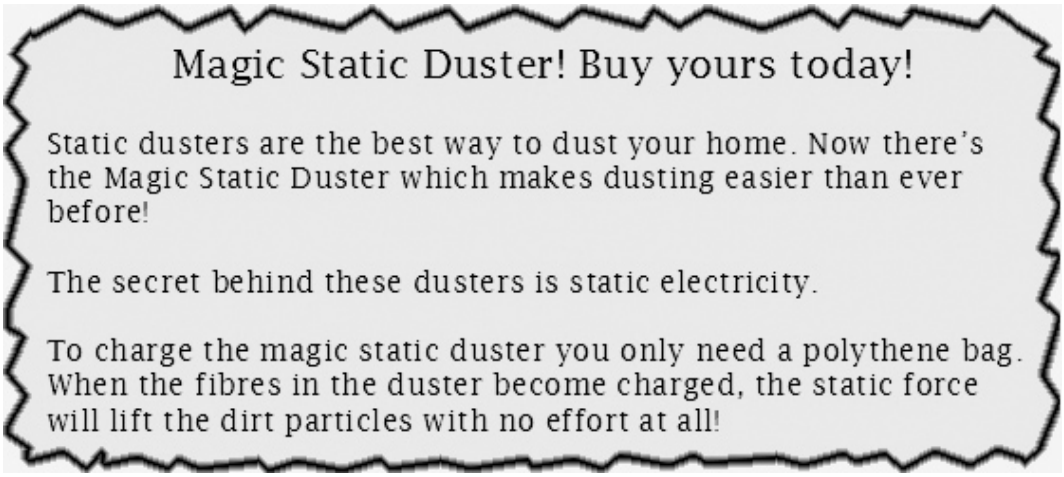
_____

f) In actual fact, more time is needed to heat the water, why is this so? (1 mark)

_____

_____

5. The following advert is seen on a magazine:

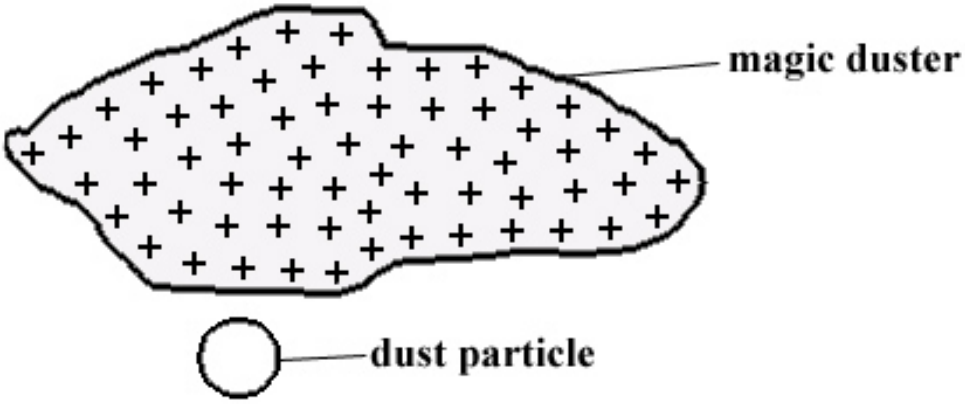



a) The static magic duster becomes _____ by rubbing it with the polythene bag. (1 mark)

b) Name the charges that are being transferred **from** the magic duster **to** the polythene bag. (1 mark)

_____

c) The magic duster is brought close to a **neutral** dust particle. Draw the charges on the dust particle when it gets close to the magic duster. (1 mark)




d) Why is the dust particle attracted to the magic duster? (2 marks)

_____

_____

e) If the dust particle sticks to the magic duster, what charge will it have now? (1 mark)

_____

f) What happens to the dust particle after some time? Explain (2 marks)

_____

_____

**SECTION B**
**Answer all questions. Each question carries 15 marks.**

6 This question is about different sports:

a) Mark's favourite sport is driving a racing car.


i) Find the resultant force acting on the car _____ (1 mark)

ii) If the mass of the car is 1500kg, find its acceleration. (2 marks)

_____

_____

iii) Mention one safety feature of a modern car. Explain how it may protect the driver. (2 marks)

_____

_____

b) Joanna's favourite sport is skydiving. The diagram below shows Joanna falling some time after she opens her parachute.

i) Draw and label the two forces acting on Joanna. (4 marks)

ii) If Joanna's mass is 55kg, what is her weight? _____ (1 mark)

iii) How much is the upward force when she is moving with constant velocity? (1 mark)

_____

iv) This constant velocity is called _____ velocity. (1 mark)

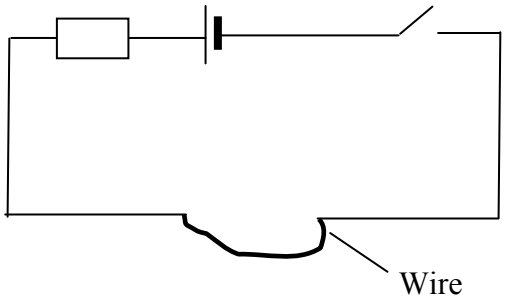
v) On another day, Joanna uses a **larger** parachute. State if the following will **increase, decrease or remain the same.** (3marks)

