# JUNIOR LYCEUMS ANNUAL EXAMINATIONS 2006

Educational Assessment Unit - Education Division

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

**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:**

$W = mg$ $F = ma$ Energy = Power x time $v = u + at$ $s = \frac{at^2}{2}$

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

Heat energy = mass x specific heat capacity x temperature change

$V = I R$ $P = V I$ $Q = I t$ $R = R_1 + R_2 + R_3$

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

**1.** Ryan of mass 50 kg, running at 1.5 m/s, jumps on to a stationary trolley of mass 10 kg, and both move together along a long corridor in a supermarket. Calculate:

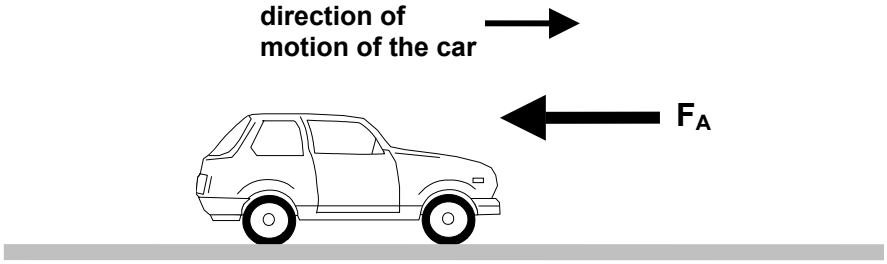
a. The momentum of the **trolley** before Ryan jumps on it. _____ **2**

b. **Ryan's** momentum just before jumping on to the trolley. **3**

c. Calculate the **total mass** moving after Ryan jumps on to the trolley. **2**

d. Calculate the **common velocity** of Ryan and the trolley as they both travel together along the long corridor. **3**

**2.** A battery-operated model car is travelling at a *uniform speed* along a level runway in the direction shown in the diagram. One external horizontal force $F_A$ acting on the car is shown on the diagram.




a. Force $F_A$ acting against the motion of the car is called _____. **1**

b. i. Add to the diagram another horizontal force $F_E$ acting on the car *in the opposite direction* to $F_A$ **1**

ii. $F_E$ is referred to as the _____ force. **2**

c. The resultant force acting on the car travelling at uniform speed is ____ N. **1**

d. i. State what happens to the speed of the car when force $F_E$ is bigger than force $F_A$. _____. **1**

ii. As force $F_E$ gets bigger, force $F_A$ gets _____ but not to the same extent. **1**

e. Calculate:

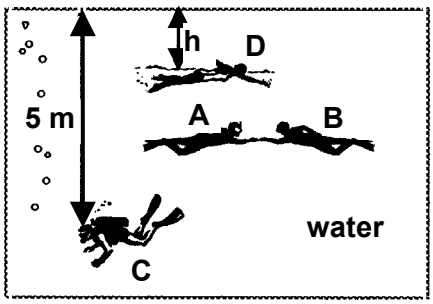
i. the resultant force acting the model car given that force $F_E$ is 5 N and force $F_A$ is 2 N. **1**

ii. the acceleration produced by this force given that the mass of the model car is 2 kg. **2**

