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JUNIOR LYCEUM ANNUAL EXAMINATIONS 2009

Directorate for Quality and Standards in Education
Educational Assessment Unit

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

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:

Motion	$v = u + at$	$a = \frac{v-u}{t}$
	$s = ut + \frac{1}{2} at^2$	
Momentum	Momentum = mv	
	Force = $\frac{\text{Change in Momentum}}{\text{time}}$	Force = $\frac{mv - mu}{t}$
Force	F = ma	W = mg
Electricity	Q = It	W = QV
	V = IR	$R = R_1 + R_2 + R_3$
	P = IV	$R \alpha \frac{1}{A}$ $R \alpha L$
	E = Pt	
Heat	$H = mc\Delta\theta$	

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

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SECTION A: **Answer all questions.**

1. Fill in the table below:

Quantity	**Symbol**	**Units**
Specific heat capacity		J/kg ^{o}C
Heat Energy	H	
	V	V
Charge		C
Current	I	
Distance		m
Final Velocity	v	
	a	m/s^2

2. A hairdryer has a power rating of 1100W when operating on an a.c. supply of 230V.

   a) What does a.c. stand for? _____ _____ [2]

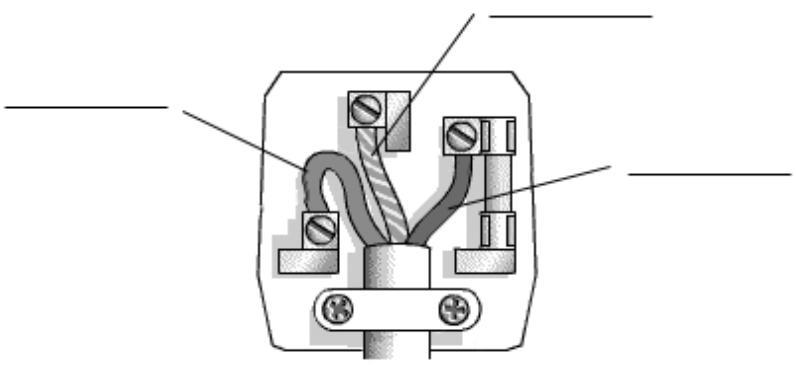
   b) Calculate the current flowing in the circuit when the hairdryer is operated. [2]

   _____

   _____

   c) Which of the following fuses is most appropriate to use with the hairdryer: 3A, 5A or 13A? _____ [1]

   d) The lead of the hairdryer is connected to a plug as shown in the diagram. Label the earth, the live and the neutral wires. [3]



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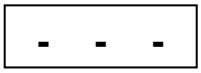
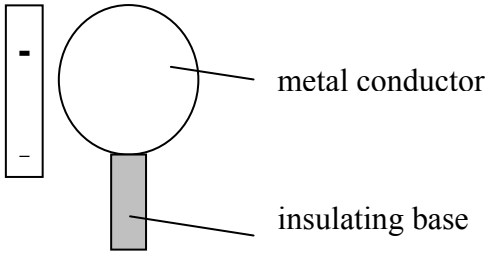
3. A negatively charged rod is shown in the diagram below.



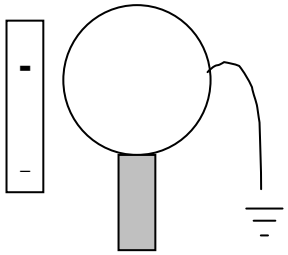
a) Underline the correct word: [1]

The rod is made of polythene / perspex.

b) The rod is brought close to an uncharged metal conductor which has an insulating base. Draw the charges on the conductor. [2]



c) The conductor is earthed as shown in the diagram below. State what happens to the charges on the conductor. [1]



_____

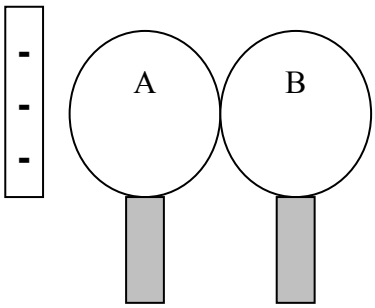
d) The earth connection is removed and then the charged rod is also removed. What is the charge on the conductor now? [1]

_____

e) What happens if the rod is removed **before** the earth connection is removed? [1]

_____

f) The rod is now brought close to two uncharged metal spheres A and B as shown. They are then separated while the negatively charged rod is held near A. The resulting charge on A is _____ and the charge on B is _____ [2]



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4. a) Even though seatbelts were invented in the late 1800's, they were only made as a standard feature in some cars in the late 1950's. Today, when designing a car, some safety tests are made by using a dummy to represent a person driving the car.

