SECONDARY SCHOOLS ANNUAL EXAMINATIONS 2006
Educational Assessment Unit - Education Division

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

$W = mg$ $F = ma$ 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

$V = IR$ $P = VI$ $Q = It$ $R = R_1 + R_2 + R_3$

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:

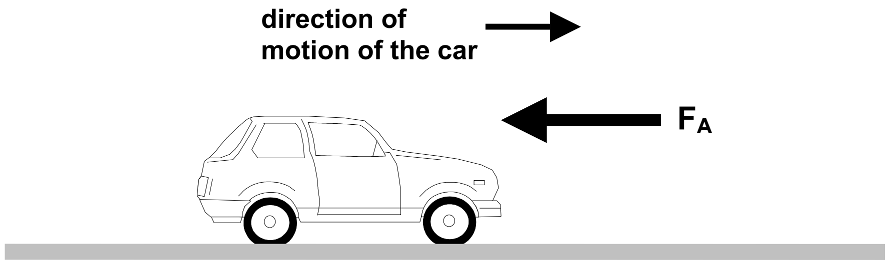
a. The momentum of the **trolley** before Ryan jumps on it. ________ **2**

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**

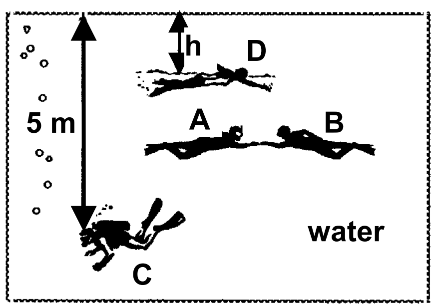
ii. As force F_E gets bigger, force F_A gets ______________ but not to the same extent. **1**

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**

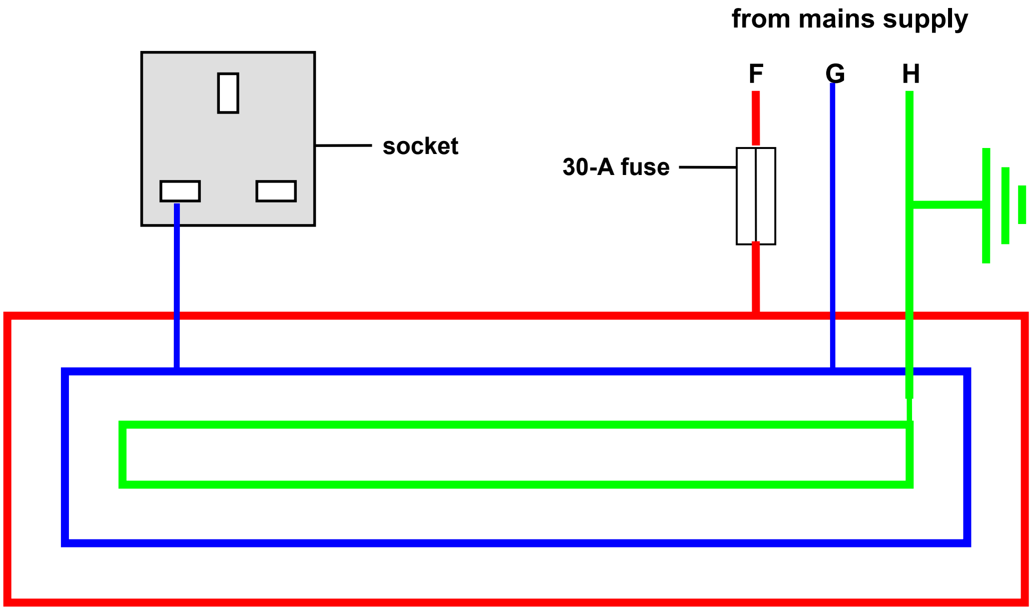
ii. Explain your answer. **1**

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.

