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

Thursday 15 January 2009 – Afternoon

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, 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 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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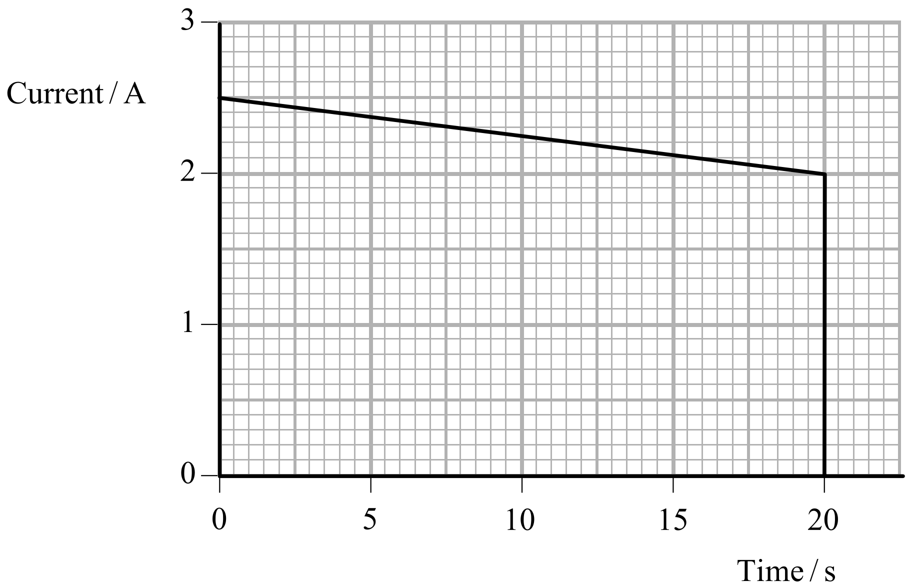
1. A wire for use as a fuse was connected to a source of constant e.m.f. until the wire melted. The following graph of current I against time t was obtained. The circuit was switched on at $t = 0$ s.



(a) Explain why the current decreased during the test before the wire melted.

....

....
(2)

(b) Determine the total charge that flowed during the test.

....

....

....

....

Total charge = ...
(3)

(Total 5 marks)

Q1

N 3 0 6 1 6 A 0 3 1 6

Turn over

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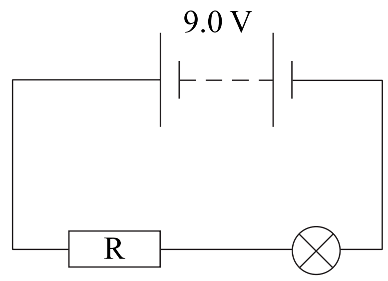
2. (a) A lamp rated at 3.0 V, 0.25 A is connected to a 9.0 V supply of negligible internal resistance with a resistor R so that the lamp works normally.



(i) Calculate the resistance of the lamp when it is working normally.

....

....

Resistance = ...
(2)

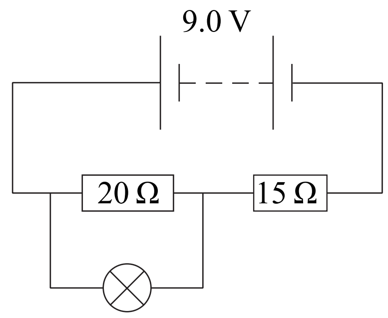
(ii) Calculate the resistance of R.

....

....

Resistance of R = ...
(2)

(b) The lamp is now connected into a different circuit as shown below. The power supply is the same as before. The lamp is still working normally.



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(i) Calculate the total resistance of this circuit.

....

....

....

....

....

Total resistance = ...

(3)

(ii) Explain which circuit dissipates the lower total power.

....

....

....

....

....

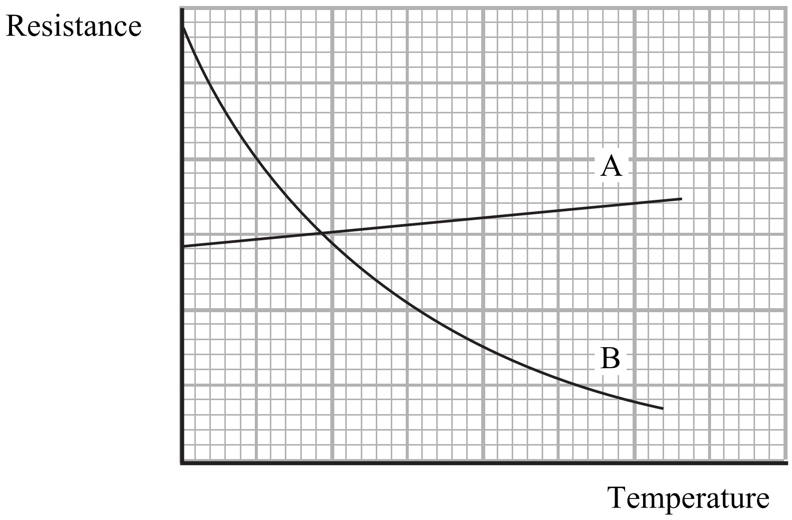
(3)

Q2

(Total 10 marks)

Leave blank

3. The graph shows how the resistance of two components **A** and **B** varies with temperature.



(a) Identify the components.