i) As can be seen in the diagram, the dummy in the car moves forward as the car stops suddenly. Explain in terms of physics principles why this happens. [1]

_____

_____

ii) If the car is hit from behind when it is at rest, in which direction will the dummy be observed to move, forward or backward? [1]

_____

b) A man of mass 80kg is driving a car at a velocity of 20m/s. The car crashes and the driver is **stopped** by the seatbelt.

i) Calculate the momentum of the man before the car crashes. [1]

_____

ii) What is the momentum of the man when he is **stopped?** [1]

_____

iii) Find the change in momentum. [1]

_____

iv) The driver is stopped by the seatbelt in 0.5s. Calculate the force exerted by the seatbelt on the driver. [2]

_____

_____

_____

c) Explain why a seatbelt can decrease injury. [1]

_____

_____

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5. Julia goes for a ride on her bicycle. She starts from **rest** on a level road and reaches a velocity of 5m/s in 10s.

a) What is her initial velocity u? _____ [1]

b) What is her final velocity v? _____ [1]

c) Calculate her acceleration. [2]

_____

_____

_____

d) Find the distance Julia moved in the first 10s. [2]

_____

_____

_____

e) After some time, she does **not** accelerate any more even though she cycles as fast as she can. She reaches a maximum constant velocity.

i) This maximum velocity is called _____ velocity. [1]

ii) What can you say about the forward and backward forces when this happens? [1]

_____

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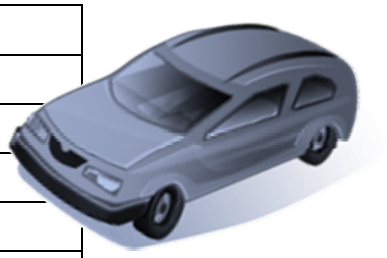
SECTION B: Answer all questions.

6. A car moves along a level road. The following table shows the velocity of the car.

Velocity in m/s	Time in s
0	0
7.5	5
15	10
22.5	15
30	20
30	25
30	30
30	35
30	40
25	45
20	50
15	55
10	60
5	65
0	70



a) Plot a graph of velocity in m/s *(y-axis)* against time in s *(x-axis).* [5]

b) From your graph or otherwise find:

i) the maximum velocity of the car _____ [1]

ii) the time the car moved with constant velocity._____ [2]

iii) the total distance moved [3]

_____

_____

_____

iv) the acceleration [2]

_____

_____

v) Use your answer in (iv) above to calculate the resultant force acting on the car if its mass is 2000kg. [2]

_____

_____

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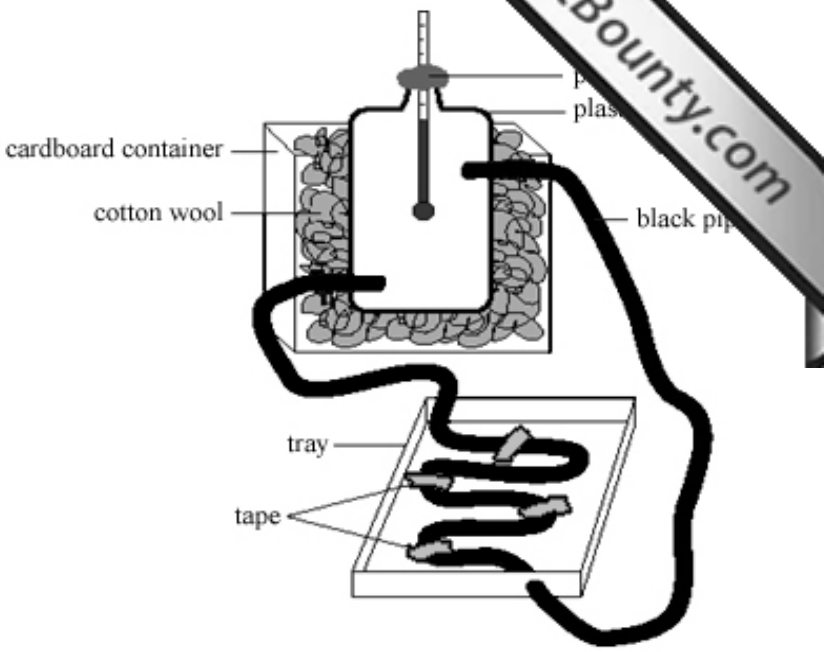
7 a) Today measures to reduce the use of fossil fuels are being taken. One of these measures is to fix a solar water heater on the roof. Sam decides to make a homemade solar water heater as shown in the diagram below.



i) Convection currents occur when _____ [2]

