

SECONDARY SCHOOL 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 $g = 10\text{m/s}^2$.

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	$Q = It$	$W = QV$
	$V = IR$	$R = R_1 + R_2 + R_3$
	$P = IV$	$R \propto \frac{1}{A} \quad R \propto L$
	$E = Pt$	
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

SECTION A: Answer all questions.

1. Fill in the table below:

[8]

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

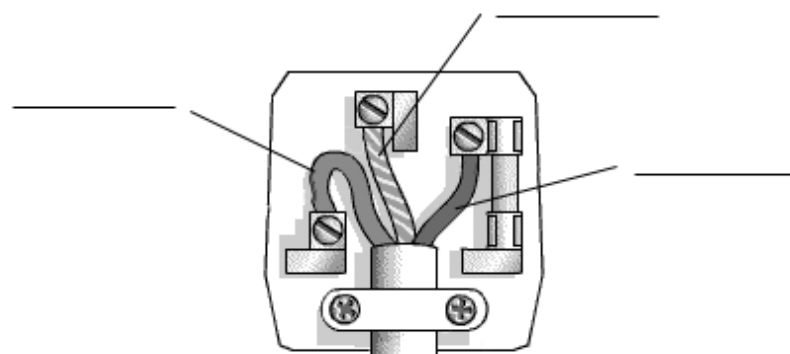
2. A hairdryer has a power rating of 1100W when operating on an a.c. supply of 230V.

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]

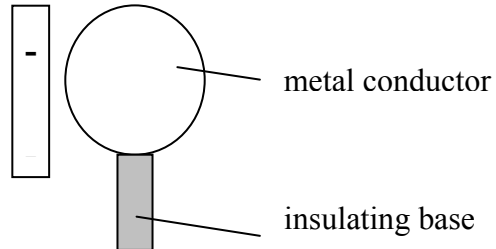


3. A negatively charged rod is shown in the diagram below.

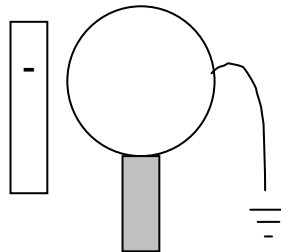


a) Underline the correct word:
The rod is made of *polythene / perspex.* [1]

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



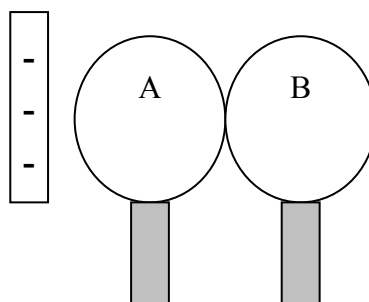
c) The conductor is earthed as shown in the diagram below. State what happens to the charges on the conductor. [1]



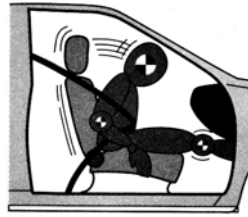
d) The earth connection is removed and then the charged rod is also removed. What is the charge on the conductor now? [1]

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]



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]

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]

SECTION B: Answer all questions.

6 A car moves along a level road.

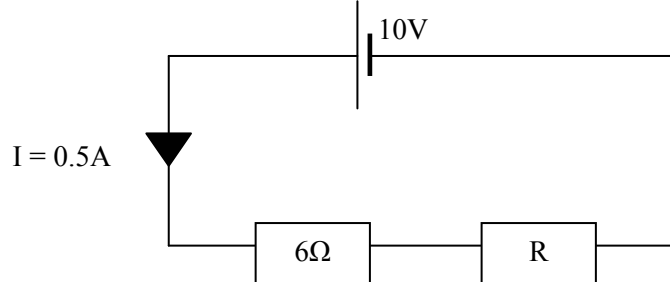


The following table shows the velocity of the car.

Velocity in m/s	Time in s
0	0
5	10
10	20
15	30
20	40
25	50
25	60
25	70
25	80

- a) Plot a graph of velocity in m/s (*y-axis*) against time in s (*x-axis*). [5]
- b) On your graph, label the part where the car moved: [2]
i) with an **acceleration**
ii) with **constant speed**.
- c) From your graph or otherwise find: [2]
i) The initial velocity of the car, $u = \underline{\hspace{2cm}}$ m/s [2]
ii) the maximum (largest) velocity of the car, $v = \underline{\hspace{2cm}}$ m/s [2]
iii) the time the car moved with an acceleration $\underline{\hspace{2cm}}$ s [2]
iv) the acceleration. You may use the formula $a = \frac{v-u}{t}$ [2]

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



[1]

i) The two resistors above are connected in _____

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

[2]