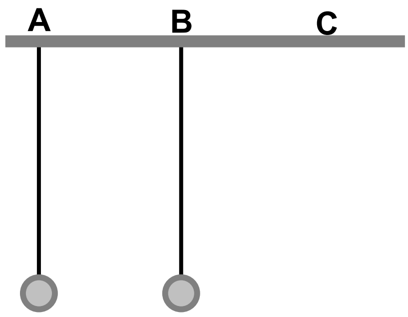


Figure 1

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**

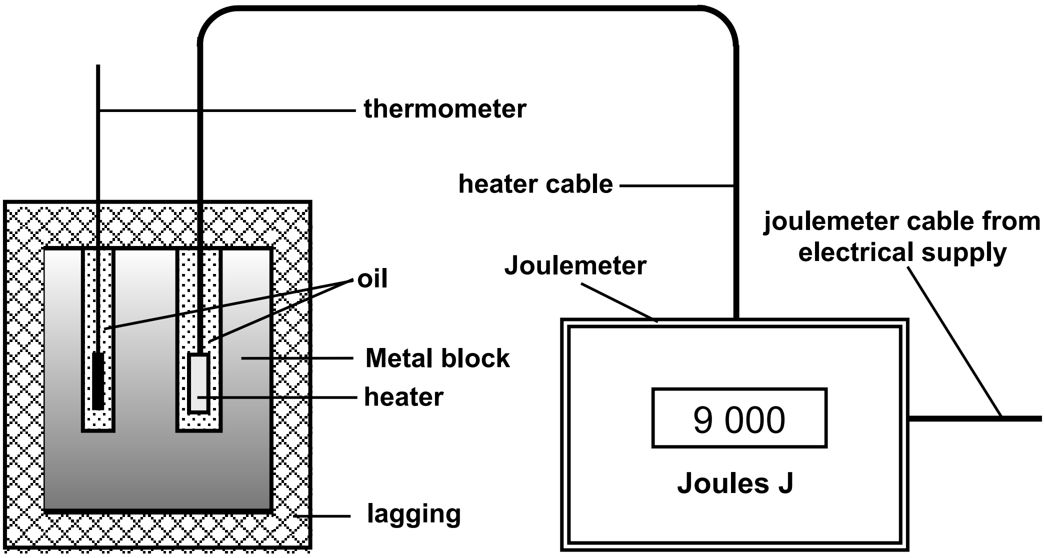
b. Calculate:

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. **8**

b. From your graph find the temperature of the block after 2.5 minutes. _____ **1**

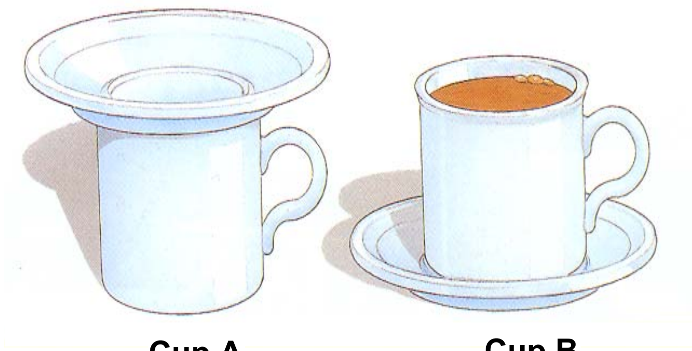
c. From the graph find the time taken by the metal block to reach a temperature of 40 °C. _____ **1**

d. What will be the temperature of the metal block **in this experiment** after heating it for 3 more minutes? _____ **1**

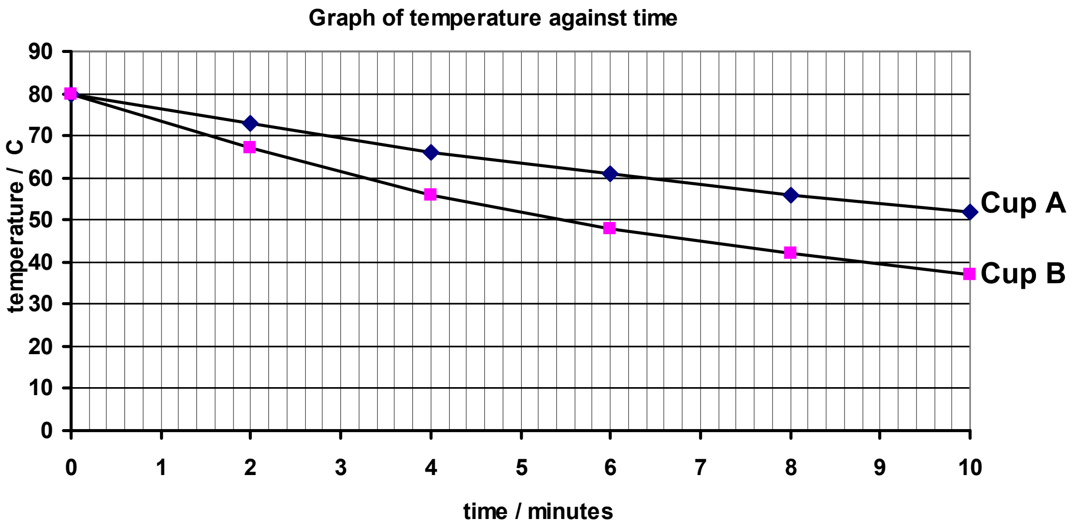
e. How long will the metal block **in this experiment** take to reach a temperature of 50 °C? _____ **1**

