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

Tuesday 17 January 2006 – 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, 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.

Printer's Log. No.
N18403A
W850/R6732/57570 7/8/8/5/4/9700

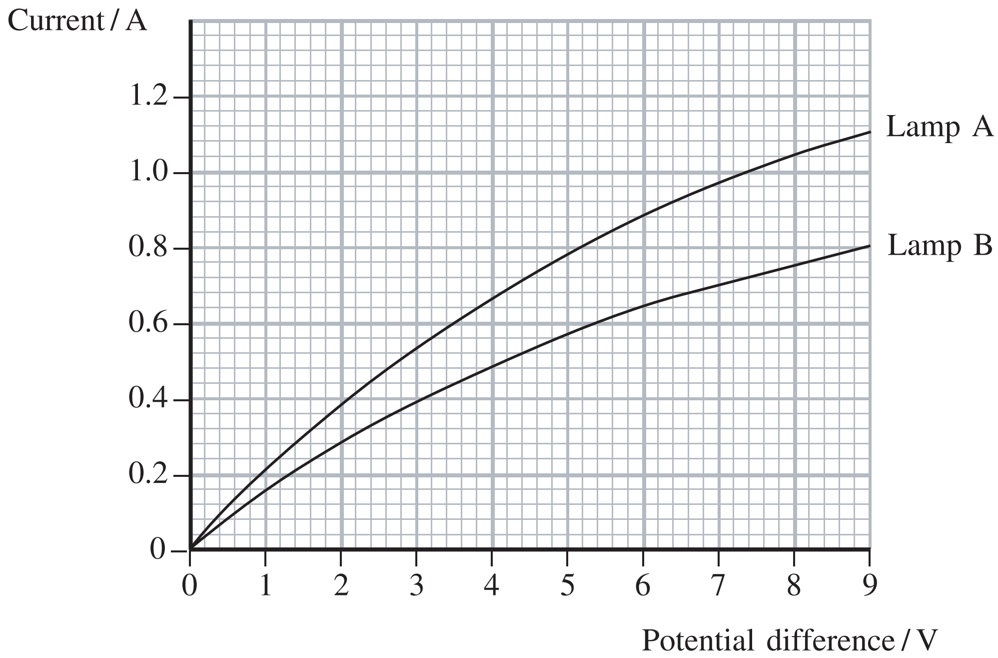
N18403A0116

Turn over

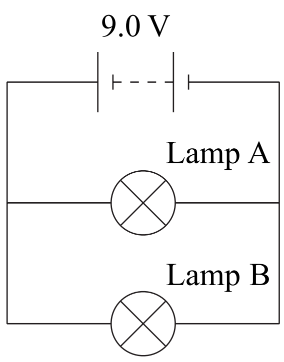
edexcel

Leave blank

1. Two filament lamps are designed to work from a 9.0 V supply but they have different characteristics. The graph shows the current–potential difference relationship for each lamp.



(a) The lamps are connected in parallel with a 9.0 V supply as shown.



(i) Which lamp is brighter? Give a reason for your answer.

....

....

(2)

(ii) Determine the current in the supply.

....

....

Current = ...

(2)

Leave blank

(iii) Calculate the total resistance of the two lamps when they are connected in parallel.

....

....

....

....

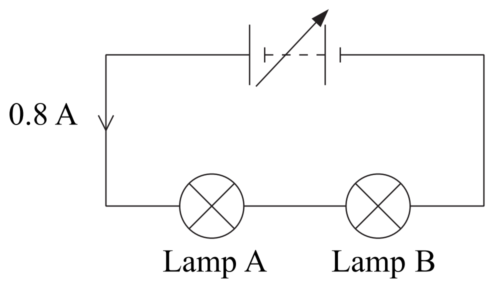
....

....

Total resistance = ...

(2)

(b) The lamps are now connected in **series** to a variable supply which is adjusted until the current is 0.8 A.



Compare and comment on the brightness of the lamps in this circuit.

....

....

....

....

