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 21 May 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	
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. (a) The resistance of an ideal ammeter is zero. Explain, with reference to how it is connected in a circuit, why an ammeter should have this value of resistance.

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(2)

(b) The resistance of an ideal voltmeter is infinite. Explain, with reference to how it is connected in a circuit, why a voltmeter should have this value of resistance.

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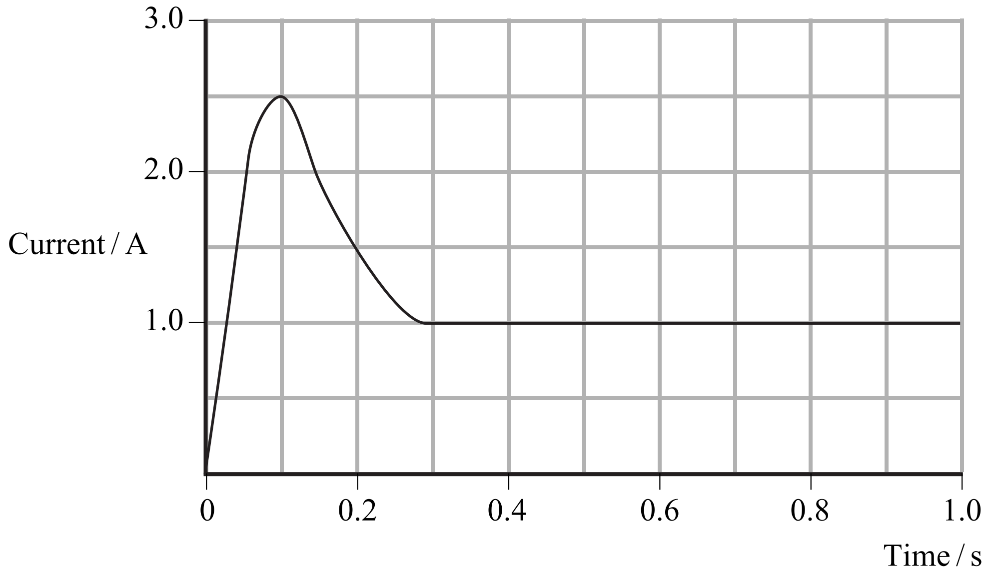
(2)

Q1

(Total 4 marks)

2. The graph shows how the current in a 6 V filament lamp varies during the first second after it has been switched on.



(a) Explain the shape of the graph. You may be awarded a mark for the clarity of your answer.

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(4)

(b) Suggest why the filament is most likely to break when the lamp is first switched on.

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(1)

(c) A student wishes to carry out an experiment to verify these results. Give a reason why using a sensor and datalogger is a sensible option and suggest a suitable sampling rate.

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(2) **Q2**

(Total 7 marks)

Leave blank

3. Electric cars have a limited distance (range) that they can travel before their batteries have to be recharged.

A typical electric car uses a combination of 12 V batteries to give a total e.m.f. of 48 V. These supply a current to an electric motor.

(a) (i) When the car is travelling at a steady speed in a built-up area, the power supplied to the motor is 2.5 kW. Calculate the current in the motor.

....

....

....

Current = ...

(2)

(ii) The batteries can supply this current for 3 hours. Calculate how much charge passes through the motor in this time.

....

....

....

Charge = ...

(2)

(iii) Calculate the energy that would be delivered to the motor in this 3 hour period.

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....

....

Energy = ...

(2)

Leave blank

(b) An advert for a petrol car states that a petrol car of the same mass as the electric car can accelerate from 0 to 60 miles per hour in 10 s. During this acceleration the car gains a kinetic energy of 300 kJ.

(i) The electric car has a maximum power output of 4.0 kW. Explain why the acceleration of the petrol car is not possible for the electric car.

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(ii) Explain the effect that frequent accelerations would have on the range of the electric car.