**3.** The figure shows an underwater photograph of four divers: A, B, C and D.

a. i. Which two divers are under the same pressure? _____ **1**

ii. Give a reason to your answer. **1**




b. i. Which diver has the greatest pressure due to the water? _____ **1**

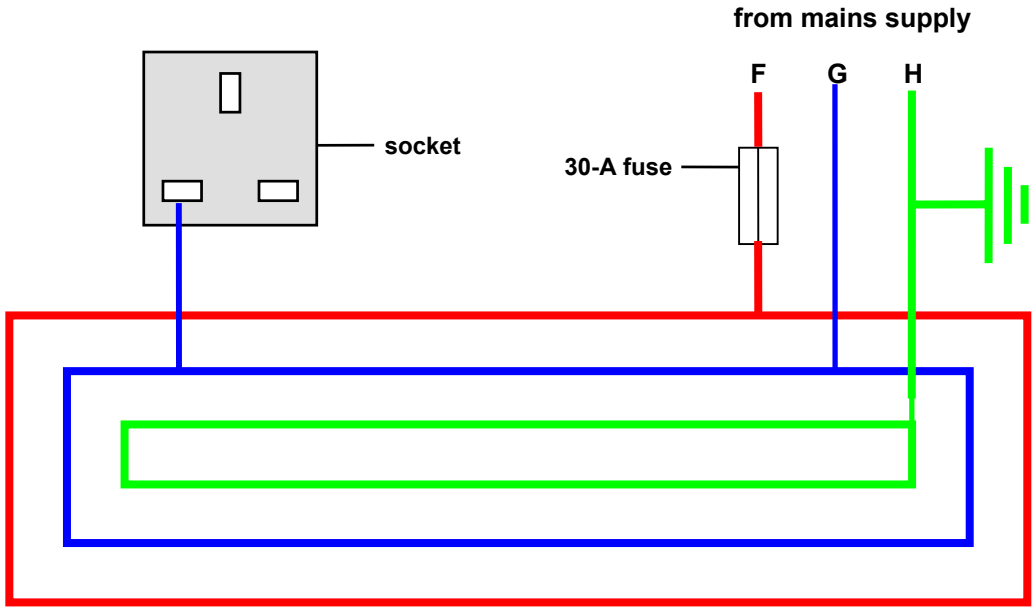
ii. Explain your answer. **1**

c. Calculate the pressure **due to the water** on diver C, given that the density of water is 1000 kg/m$^3$. **2**

d. Calculate the **total pressure** on diver C given that atmospheric pressure is 100 000 Pa. **2**

e. The pressure **due to the water only** acting on diver D is 10 000 Pa. Calculate the depth, h, of diver D. **2**

**4a.** The diagram shows a power ring circuit diagram and an unconnected 13-A socket.




i. Wire ___ is the live wire and its colour is brown. **1**

ii Wire ___ is the neutral wire and its colour is blue. **1**

iii. Complete the circuit diagram by completing the missing socket connections to the circuit. **2**

**4b.** A 100-W lamp on a 240 V supply is switched on for 30 minutes. Calculate:

i. current flowing through the heating element, **2**

ii. resistance of the filament of the lamp, **2**

iii. the number of kWh consumed. **2**

**5.** Two small balls coated in metallic paint are suspended by long insulating strings from A and B as shown in figure 1 below.

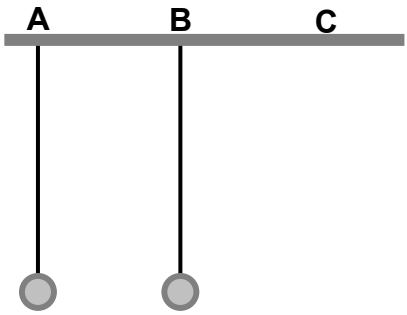



**Figure 1**


**Figure 2**

a. Both balls in figure 1 are given a negative charge.

i. Complete figure 2 above to show the new positions of the balls. **1**

ii. Choose the appropriate word to complete the sentence below from the following list: *attract, unlike, force, repel, like, small.*
The balls in figure 2 _____ each other since_____ charges repel each other. **2**

b. The ball suspended from B is carefully moved and suspended from C without changing the size of the charges on both balls.

i. Complete figure 3 to show the new positions of the balls. **1**

ii. As the distance between the two balls carrying the same charge increases, the force of repulsion between them _____. **1**


**Figure 3**

**6.** A boy drops a large stone from the top of a cliff. The time taken by the stone to strike the ground below is 2.5 s.

