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 = 10m/s^2.

You might find the following list of formulae useful:

Motion	v = u + at	$a = \dfrac{v-u}{t}$
	s = ut + ½ at^2	
Momentum	Momentum = mv	
	Force = $\dfrac{\text{Change in Momentum}}{\text{time}}$	Force = $\dfrac{mv - mu}{t}$
Force	F = ma	W = mg
Electricity	Q = It	W = QV
	V = IR	R = R$_1$ + R$_2$ + R$_3$
	P = IV	$R \; \alpha \; \dfrac{1}{A}$ $R \; \alpha \; L$
	E = Pt	
Heat	H = mcΔθ	

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:

Quantity	Symbol	Units
Specific heat capacity		J/kg $^{\circ}$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: [1]
        3A, 5A or 13A? _____

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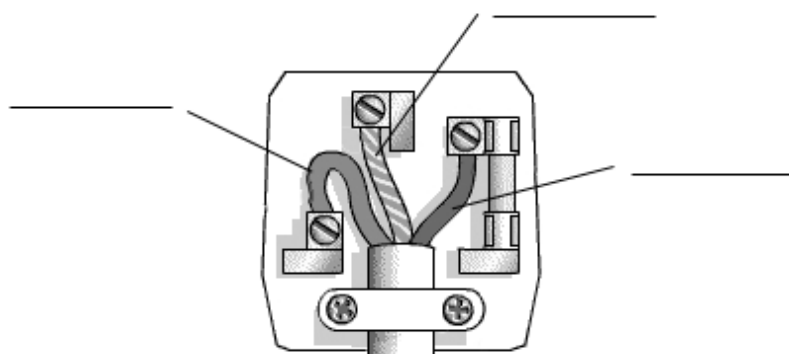
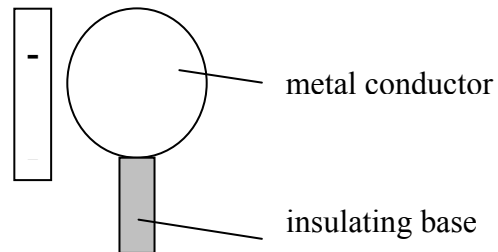3. A negatively charged rod is shown in the diagram below.

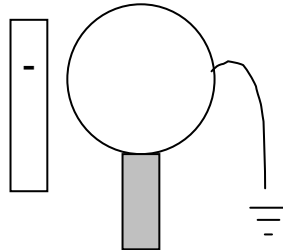$$\boxed{-\quad-\quad-}$$

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]


metal conductor

insulating base

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]

A   B
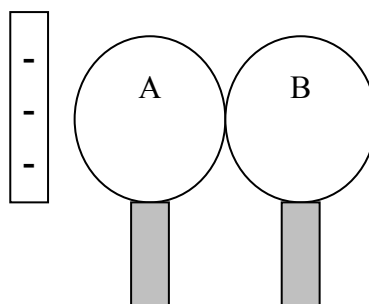
4. a) Even though seatbelts were invented in the late 1800's, they were o... made as a standard feature in some cars in the late 1950's. Today, when... designing a car, some safety tests are made by using a dummy to represent a person driving the car.
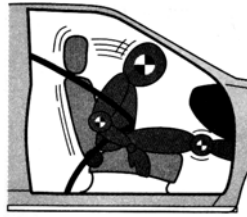
   i) As can be seen in the diagram, the dummy in the car moves forward [1] as the car stops suddenly. Explain in terms of physics principles why this happens.

   _____

   _____

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

   _____

   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 [2] exerted by the seatbelt on the driver.

   _____

   _____

   _____

   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 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   [1]
           happens?

      _____

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:
   i) The initial velocity of the car, u = _____m/s   [2]
   ii) the maximum (largest) velocity of the car, v = _____m/s   [2]
   iii) the <u>time</u> the car moved with an acceleration _____s   [2]
   iv) the acceleration. You may use the formula $a = \dfrac{v-u}{t}$ [2]

_____

_____

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

$$|\ 10V$$

$$I = 0.5A$$

| 6Ω | | R |

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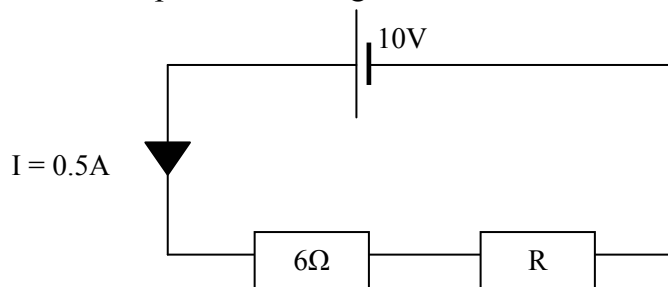
i) The two resistors above are connected in _____

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

_____

_____

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.