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(3)

Q3

(Total 9 marks)

N 3 1 1 3 1 A 0 5 2 0

Turn over

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4. A student is asked to measure the resistivity of the material of a resistance wire. The following apparatus is available:

- the resistance wire
- a battery
- a variable resistor
- an ammeter
- a voltmeter
- connecting wires.

(a) Draw a circuit diagram to show how the student should use this apparatus.

(2)

(b) List all the measurements the student should take, stating any other apparatus that would be needed.

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(3)

Leave blank

(c) Explain how the student should use these measurements to find the resistivity. You should include any precautions that the student should take to ensure an accurate result.

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(5)

Q4

(Total 10 marks)

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5. (a) The current I in a conductor is given by the formula

$$I = n\,A\,Q\,v$$

where A is the cross-sectional area of the conductor and v is the drift velocity of the charge carriers.

Define the symbols n and Q.

n ....

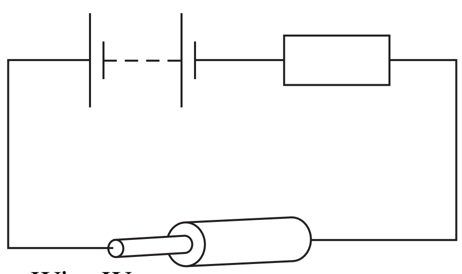
....

Q ....

....

(2)

(b) Two pieces of thick copper wire, W and Z, are joined end-to-end and connected in series to a battery and resistor. The cross-sectional area of W is half that of Z.



In the table fill in the value of each ratio and give an explanation for your answer.

Ratio	**Value**	**Explanation**
$\frac{n_W}{n_Z}$		
$\frac{I_W}{I_Z}$		
$\frac{v_W}{v_Z}$		

(3) **Q5**

(Total 5 marks)

N 3 1 1 3 1 A 0 9 2 0

Turn over

Leave blank

6. (a) (i) State what is meant by the absolute zero of temperature.

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....

(ii) State the unit of the absolute temperature scale.

....

(2)

(b) A quantity of air is contained in a gas-tight syringe. The piston is fixed so that the volume of air remains constant at 100 cm^3. When the air is at a temperature of 0 °C its pressure is 1.00×10^5 Pa. The apparatus is now heated to 100 °C.

(i) Calculate the pressure of the air at 100 °C.

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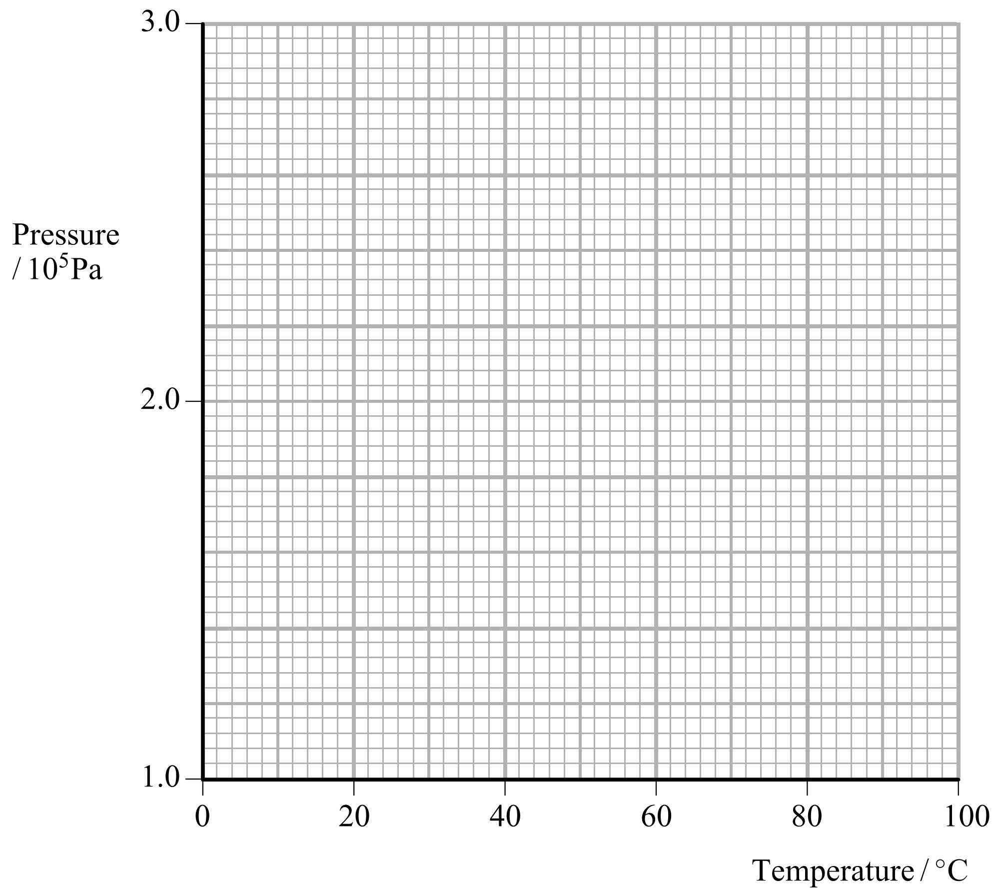
Pressure = ...