a. i. The initial velocity of the stone = _____ m/s. **1**

ii. The initial acceleration of the stone is _____ $m/s^2$. **1**

iii. The acceleration of the stone is caused by the _____. **1**

iv. The velocity of the ball **after** it hits the ground = _____ m/s. **1**

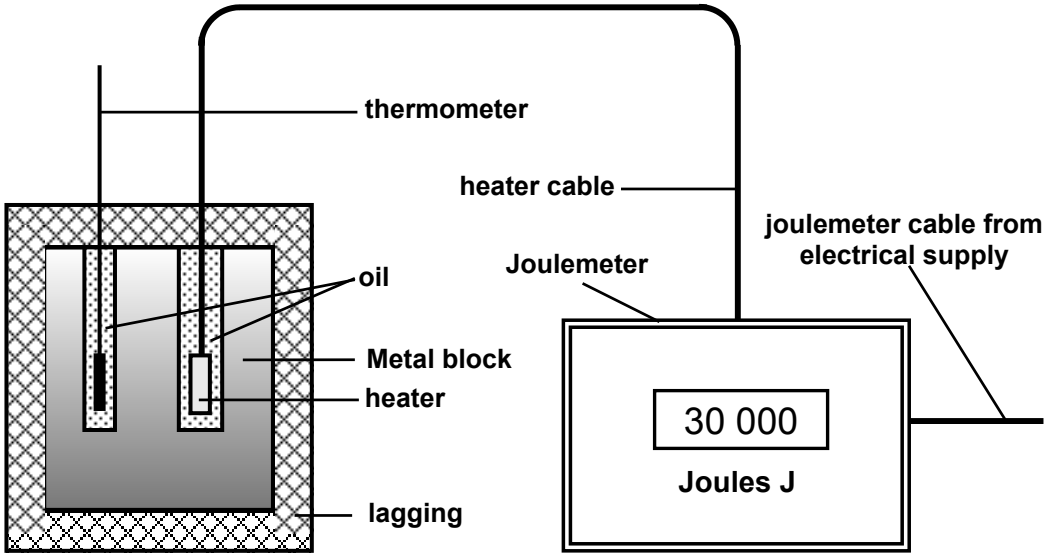
b. Calculate:

i. the height of the cliff, **3**

ii. the velocity with which the stone hits the ground. **3**

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

**1.** Marica sets up the apparatus as shown in the diagram below in order to find the specific heat capacity **c** of an unknown metal. The mass of the metal block is 2 kg.




The heater is switched on and the following results are obtained.

| temperature θ / °C | 20 | 25 | 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|---|
| time t / minutes | 0 | 1 | 2 | 3 | 4 | 5 |

a. Plot a graph of temperature (y-axis) against time (x-axis) on the graph paper provided. **6**

b. From your graph find the room temperature. _____ **1**

c. What do you notice about your graph that shows that the metal block is very well-lagged? **1**

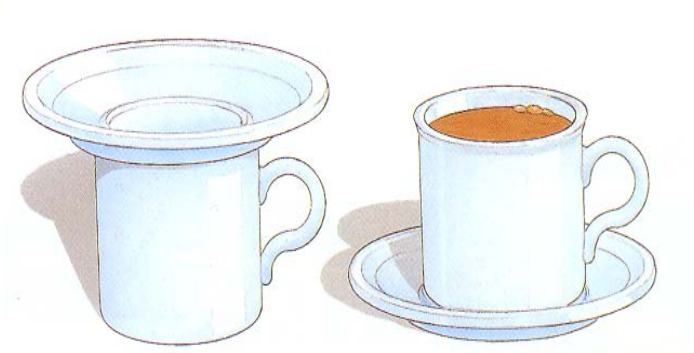
d. The joulemeter in the diagram shows the reading **before** the heater is turned on. The reading on the joulemeter when the temperature of the metal block is 45 °C is 39 000 J. Calculate energy supplied by the heater. **1**

e. Find the time in **seconds** during which the heater is switched on. **1**

f. Calculate the power of the heater in J/s or watts W. **2**

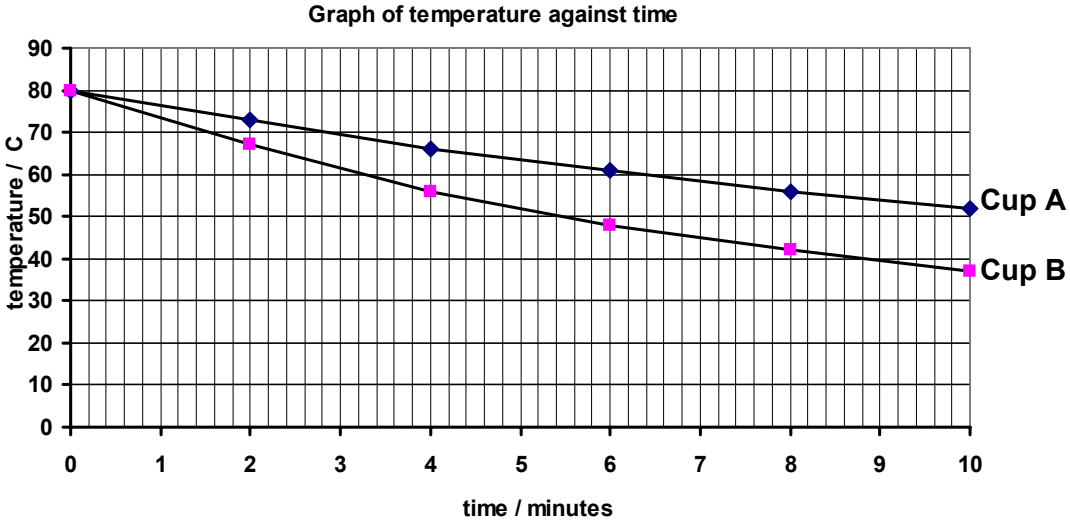
g. Calculate the specific heat capacity **c** of the metal block. **3**