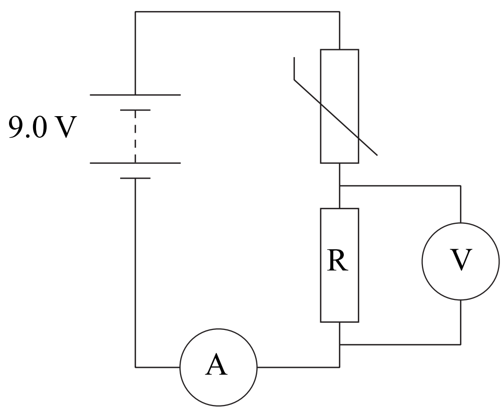
(3)

Q1

(Total 9 marks)

Leave blank

2. A student connects a 9.0 V battery in series with a resistor R, a thermistor and a milliammeter. He connects a voltmeter in parallel with the resistor. The reading on the voltmeter is 2.8 V and the reading on the milliammeter is 0.74 mA.



(a) (i) Show that the resistance of R is approximately 4000 Ω.

....

....
(2)

(ii) Calculate the resistance of the thermistor.

....

....

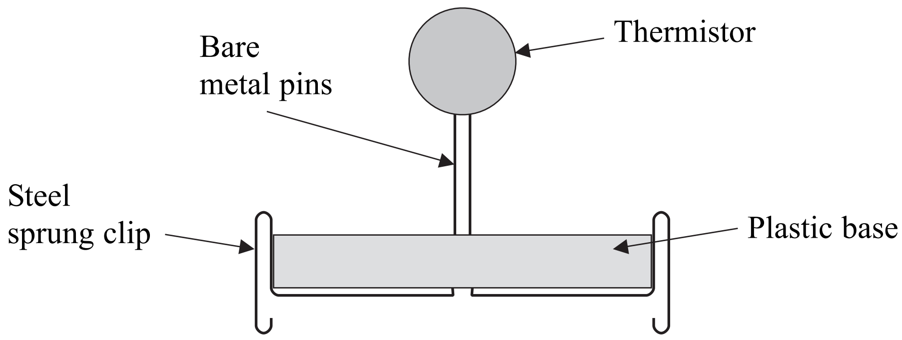
....

Resistance = ...
(2)

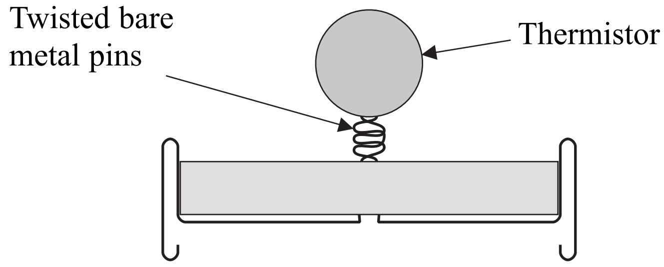
N 1 8 4 0 3 A 0 4 1 6

Leave blank

(b) The thermistor is mounted on a plastic base that has steel sprung clips for secure connection in a circuit board.



Another student is using an identical circuit except that the bare metal pins of his thermistor are twisted together.



Suggest an explanation for how the reading on this student's milliammeter will compare with that of the first student.

....

....

....

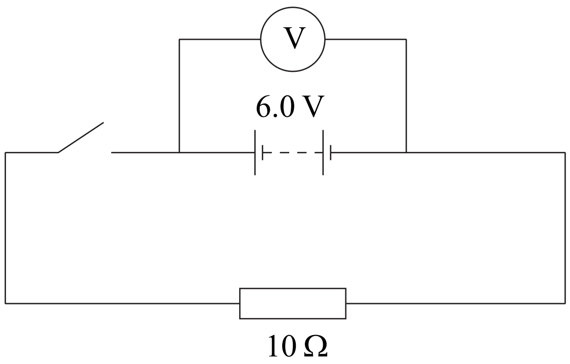
(3)

(Total 7 marks)

Q2

Leave blank

3. A battery of e.m.f. 6.0 V is connected to a 10 Ω resistor as shown in the circuit diagram.



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

....

....

....
(2)

(b) When the switch is open the voltmeter reading is 6.0 V. The internal resistance of the battery is 0.40 Ω. Calculate the reading on the voltmeter when the switch is closed.

....

....

....

....