(3)

Leave blank

(ii) On the axes below draw a graph to show how the pressure of the air varies with temperature over the range 0 °C to 100 °C. Label your graph A.



(2)

(iii) The piston is pushed in and fixed in a position where the volume is 50 cm^3. On the same axes draw a second graph to show how the pressure of the air would vary over the same temperature range. Label this graph B.

(2) **Q6**

(Total 9 marks)

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N 3 1 1 3 1 A 0 1 2 2 0

Leave blank

7. (a) The ideal gas equation is

$$pV = nRT$$

Show that the product pV has the same unit as the unit of energy.

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(2)

(b) Explain, in terms of the kinetic model of an ideal gas, how the molecules of a gas exert a pressure.

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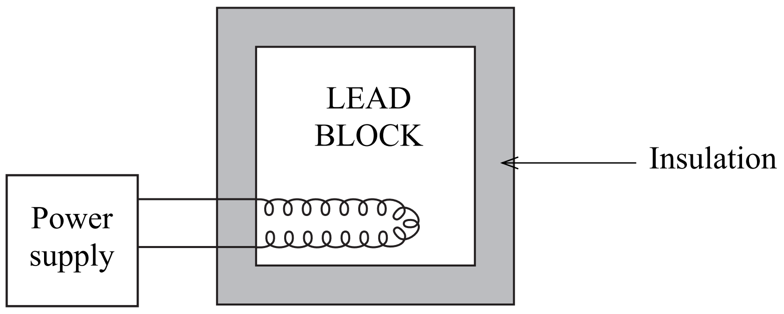
(4)

Q7

(Total 6 marks)

Leave blank

8. A student connects a power supply to a heating coil embedded in a block of lead that is thermally insulated from its surroundings.



(a) A potential difference of 0.50 V drives a current of 21 A through the heating coil for 30 s. Show that the energy supplied is about 300 J.

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(2)

(b) The temperature of the block increases by 4.9 K. The mass of the block is 500 g. Calculate the specific heat capacity of lead.

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Specific heat capacity = ...

(2)

N 3 1 1 3 1 A 0 1 4 2 0

Leave blank

(c) The equation $\Delta U = \Delta Q + \Delta W$ can be applied to the block during this process. State and explain the value of each of the terms in the equation at the end of the 30 s for which the block was heated.

(i) ΔW

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(2)

(ii) ΔQ

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....
(2)

(iii) ΔU

....

....

....
(2)

Q8

(Total 10 marks)

TOTAL FOR PAPER: 60 MARKS

END

List of data, formulae and relationships

Data

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

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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