A ....

B ....

(2)

(b) Explain, with reference to charge carriers and drift velocity, why the resistance of component **A** increases as the temperature increases, while the resistance of component **B** decreases as the temperature increases. You may be awarded a mark for the clarity of your answer.

....

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....

....

....

....

....

....

(5) **Q3**

(Total 7 marks)

Leave blank

4. (a) (i) Draw a labelled diagram of the apparatus you would use to show how the pressure of a gas depends on its volume.

(3)

(ii) For the results to be valid two variables must be kept constant. State what they are and how they are kept constant in your experiment.

Variable 1 ....

....

....

Variable 2 ....

....

....

(4)

(b) The results of such an experiment indicate that the pressure of the gas is inversely proportional to its volume.

(i) State what you would plot on the axes of a graph in order to obtain a straight line from these results.

....

(1)

(ii) What other feature of the straight-line graph is necessary in order to demonstrate the relationship?

....

(1)

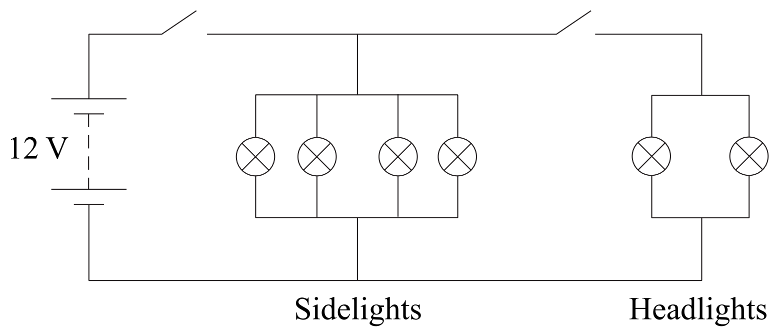
Q4

(Total 9 marks)

Leave blank

5. One of the functions of the 12 V battery in a car is to provide the energy for the car's sidelights and headlights.

(a) The diagram shows the battery connections for four sidelights and two headlights.



(i) Each sidelight is rated at 12 V, 6.0 W. Assuming the internal resistance of the battery is negligible, calculate the current in the battery when just the four sidelights are lit.

....

....

....

Current = ...

(2)

(ii) The power of each headlight is 48 W. Calculate the combined resistance of the headlights.

....

....

....

....

....

....

Combined resistance = ...

(3)

N 3 0 6 1 6 A 0 8 1 6

Leave blank

(b) The internal resistance of a car battery is not negligible but is designed to be as small as possible. Why is it necessary for the internal resistance of a car battery to be as small as possible?

....

....

....

....

....

(2)

Q5

(Total 7 marks)

Leave blank

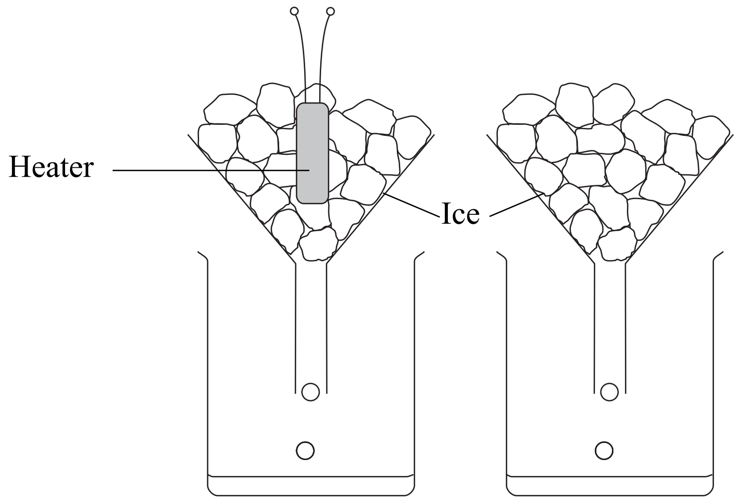
6. (a) Define the term specific latent heat of fusion.

....

....

....
(3)

(b) A student decides to measure the specific latent heat of fusion of water by using two funnels filled with crushed ice. A heater which is not turned on has been put into one of the funnels.



(i) In the space below draw a labelled diagram of the electric circuit needed for the heater.