Voltmeter reading = ...
(3)

(c) A second identical battery is connected in parallel with the first one. Describe and explain qualitatively what would happen to the voltmeter reading if the switch remains closed.

....

....

....

....

....
(3) **Q3**

(Total 8 marks)

Leave blank

4. (a) A student thinks that the formula for the current I in a conductor of length l is

$$I = \frac{\pi Q v}{l}$$

where Q is the charge on each charge carrier and v is their average drift velocity. Show whether or not the equation is homogeneous with respect to units.

....

....

....

(2)

(b) Suggest why an equation which is homogeneous with respect to units may **not** be correct.

....

....

(1)

(c) Another equation for the current I is given by the formula

$$I = nAQv$$

where A is the cross-sectional area of the conductor.

In this equation what is the unit of n?

....

(1)

Q4

(Total 4 marks)

Leave blank

5. (a) Draw a labelled diagram of the apparatus you would use to verify that the pressure exerted by a fixed mass of gas at constant volume is directly proportional to its kelvin temperature.

(4)

(b) State the readings you would take. Explain how you would use your measurements to verify this relationship between pressure and temperature. You may be awarded a mark for the clarity of your answer.

....

....

....

....

....

....

....

....

....

....

(5)

(c) State one precaution that you would take in order to ensure accurate results.

....

(1)

Q5

(Total 10 marks)

BLANK PAGE

Leave blank

6. The first law of thermodynamics is represented by the equation $\Delta U = \Delta Q + \Delta W$.

(a) (i) Explain in molecular terms what is meant by the internal energy U of a body.

....

....

....

(2)

(ii) Energy is transferred to a lead block by repeatedly striking it with a hammer. The head of the hammer has a mass of 0.32 kg and it strikes the block with a speed of $13\ \mathrm{m\ s^{-1}}$. Show that the kinetic energy of the head of the hammer is approximately 30 J.

....

....

(2)

(iii) The lead block has a mass of 0.18 kg. It is struck 10 times. Determine the maximum temperature rise of the block. The specific heat capacity of lead is $130\ \mathrm{J\ kg^{-1}\ K^{-1}}$.

....

....

....

....

Temperature rise = ...

(3)

Leave blank

(b) Complete the following table to show how the quantities involved in the first law of thermodynamics change, or otherwise, in the case of the hammered lead block.

Symbol	Energy change	+, – or 0
ΔU	Change in internal energy of the lead	+
ΔQ		
ΔW		

(4)

Q6

(Total 11 marks)

Leave blank

7. (a) (i) The kinetic model of an ideal gas is based on a number of assumptions. State three of them.

1 ....

....

2 ....

....

3 ....

....

(3)

(ii) An ideal gas sample of volume V contains N molecules, each of mass m. Write down an expression for the density ρ of the gas.

....

....

(1)

(iii) The mean square speed of the molecules is $\langle c^2 \rangle$. Write an expression for the average kinetic energy E of a molecule.

....

(1)

Leave blank

(b) The average kinetic energy of a molecule is directly proportional to the kelvin temperature T, i.e. $E = \text{constant} \times T$. The pressure p of an ideal gas is given by the equation

$$p = \frac{1}{3}\rho\langle c^2\rangle$$

Use this information to show that p is directly proportional to T for a fixed mass of gas at constant volume.

....

....

....

....

....

....

(3)

(c) An aerosol can contains a propellant gas at a pressure of three times atmospheric pressure at a temperature of 20 °C. The aerosol can is able to withstand a maximum pressure of seven times atmospheric pressure. Calculate the temperature at which the can will explode.

....

....

....

....

Temperature = ...

(3)

Q7

(Total 11 marks)

TOTAL FOR PAPER: 60 MARKS

END

N 1 8 4 0 3 A 0 1 3 1 6

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	$1 \text{ eV} = 1.60 \times 10^{-19} \text{ J}$	
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 $F = m\dfrac{\Delta v}{\Delta t} = \dfrac{\Delta p}{\Delta t}$

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

Temperature and energy $T \propto$ 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 $= \frac{\text{Useful output}}{\text{Input}}$

Heat engine maximum efficiency $= \frac{T_1 - T_2}{T_1}$

Experimental physics

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

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)

$\cos\theta \approx 1$

BLANK PAGE