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 9 June 2006 – 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	
Total	

Materials required for examination
Nil

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials 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 seven 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. (a) (i) Write the word equation that defines potential difference.

....

(1)

(ii) The unit of potential difference is the volt. Express the volt in terms of base units only.

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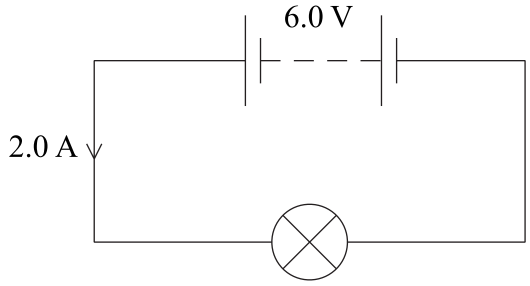
....

(3)

(b) A 6.0 V battery of negligible internal resistance is connected to a filament lamp. The current in the lamp is 2.0 A.



Calculate how much energy is transferred in the filament when the battery is connected for 2.0 minutes.

....

....

....

....

Energy transferred = ...

(3) **Q1**

(Total 7 marks)

N 2 2 3 6 3 A 0 2 1 6

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2. The current I in a conductor of cross-sectional area A is given by the formula

$$I = nAQv$$

where Q is the charge on a charge carrier.

(a) What quantities do n and v represent?

n ....

v ....

(2)

(b) A student has a metal conductor and a plastic insulator of the same dimensions. He applies the same potential difference across each. Explain how the relative values of n for the metal conductor and plastic insulator affect the current in each.

....

....

....

....

(2)

(c) The student connects two pieces of copper wire, A and B, in series with each other and a battery. The diameter of wire A is twice that of wire B. Calculate the ratio of the drift velocity in wire A to the drift velocity in wire B and explain your answer.

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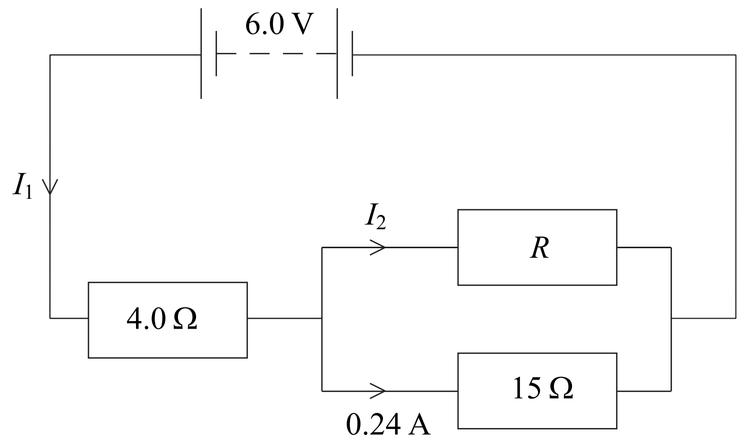
(3)

Q2

(Total 7 marks)

Leave blank

3. The circuit shows a battery of negligible internal resistance connected to three resistors.



(a) Calculate the potential difference across the 15 Ω resistor.

....

Potential difference = ...

(1)

(b) Calculate the current I_1 in the 4.0 Ω resistor.

....

....

....

I_1 = ...

(3)

(c) Calculate the current I_2 and the resistance R.

....

....

....

I_2 = ...

R = ...

(3)

Q3

(Total 7 marks)