f Calculate the specific heat capacity **c** of the metal block of mass 2 kg given that the heat energy required to increase its temperature by 25 °C is 9000 J. **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.



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 **2**

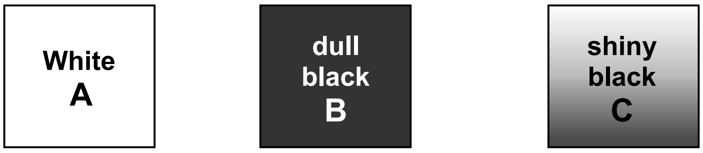
iv. The temperature of the tea in cup A drops to 60 ºC in approximately _____ minutes. **1**

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. **2**

vii. Why does the tea in cup A take a longer time to cool than that of B? **1**

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

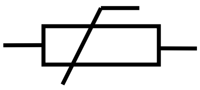
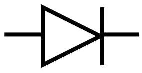


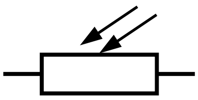
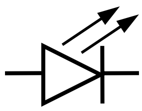
i. Surface ______ absorbs heat energy very quickly. **2**

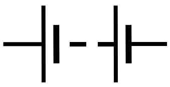
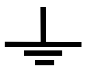
ii. Surface ______ is a very good emitter of thermal radiation. **2**

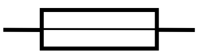
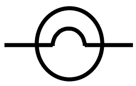
iii. Surface ______ is the best reflector of heat energy. **2**

3a. Write down the meaning of these symbols:

i.  ______________ v.  ______________ **1** **1**

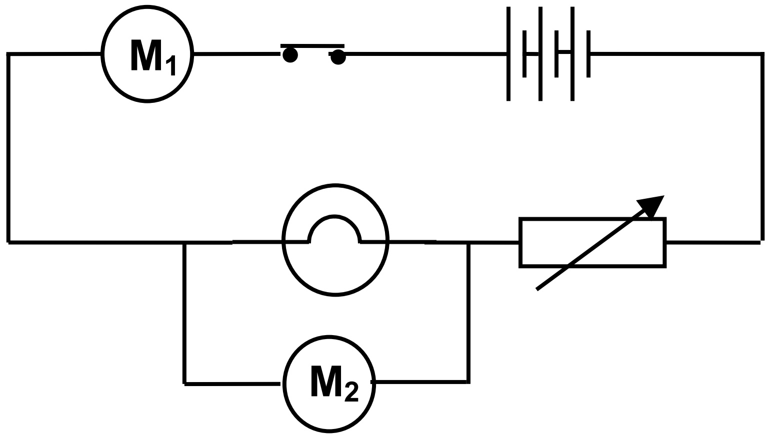
ii.  ______________ vi.  ______________ **1** **1**

iii.  ______________ vii.  ______________ **1** **1**

iv.  ______________ viii.  ______________ **1** **1**

PLEASE TURN OVER

3b. Nadia sets up the circuit below to carry out an experiment on a filament lamp.



i. M_1 is the ______________ measuring _______________ in amperes. **2**

ii. M_2 is the __________________ measuring p.d. in ______________. **2**

iii. M_1 has a ________ resistance while M2 has a ________ resistance. **2**

iv. Is the lamp in the circuit switched ON or turned OFF? __________. **1**