_____

ii) Why should the homemade solar water heater have a long length of pipe positioned in the tray? [1]

_____

iii) What is the advantage of having the pipe painted black? [1]

_____

iv) If Sam forgets to place a piece of plasticene at the top of the bottle as shown in the diagram, what will happen to the water temperature in the bottle? [1]

_____

v) What is the purpose of the cotton wool between the bottle and the cardboard container? [1]

_____

vi) Name the process by which the heat is transferred from the sun **to** the pipe [1]
_____.

vii) Name the process by which the heat is transferred **through** the pipe [1]
_____.

viii) The solar water heater is then placed in a box made out of glass. How will the temperature inside the box of glass change after some time? [2]

Temperature will_____

The effect which causes this change is called _____

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b) A large metal black container filled with 10kg of water is placed on a roof. It is then left for some time in the sun and the temperature of the water in the container rises from 20°C to 50°C.

i) Calculate the rise in temperature. [1]

_____

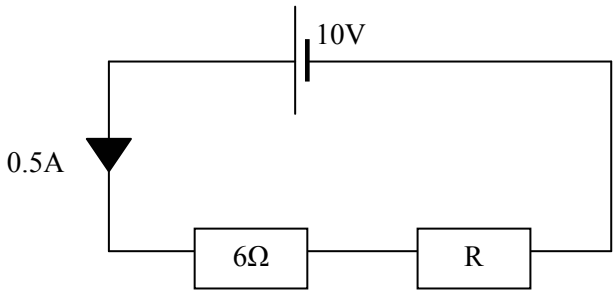
ii) If the specific heat capacity of water is 4200J/kg °C, find the quantity of heat energy absorbed by the 10kg of water. [3]

_____

_____

iii) Underline the correct answer: [1]
If the container was made of **plastic** instead of **metal**, the rise in temperature would be *higher/ lower/ the same*

8. a) Robert and Louisa set up the following circuit.



i) The two resistors above are connected in _____ [1]

ii) A current of 0.5A flows through the circuit. Find the voltage across the 6Ω resistor. [2]

_____

_____

iii) What is the voltage across resistor R? [1]

_____

iv) Calculate the resistance of resistor R. [2]

_____

_____

_____

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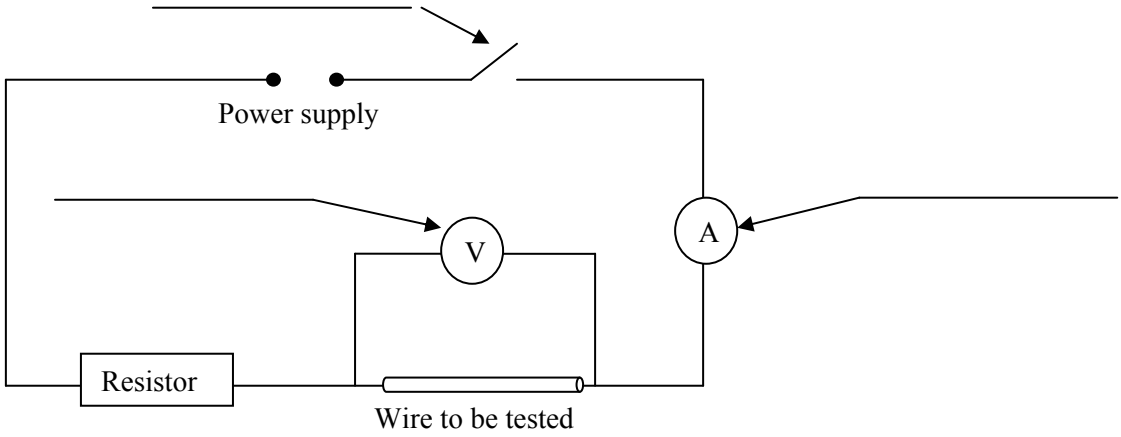
b) Robert opens one of the resistors and finds it is made up of a coil of wire. Louisa [illegible] that if the **wire in a resistor has a <u>larger</u> cross sectional area, it will have a <u>small</u> resistance**. They decide to design an experiment to investigate this. They set up the following circuit:



i) Label the circuit diagram shown above. [3]

ii) Describe an experiment Robert and Louisa may carry out to demonstrate that the **thicker the wire the smaller the resistance**. Besides the above circuit, they also have wires of different thicknesses and a micrometer screw gauge to measure the thickness of the wire. [3]

_____

_____

_____

_____

_____

_____

iii) They plot a graph of _____ against thickness of wire. [1]

iv) Mention one precaution they should take. [1]

_____

v) The conclusion of their experiment is: [1]

Resistance of a wire is inversely _____to its cross sectional area.

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