N 2 2 3 6 3 A 0 4 1 6

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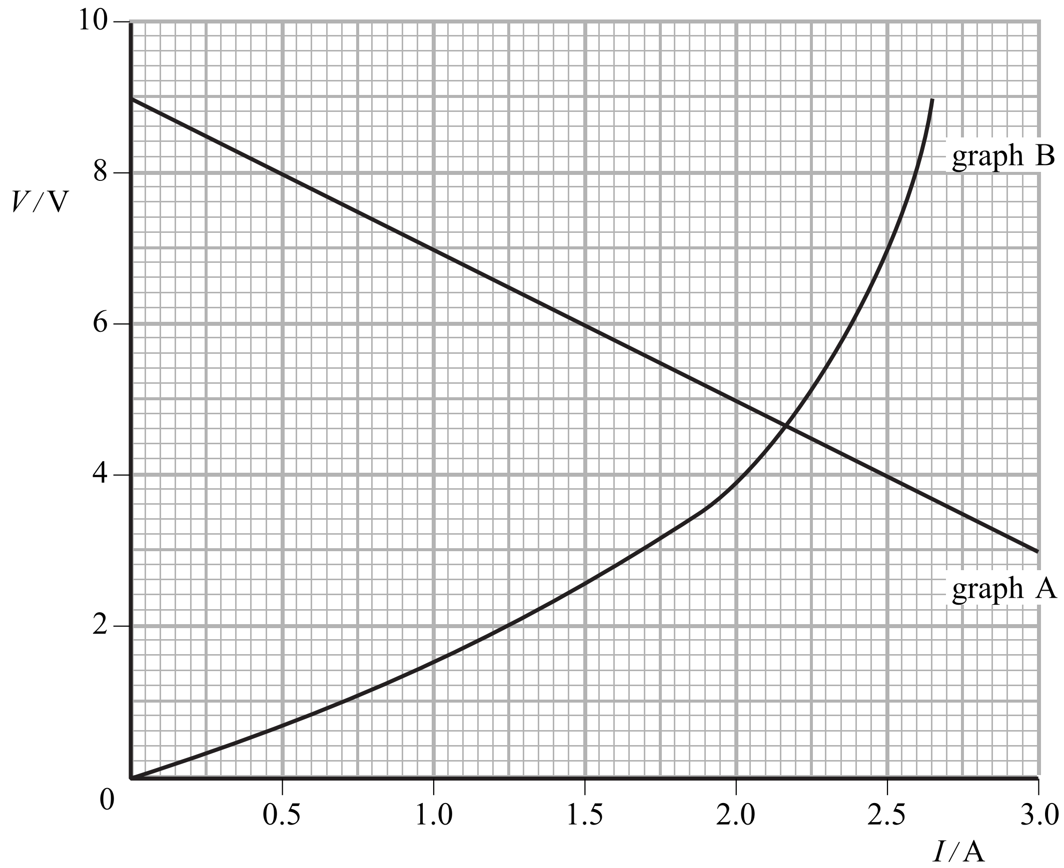
4. Graph A shows how the potential difference across a battery varies with the current supplied. Graph B shows how the current in a filament lamp varies with the p.d. across it.



(a) (i) Use graph A to determine the internal resistance and the e.m.f. of the battery.

....

....

Internal resistance = ...

e.m.f. = ...

(2)

(ii) The lamp is connected to the battery. Determine the current in the lamp.

....

(1)

Leave blank

(iii) Calculate the resistance of the filament lamp when it is connected to the battery.

....

....

....

Resistance = ...

(2)

(b) (i) Draw a diagram of a circuit that would enable graph A to be plotted.

(2)

(ii) Describe how you would use this circuit to obtain the data for the graph.

....

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....

....

(2)

Q4

(Total 9 marks)

N 2 2 3 6 3 A 0 7 1 6

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5. The equation for an ideal gas is

$$pV = nRT$$

(a) For each of these symbols, state the physical quantity and its S.I. unit. One has been done as an example for you.

Symbol	Physical quantity	S.I. unit
p		
V		
n		
R	Molar gas constant	$\mathrm{J\,K^{-1}\,mol^{-1}}$
T		

(4)

(b) An ideal gas of volume $1.0 \times 10^{-4}\,\mathrm{m}^3$ is trapped by a movable piston in a cylinder. The initial temperature of the gas is 20 °C.

The gas is heated and its volume increases by $5.0 \times 10^{-5}\,\mathrm{m}^3$ at a constant pressure. Calculate the new temperature of the gas in °C.

....

....

....

....

....

Temperature of gas = ...°C

(4)

Q5

(Total 8 marks)

Leave blank

6. (a) Define the term **specific latent heat of fusion**.

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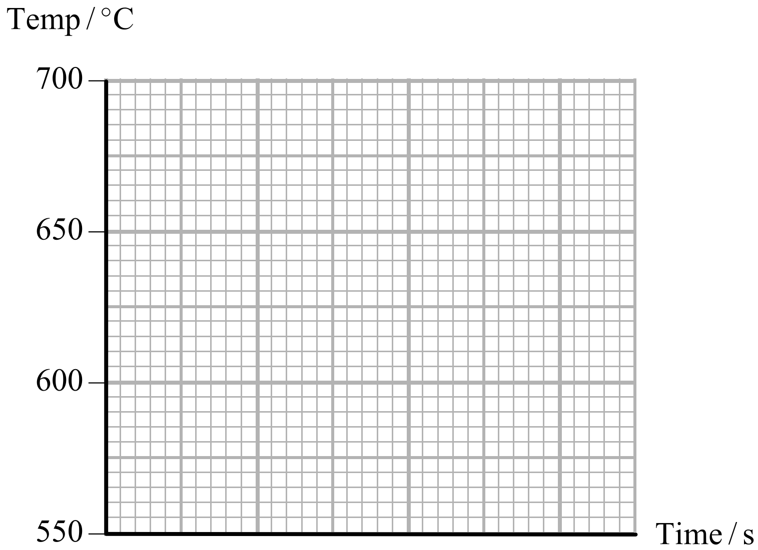
....