Power supply

A

Wire to be tested

Resistor

A   B

C   D

E   F
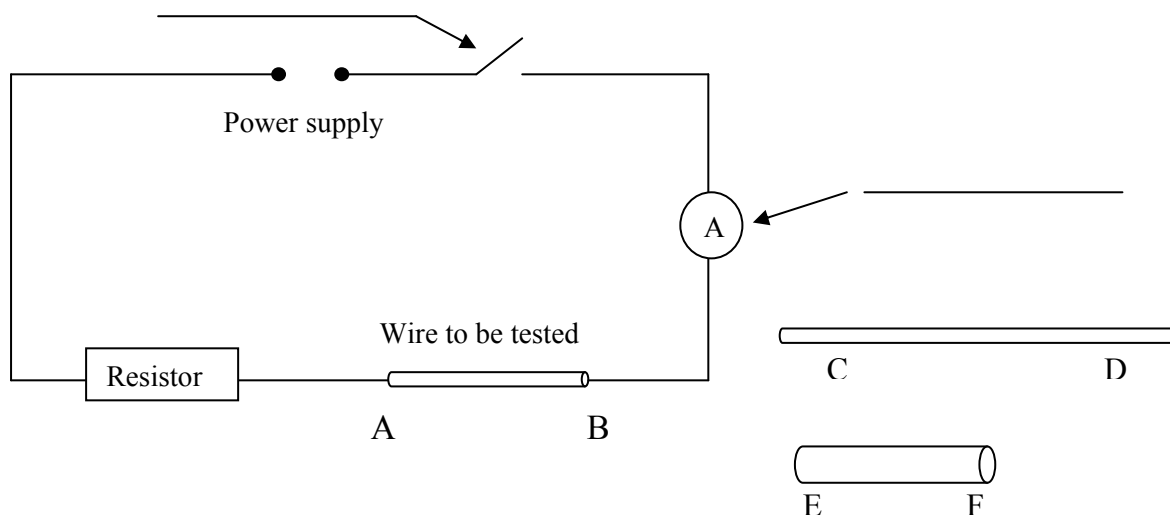
i) Label the circuit diagram shown above. [2]

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 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.
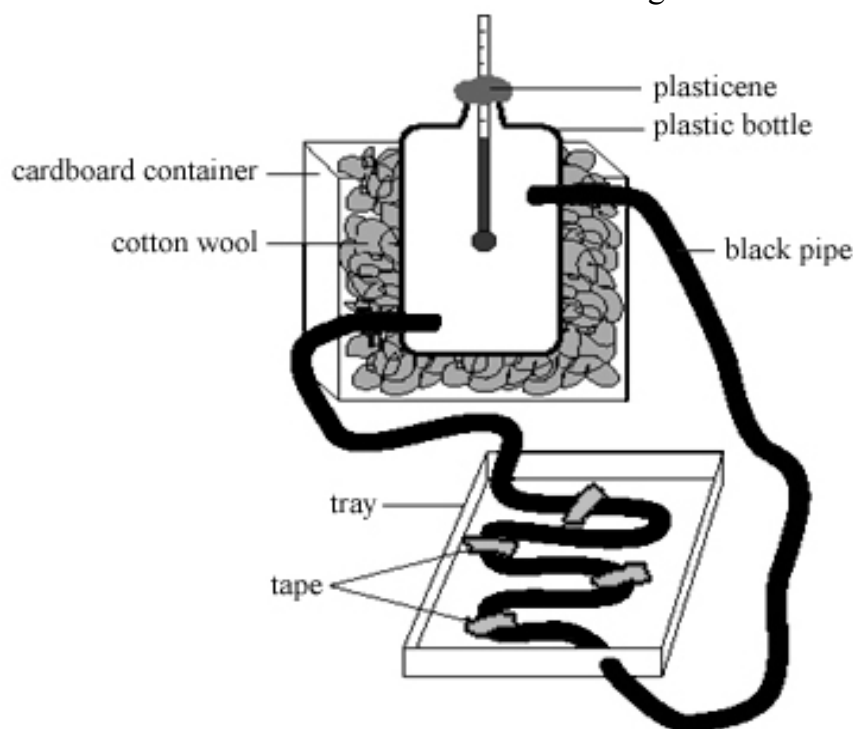
Underline the correct answer:

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, *conduction / convection / radiation* takes place.

iv) Sam places cotton wool between the bottle and the cardb~~oard~~
     container as a form of lagging. Cotton wool is a *good / ba~~d~~*
     conductor of heat.

v)   The pipe is painted black because black surfaces are better   [1]
     absorbers / emitters   of heat.

vi) Sam places a piece of plasticene at the top of the bottle as shown in [1]
     the diagram. He does this to prevent   *heat losses / heat gain*.

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 $20^{\circ}C$ to $50^{\circ}C$.

i)   Calculate the rise in temperature.   [2]

_____

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

_____

_____

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   [2]
     this done?

_____