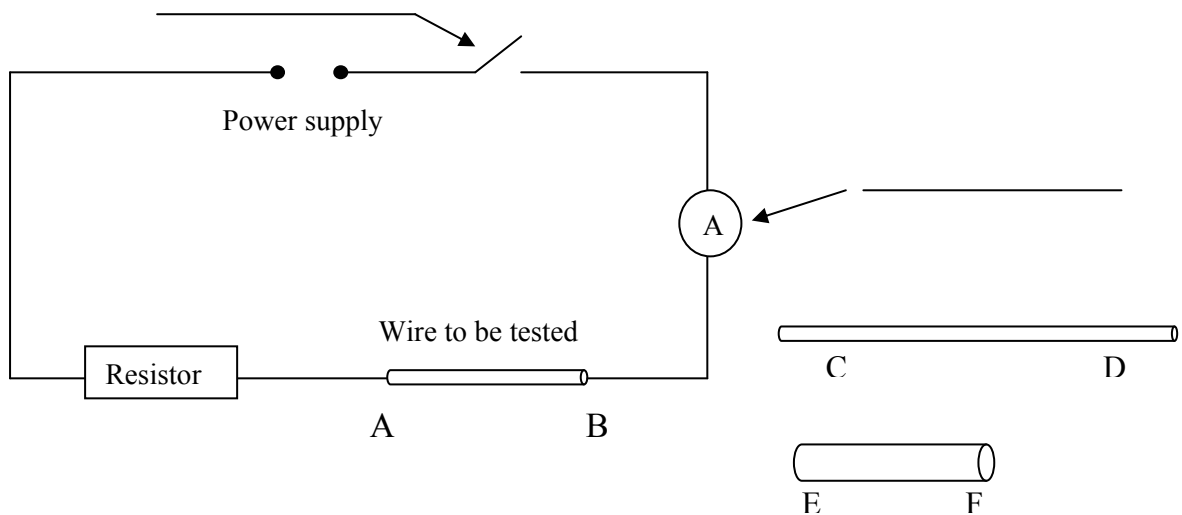
iii) What is the voltage across resistor R?

[2]

iv) Calculate the resistance of resistor R.

[2]

b) Robert and Louisa then set up the following circuit to test the resistance of different wires. A wire is placed across AB and the current is recorded.



i) Label the circuit diagram shown above.

[2]

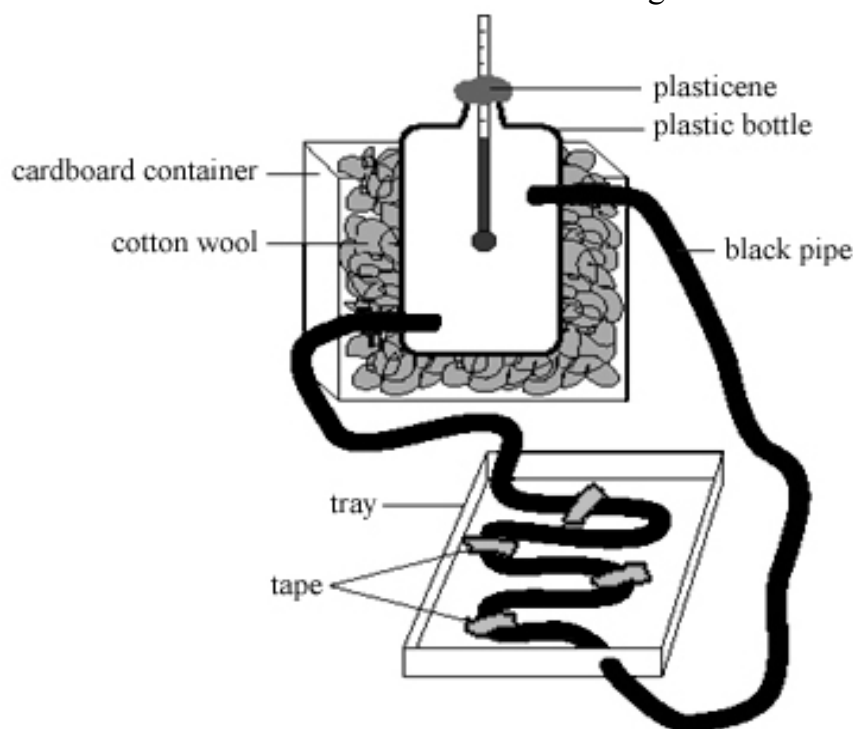
ii) The wire AB is replaced by a longer wire but same thickness CD.

[2]

The reading of the ammeter will _____ since resistance of wire _____ as the length increases.

- iii) The wire CD is removed and a wire EF of the same length as AB but [2]
of a larger thickness is now connected. The reading of the ammeter
will _____ since resistance of wire _____
as the cross sectional area increases.
- iv) The wire is then replaced by a piece of plastic. What happens to the [2]
ammeter reading? Explain.
-

8. 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 builds a
homemade solar water heater as shown in the diagram below.



Underline the correct answer:

- i) The process by which the heat is transferred from the sun **to** the pipe [1]
is called conduction / convection / radiation
- ii) The process by which the heat is transferred **through** the pipe is [1]
called conduction / convection / radiation
- iii) When a hot liquid (less dense) moves up and a colder liquid moves [1]
down to replace it, convection / conduction / radiation takes place.

- iv) Sam places cotton wool between the bottle and the cardboard container as a form of lagging. Cotton wool is a *good / bad* conductor of heat. [1]
- v) The pipe is painted black because black surfaces are better *absorbers / emitters* of heat. [1]
- vi) Sam places a piece of plasticene at the top of the bottle as shown in the diagram. He does this to prevent *heat losses / heat gain*. [1]

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



- i) Calculate the rise in temperature. [2]

- ii) Use the formula, $H = mc\Delta\theta$, to find the quantity of heat energy absorbed by the 10kg of water if the specific heat capacity of water is 4200J/kg °C. [3]

- iii) Underline the correct answer: [2]
 - If the container was made of **plastic** instead of **metal**, the rise in temperature of the water will be *higher / lower/ the same*
 - If a lid is placed on the container, the rise in temperature of the water will be *higher / lower/ the same*
- iv) Before recording the temperature, the water must be stirred. Why is this done? [2]