(3)

(b) (i) Aluminium has a melting point of 660 °C. A sample of aluminium at 600 °C is heated steadily until its temperature reaches 700 °C. Sketch a graph to show how the temperature of the aluminium varies with time.



(3)

(ii) Explain the shape of your graph with reference to the potential energy and kinetic energy of the molecules.

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(4)

Q6

(Total 10 marks)

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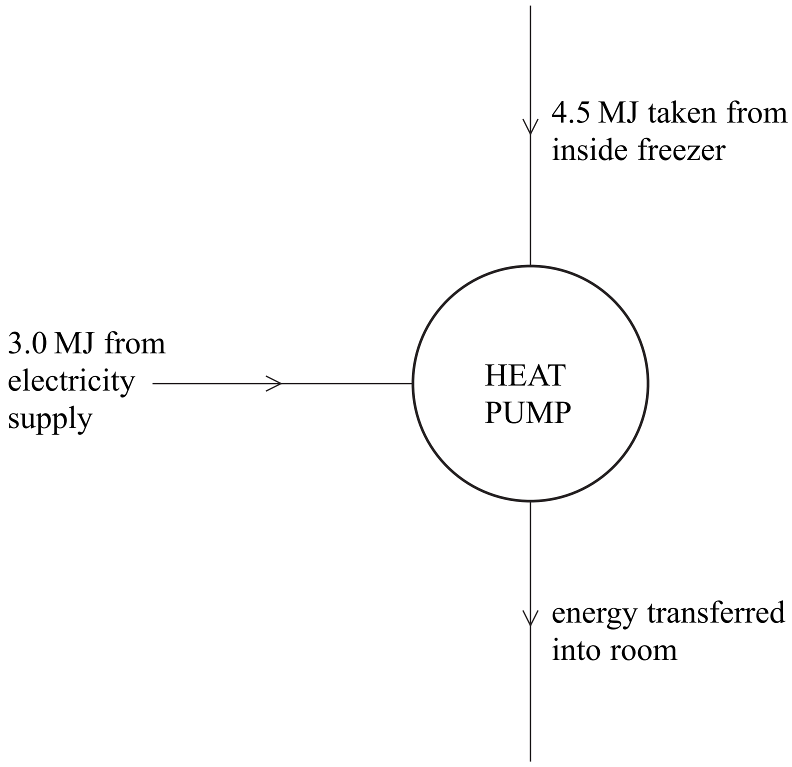
7. A freezer contains a heat pump which pumps energy from the inside of the freezer to the outside. The diagram shows the energy flow for one day of use.



(a) (i) How much energy is transferred into the room?

....

Energy = ...

What principle have you applied to do this calculation?

....

(2)

(ii) Why do you need an energy source to pump energy from the inside of the freezer to the outside?

....

....

(1)

(iii) Assuming the inside of the freezer remains at a constant temperature, calculate the rate at which energy is flowing in through the walls of the freezer.

....

....

Rate of flow of energy = ...

(2)

Leave blank

(b) An ice cube tray is filled with 0.35 kg of water at 20 °C and placed in the freezer. The specific heat capacity of water is 4.2×10^3 J kg^{-1} K^{-1} and the specific latent heat of fusion of water is 3.3×10^5 J kg^{-1}. Calculate the minimum amount of additional energy the heat pump has to pump out of the freezer in order to freeze the water.

....

....

....

....

....

....

Energy = ...

(3)

(c) Inside the freezer there are cooling fins towards the top but not at the bottom. Explain how these fins cool the air in the freezer and why there are no fins at the bottom. You may be awarded a mark for the clarity of your answer.

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(4) **Q7**

(Total 12 marks)

TOTAL FOR PAPER: 60 MARKS

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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	$m_e = 9.11 \times 10^{-31}\ \mathrm{kg}$	
Electronvolt	$1\ \mathrm{eV} = 1.60 \times 10^{-19}\ \mathrm{J}$	
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 $\lambda t_{\frac{1}{2}} = 0.69$

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Electrical current and potential difference

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

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	$\theta/°\mathrm{C} = T/\mathrm{K} - 273$	

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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