(2)

(ii) What other two pieces of apparatus are needed, apart from the electrical components?

1 ....

2 ....
(2)

Leave blank

(iii) The heater is not turned on immediately. Suggest a reason.

....

....
(1)

(iv) Describe the readings that are taken and explain how the specific latent heat of fusion of ice is calculated.

....

....

....

....

....

....

....

....

....
(4)

Q6

(Total 12 marks)

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7. (a) The first law of thermodynamics can be expressed as

$$\Delta U = \Delta Q + \Delta W$$

(i) State the meanings for the positive values of each of the symbols in this equation.

ΔU ....

ΔQ ....

ΔW ....

(3)

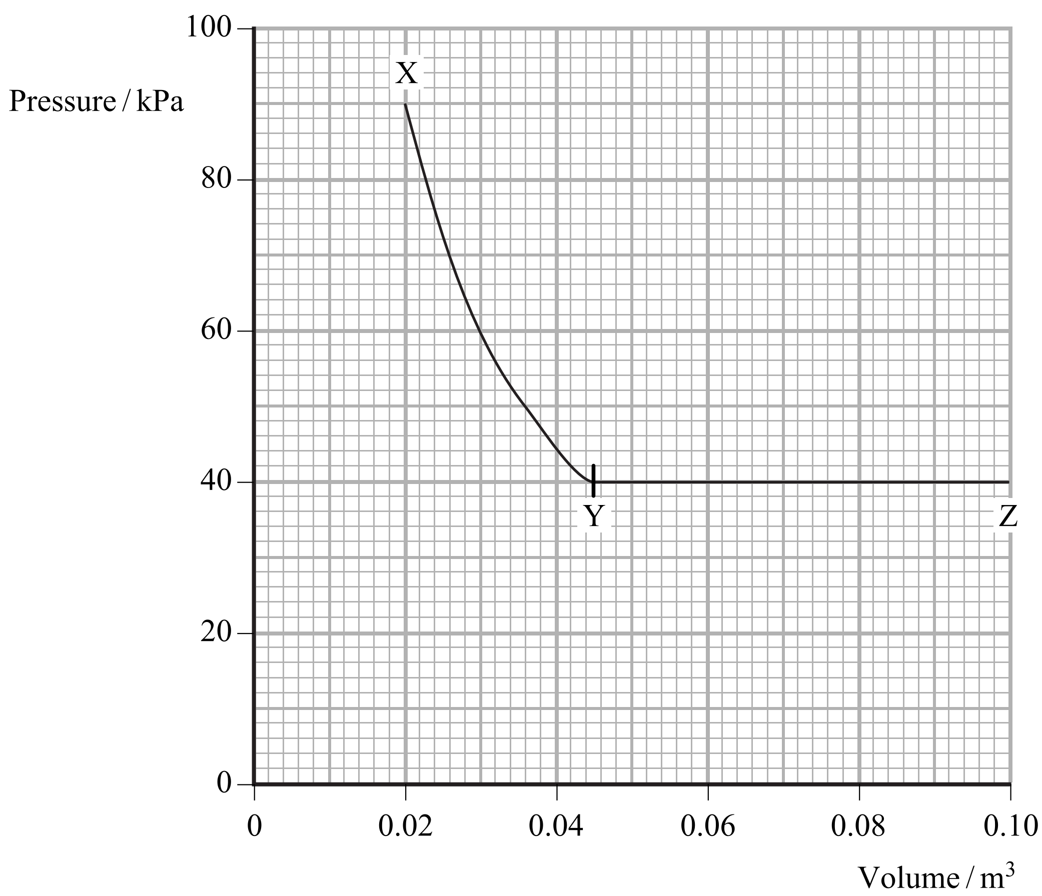
(ii) When a gas undergoes an isothermal change its temperature remains constant and $\Delta U = 0$.
State the effect that this will have on ΔQ and ΔW.

....

....

(1)

(b) The graph shows an ideal gas undergoing two changes. Initially the gas is at **X**. It undergoes an isothermal expansion to **Y** and then it expands at constant pressure to **Z**.



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(i) The amount of gas used is 0.73 mol. Show that the temperature of the gas during the isothermal change from **X** to **Y** is approximately 300 K.

....

....

....

....

....

(3)

(ii) Calculate the temperature of the gas at **Z** after its expansion at constant pressure.

....

....

....

....

....

Temperature = ...

(3)

Q7

(Total 10 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	$m_e = 9.11 \times 10^{-31}\ \mathrm{kg}$	
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 $\quad F = m\dfrac{\Delta v}{\Delta t} = \dfrac{\Delta p}{\Delta t}$

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

Mechanical energy

Power $\quad P = Fv$

Radioactive decay and the nuclear atom

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

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

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

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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