Centre No.						Paper Reference	Surname	Initial(s)
Candidate No.						6 7 3 2 / 0 1	Signature	

Paper Reference(s)

6732/01

Edexcel GCE

Physics

Advanced Subsidiary

Unit Test PHY2

Friday 8 June 2007 – Morning

Time: 1 hour 15 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
Total	

Materials required for examination	Items included with question papers
Nil	Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Answer ALL questions in the spaces provided in this question paper.
In calculations you should show all the steps in your working, giving your answer at each stage.
Calculators may be used.
Include diagrams in your answers where these are helpful.

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets.
There are eight questions in this paper. The total mark for this paper is 60.
The list of data, formulae and relationships is printed at the end of this booklet.

Advice to Candidates

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking account of your use of grammar, punctuation and spelling.

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1. Listed below are five physical quantities.

charge   current   potential difference   resistance   resistivity

Select from this list the quantity that fits each description below. You may use each quantity once, more than once or not at all.

(i) A quantity which can be measured in joules per coulomb.

....

(ii) A quantity which equals the product of two other quantities in the list.

....

(iii) A quantity which equals the rate of change of another quantity in the list.

....

(iv) A base quantity in the SI system.

....

Q1

(Total 4 marks)

N 2 6 1 4 0 A 0 2 1 6

Leave blank

2. (a) A thermistor has a negative temperature coefficient. Explain with reference to the equation $I = nAQv$ what happens to its resistance when its temperature increases.

....

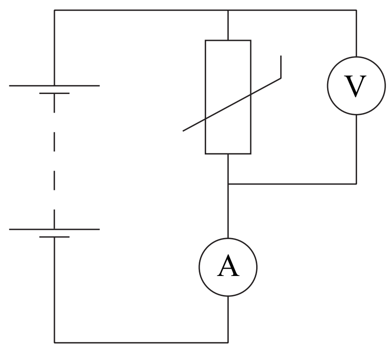
....

....

....

....
(3)

(b) This thermistor is connected as shown in the diagram. Assume the battery has negligible internal resistance.



This circuit can be used as an electrical thermometer to monitor the temperature of a water bath.

(i) State how each meter responds when the temperature of the water is decreased.

Ammeter: ....

Voltmeter: ....
(2)

(ii) Which meter is used to indicate temperature?

....
(1)

(iii) State another assumption that you made.

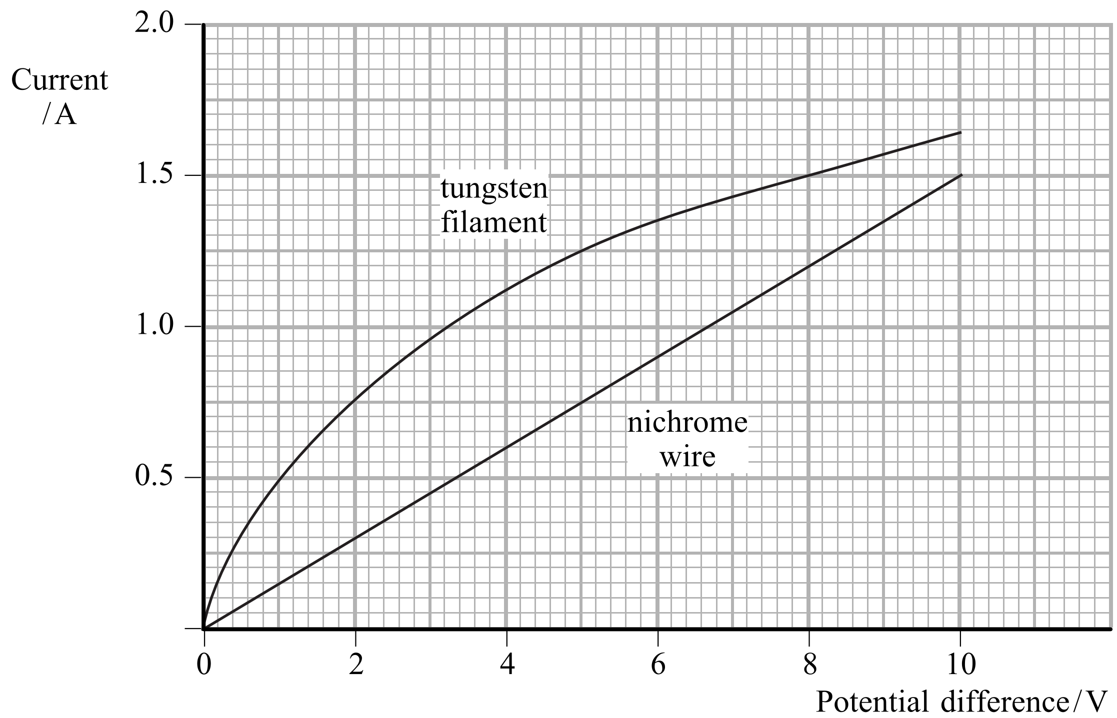
....
(1)

Q2

(Total 7 marks)

Leave blank

3. The graph shows the *I–V* characteristics for two conductors. One is a length of nichrome wire and the other is the tungsten filament of a lamp.



