Harmonized 5th year Physics examination

Candidates should attempt all the questions. Credit will be given for clear explanations, accompanied where appropriate by diagrams. Time allowed, 2 periods.

Points

Section A. Short Questions.

For all the questions which require it, take the value of g as 10 N/kg.

1. A force of 300N acts on a sledge of mass 100kg, which is lying on level ground.

4 points i) What would you expect the acceleration of the sledge to be?

3 points ii) If the sledge starts from rest, how fast will it be travelling after 8 seconds?

3 points iii) And what distance will it cover in 8 seconds?

3 points iv) If the acceleration proved really to be only $2 m.s^{-2}$ this would probably be because of friction. What would the friction force have been?

2. A light bulb is designed to work in a 220V circuit, and is rated at 150W.

3 points i) What current flows through it when it is connected to a 220V supply?

3 points ii) What is the resistance of the bulb?

3 points iii) An American takes this bulb to the United States and connects it to a 110V supply. Would the resistance be different? Give a reason for your answer.

3. A ball of mass 200grammes is dropped from a height of 12m. (g = 10 N/kg)

4 points i) How much Gravitational Potential Energy does it lose as it falls to the ground?

3 points ii) What is its Kinetic Energy just before it hits the ground?

4 points iii) Calculate its velocity just before it hits the ground.

Turn over.....

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4. A computer screen uses a current of 2.3A when connected to a 220V power supply. The computer screen is in an office where all the screens are left on all the time.

4 points i) How many joules of energy does it use in a week?

3 points ii) How many k.Wh is this?

1 point iii) What is the yearly cost of running the screen, if electrical energy costs 5 cents per kW.h?

5. A woman of mass 65 kg is standing in a stationary lift on a set of weighing scales.

3 points i) Sketch the woman and mark in all the forces which act on her, with named arrows.

3 points ii) Calculate the values of these forces if you can.

Now the lift starts to accelerate upwards at 3 $m.s^{-2}$.

4 points iii) Which force(s) have changed? Have they increased or decreased? Give reasons.

3 points iv) Calculate the new value(s) of the forces.

After 1 second the lift stops accelerating, and continues to travel upwards at a steady speed.

3 points v) What is this speed?

3 points vi) What now are the value(s) of the forces, and why?

Go on to section B.

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Points

Section B. Longer Questions.

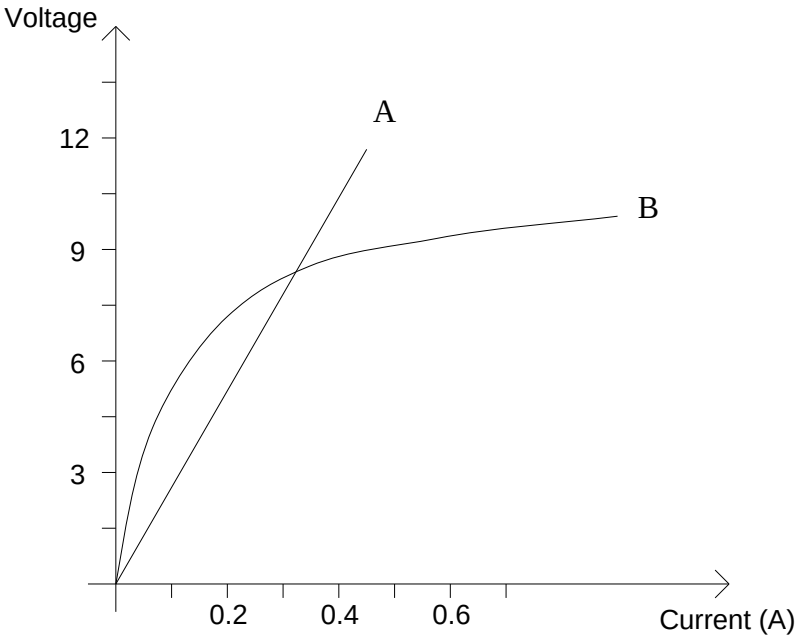
6. The graph below shows the relationship between the voltage and current for two different resistors A and B.

3 points i) Say which of the two is an ohmic resistor and why.

Resistors A and B are connected in parallel to a 5V battery.

3 points ii) Draw a diagram to show this.

1 point iii) On your diagram mark the direction of the conventional current flow.



2 points iv) How much current flows through each resistance?

4 points v) Work out the value of each resistance when it is in this circuit.

2 points vi) What is the total current passing through the battery?

3 points vii) The two resistors are replaced by one resistor having the same equivalent resistance. Calculate its value.

4 points viii) A piece of wire has a radius of 0.25mm, and is 4.5m long. It has a resistance of 10 Ω. Using the resistivities below, say which metal you think the wire is made of.

Resistivities (all × 10^{-8} Ω.m):

Constantan, 50: Manganin 43: Nichrome 105: Duralumin 40.

Turn over.....

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Points

7. A racing driver is driving his car along a straight and level road. The driver pushes the accelerator pedal as far down as possible. As the speed increases the acceleration becomes less, until it is finally zero.

3 points i) Sketch a graph of the car's speed against time

3 points ii) Explain why the acceleration gets less as the speed increases, in terms of the forces acting on the car.

During the race the amount of fuel in the car gets less.

3 points iii) Do you think that the time for a lap will get longer or shorter as a result of this? Explain.

The car has a mass of 1250kg. When the brake pedal is pushed, a braking force of 10,000N is exerted on the car

3 points iv) Calculate the deceleration of the car.

The car is travelling at 48m/s.

3 points v) Calculate its kinetic energy.

3 points vi) Calculate the distance travelled by the car as it brakes to a stop. (Assume that the car does not skid and that the braking force remains constant).