Weight of Joanna _____

Upward force _____

Time to reach the ground _____

7. a) Two students were given the task to measure how the resistance changes when the length of a wire is changed. They set up the apparatus below




i) Draw on the diagram, the apparatus needed to record the current. (1 mark)

ii) After they find the current for each length of wire, they calculate the resistance of each length by using the formula V= IR. The following are the results they obtain:

| | | | | |
|---|---|---|---|---|
| Resistance (Ω) | 0.35 | 0.70 | 1.05 | 1.40 |
| Length of Wire (cm ) | 5 | 10 | 15 | 20 |

Plot a graph of **Resistance on the y axis against length of wire on the x-axis** (4 marks)

iii) From the graph find the resistance when the length of the wire is 12cm ____ (1 mark)

iv) Calculate the current of this length of wire if the voltage across it is 12V. (2 marks)

_____

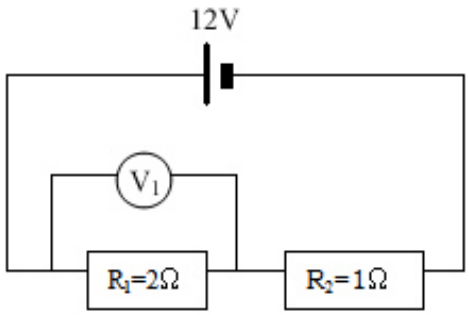
_____

v) Why is it important **not** to leave the circuit switched on for a long time? (1 mark)

_____

_____

b) Look at the circuit below




i) What is the total resistance of the circuit?_____ (1 mark)

ii) Find the current in the circuit (2 marks)

_____

_____

_____

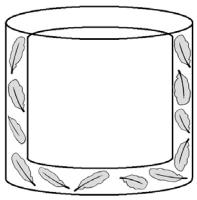
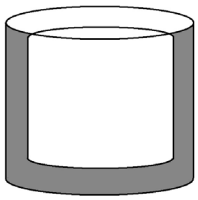
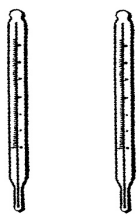
iii) Find the reading of voltmeter $V_1$ (2 marks)

_____

_____

iv) Should the resistance of a voltmeter be large or small? _____ (1 mark)

8 Sue and Dave work in a fashion design company. They are asked to design a winter jacket with good insulation. Before they start their design, they need to find **which the best insulator is: feathers or a layer of cloth.** They are given the following apparatus:

| | | | | |
|---|---|---|---|---|
|  |  |  |  |  |
| Can covered with feather as an insulation | Can covered with cloth as an insulation | Two thermometers | Boiling Water | Stop watch |

a) Describe an experiment that Sue and Dave must do in order to find which is the **best insulator** (3 marks)

_____

_____

_____

_____

_____

_____

b) Mention two precautions taken in their experiment. (2 marks)

1. _____

_____

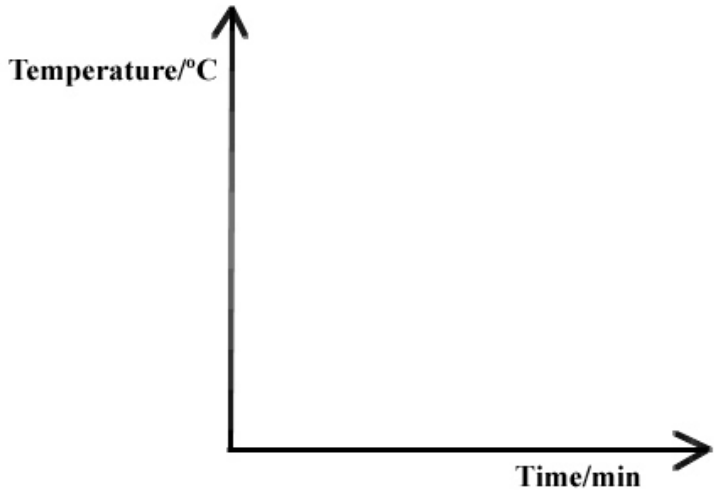
_____

2. _____

_____

_____

c) Sketch two graphs of temperature against time on the same axes to show the expected results. Label your graphs: feather insulation and cloth insulation (4 marks)




d) It is expected that _____ is the better insulator since trapped air is a _____ conductor of heat. (2 marks)

e) Why do you think this would not be a fair experiment if the inside of one beaker is silver and the other is black? (2 marks)

_____

_____

f) Dave and Sue design a quilted reversible jacket. One side of the jacket is black and the other side is white. Choose the best way to wear the jacket to keep a person warmer in winter. Give a reason for your choice.

| | |
|---|---|
|  | Option 1<br><br>Black inside and white outside |
|  | Option 2<br><br>White inside and black outside |

Option _____ (1 mark)

Reason: _____ (1 mark)

_____