(a) Making reference to Ohm's law, explain the shape of the tungsten filament graph. You may be awarded a mark for the clarity of your answer.

....

....

....

....

....

....

....

....

....

(4)

Leave blank

(b) (i) Calculate the resistance of the tungsten filament when the potential difference across it is 8.0 V.

....

....

....

Resistance = ...

(2)

(ii) Both conductors are connected in parallel with an 8.0 V supply. Calculate the current that will be drawn from the supply.

....

....

....

....

Current = ...

(2)

Q3

(Total 8 marks)

Leave blank

4. A heater used on the rear window of a car consists of five strips of a resistive material joined as shown in the diagram.

When it is in use, the potential difference applied to the heater is 12 V and the heater generates 32 J of energy each second.

(a) (i) Calculate the total resistance of the heater.

....

....

Total resistance = ...

(2)

(ii) Calculate the resistance of a single strip.

....

....

....

Resistance = ...

(2)

(b) Each strip has a cross-sectional area of 4.0×10^{-8} m^2 and is made from a material of resistivity 1.1×10^{-6} Ω m. Calculate the length of each strip.

....

....

....

....

Length = ...

(3)

Leave blank

(c) The car manufacturer wants the rear window heater to be more powerful. Explain how this could be achieved without altering the dimensions of the individual strips or the potential difference across them.

....

....

....

....

....

(2)

Q4

(Total 9 marks)

N 2 6 1 4 0 A 0 7 1 6

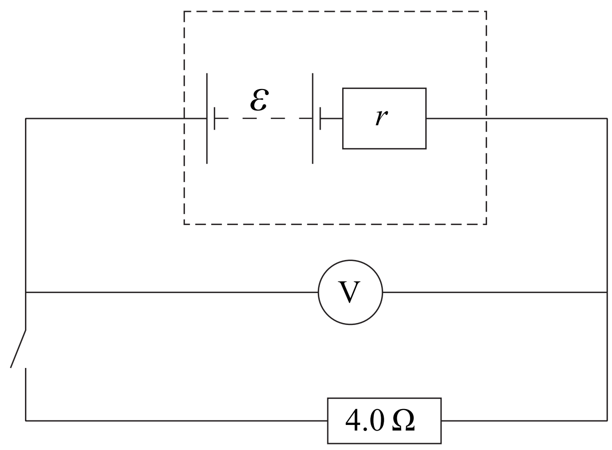
Leave blank

5. (a) Define the e.m.f. of a battery.

....

....
(1)

(b) (i) A battery of e.m.f. $\mathcal{E}$ and internal resistance r is connected into a circuit as shown below.



When the switch is open the voltmeter reads 12.0 V and when the switch is closed it reads 8.0 V. Calculate the current in the circuit when the switch is closed.

....

....

Current = ...
(2)

(ii) Determine the value of r.

....

....

r = ...
(2)

(iii) The switch remains closed. Calculate the power dissipated in the 4.0 Ω resistor.

....

....

Power = ...
(2)

Leave blank

(iv) Calculate the energy wasted in the battery in five minutes.

....

....

....

Energy = ...

(3)

Q5

(Total 10 marks)

Leave blank

6. (a) (i) Define specific heat capacity.

....

....

....

(2)

(ii) Explain the term internal energy.

....

....

....

(2)

(b) A night storage heater contains a stack of bricks which is warmed in the night by electric power and then gives off its energy during the day to the room.

A heater of this type contains bricks of total mass 800 kg. Calculate the energy given out by this heater as it cools from 70 °C to 20 °C.

Specific heat capacity of brick = 1.1×10^{3} J kg^{-1} K^{-1}

....

....

....

....

....

Energy = ...

(3)

Q6

(Total 7 marks)

Leave blank

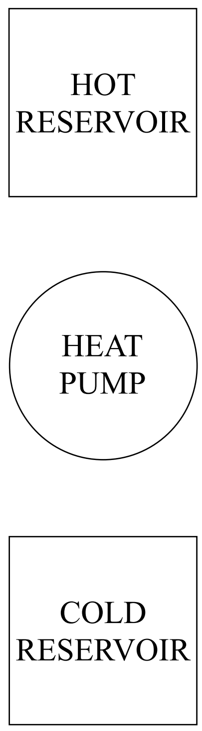
7. (a) What is the function of a heat pump?

....