**2a.** The figure below shows two freshly poured cups of hot tea. **Cup A** is covered by a saucer while **Cup B** is left uncovered.



**Cup A** **Cup B**

The graphs below show how the **temperature** of the tea in **Cup A** and **the temperature** of the tea in **Cup B** drops with **time**.




i. The temperature of the tea in cup A after 8 minutes is _____ ºC **1**

ii. The temperature of the tea in cup B after 8 minutes is _____ ºC **1**

iii. The difference in temperature between the tea in cup A and that in cup B after 8 minutes is _____ ºC **1**

iv. The temperature of the tea in cup A drops to 60 ºC in approximately _____ minutes. **1**

v. The temperature of the tea in cup B drops to 60 ºC in approximately _____ minutes. **1**

vi. The temperature of the tea in cup A takes _____ minutes longer than the tea in cup B to drop to 60 ºC. **1**

vii. Why does the tea in cup A take a longer time to cool than that of B? **2**

viii. Heat is lost from ***cup B*** to the surrounding air *mostly* by_____. **2**

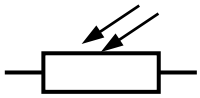
ix. Use the graph to find how long you could leave the **uncovered cup** of tea before drinking the tea at a temperature of 45 ºC. _____. **2**

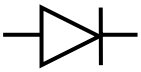
**2b.** The figures below represent three sheets of copper A, B and C, painted in different colours.

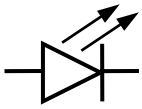

i. Surface _____ absorbs heat energy very quickly. **1**
ii. Surface _____ is a very good emitter of thermal radiation. **1**
iii. Surface _____ is the best reflector of heat energy. **1**

**3a.** Write down the meaning of these symbols:

i.  _____ **1**

ii.  _____ **1**

iii.  _____ **1**

iv.  _____ **1**

**3b.** Describe an experiment to show the relationship between the current flowing through a **resistor** and the p.d. (voltage) across it.
**You are provided with the following apparatus:**
battery, switch, variable resistor, ammeter, voltmeter, the resistor and connecting wire.

**Your answer should include:**
i. a circuit diagram of the experimental set-up, **2**
ii. a **brief** account of how you would carry out the experiment, **2**
iii. a table of results to record the list of observations made, **2**
iv. the result you expect from your investigation, **2**
v. a sketch of an appropriate graph showing the expected results. **2**
vi. one precaution in order to obtain more accurate results **1**

**i. Circuit diagram**

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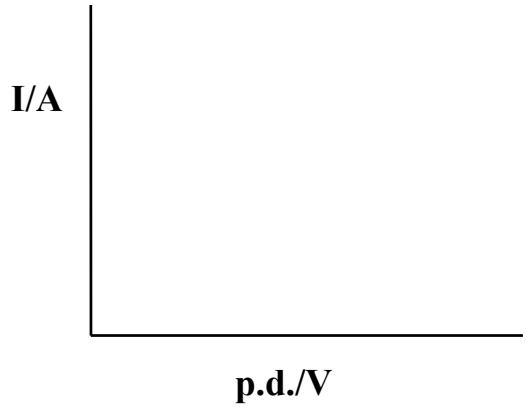
**ii. Method**

**iii. Table of results**

**iv. Result expected.**

**v. Expected Graph**




**vi. One Precaution**