....

....
(2)

(b) The diagram shows the components of a heat pump.



(i) Add to the diagram an arrow labelled W to represent the mechanical work of the system.
(2)

(ii) A refrigerator is an example of a heat pump. For this example identify the hot reservoir and the cold reservoir.

Hot reservoir: ....

....

Cold reservoir: ....

....
(2)

Q7

(Total 6 marks)

N 2 6 1 4 0 A 0 1 1 1 6

Turn over

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8. (a) A 36 W filament lamp has been switched on for some time. The first law of thermodynamics, represented by the equation $\Delta U = \Delta Q + \Delta W$, may be applied to the lamp. Determine and explain the value of each of the terms in the equation for a period of 60 seconds of the lamp's operation.

(i) ΔU ....

....

....

(2)

(ii) ΔW ....

....

....

(2)

(iii) ΔQ ....

....

....

(2)

(b) Typically a filament lamp has an efficiency of only 4%. Explain what this means and how it is consistent with the law of conservation of energy.

....

....

....

....

....

(3) **Q8**

(Total 9 marks)

TOTAL FOR PAPER: 60 MARKS

END

List of data, formulae and relationships

Data

Speed of light in vacuum	$c = 3.00 \times 10^{8}\ \mathrm{m\ s^{-1}}$	
Acceleration of free fall	$g = 9.81\ \mathrm{m\ s^{-2}}$	(close to the Earth)
Gravitational field strength	$g = 9.81\ \mathrm{N\ kg^{-1}}$	(close to the Earth)
Elementary (proton) charge	$e = 1.60 \times 10^{-19}\ \mathrm{C}$	
Electronic mass	$m_{\mathrm{e}} = 9.11 \times 10^{-31}\ \mathrm{kg}$	
Electronvolt	$1\ \mathrm{eV} = 1.60 \times 10^{-19}\ \mathrm{J}$	
Planck constant	$h = 6.63 \times 10^{-34}\ \mathrm{J\ s}$	
Molar gas constant	$R = 8.31\ \mathrm{J\ K^{-1}\ mol^{-1}}$	

Rectilinear motion

For uniformly accelerated motion:

$$v = u + at$$

$$x = ut + \tfrac{1}{2}at^{2}$$

$$v^{2} = u^{2} + 2ax$$

Forces and moments

Moment of F about O = $F \times$ (Perpendicular distance from F to O)

Sum of clockwise moments about any point in a plane = Sum of anticlockwise moments about that point

Dynamics

Force $$F = m\frac{\Delta v}{\Delta t} = \frac{\Delta p}{\Delta t}$$

Impulse $$F\Delta t = \Delta p$$

Mechanical energy

Power $$P = Fv$$

Radioactive decay and the nuclear atom

Activity $$A = \lambda N$$ (Decay constant λ)

Half-life $$\lambda t_{\frac{1}{2}} = 0.69$$

Electrical current and potential difference

Electric current	$I = nAQv$	
Electric power	$P = I^2R$	

Electrical circuits

Terminal potential difference	$V = \mathcal{E} - Ir$	(E.m.f. $\mathcal{E}$; Internal resistance r)
Circuit e.m.f.	$\Sigma\mathcal{E} = \Sigma IR$	
Resistors in series	$R = R_1 + R_2 + R_3$	
Resistors in parallel	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$	

Heating matter

Change of state:	energy transfer $= l\Delta m$	(Specific latent heat or specific enthalpy change l)
Heating and cooling:	energy transfer $= mc\Delta T$	(Specific heat capacity c; Temperature change ΔT)
Celsius temperature	$\theta/°C = T/K - 273$	

Kinetic theory of matter

	$T \propto$ Average kinetic energy of molecules
Kinetic theory	$p = \frac{1}{3}\rho\langle c^2\rangle$

Conservation of energy

Change of internal energy	$\Delta U = \Delta Q + \Delta W$	(Energy transferred thermally ΔQ; Work done on body ΔW)
Efficiency of energy transfer	$= \frac{\text{Useful output}}{\text{Input}}$	
For a heat engine, maximum efficiency	$= \frac{T_1 - T_2}{T_1}$	

Mathematics

$$\sin(90° - \theta) = \cos\theta$$

Equation of a straight line	$y = mx + c$	
Surface area	cylinder $= 2\pi rh + 2\pi r^2$	
	sphere $= 4\pi r^2$	
Volume	cylinder $= \pi r^2 h$	
	sphere $= \frac{4}{3}\pi r^3$	
For small angles:	$\sin\theta \approx \tan\theta \approx \theta$	(in radians)
	$\cos\theta \approx 1$	

Experimental physics

Percentage uncertainty $= \frac{\text{Estimated uncertainty} \times 100\%}{\text{Average value}}$

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