Centre No.					
Candidate No.					

Paper Reference

6 7 3 3 / 2 C

Surname	Other names
Signature	

Edexcel GCE

For Examiner's use only

For Team Leader's use only

Question numbers	Leave blank
A	
B	
Total	

Physics

Advanced Subsidiary

Unit Test PHY3 Practical Test (International)

May 2009

Time: 1 hour 30 minutes

Supervisor's Data and Comments			
A	a	Tick if circuit set up for candidate (Give details below)	
	b	Thickness *t* to 0.001 mm	
Comments			

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, other names and signature.

PHY3 consists of questions A and B. Each question is allowed 35 minutes plus 5 minutes writing-up time. There is a further 10 minutes for writing-up at the end. The Supervisor will tell you which experiment to attempt first.

Write all your results, calculations and answers in the spaces provided in this question booklet.

In calculations you should show all the steps in your working, giving your answer at each stage.

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets.

The total mark for this paper is 48.

The list of data, formulae and relationships is printed at the end of this booklet.

Printer's Log. No.
N33057A
W850/R6733/57570 6/6/6/
N 3 3 0 5 7 A 0 1 1 2

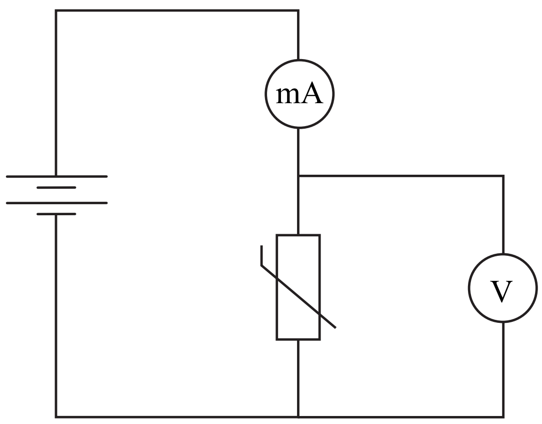
Turn over

edexcel
advancing learning, changing lives

Leave blank

Question A

(a) (i) Set up the circuit as shown in the diagram below. Before connecting to the power supply, have your circuit checked by the Supervisor. You will be allowed a short time to correct any faults. If you are unable to set up the circuit the Supervisor will set it up for you. You will only lose two marks for this.



(2)

(ii) Using the space below, record the potential difference *V* across the thermistor and the current *I* in the circuit.

V = ...

I =...

Hence calculate a value for the resistance *R* of the thermistor.

....

....

....

(3)

N 3 3 0 5 7 A 0 2 1 2

Leave blank

(iii) You are to observe how the current changes with time as you warm the thermistor and then sketch a graph of this.

Hold the thermistor between your thumb and forefinger and observe what happens to the current in the circuit. Continue holding the thermistor until the current reaches a steady value. Record the final steady values for the current I_f in the circuit and the potential difference V_f across the thermistor.

V_f ....

I_f ....

Hence calculate a second value R_f for the resistance of the thermistor.

....

....

....

In the space below **sketch** a graph of the current in the circuit against the time for which the thermistor is held. You should indicate relevant values on the current axis.

(7)

N 3 3 0 5 7 A 0 3 1 2

Turn over

Leave blank

(b) (i) You have been provided with a sheet of foil. Measure its length l and width w. Explain with the aid of a diagram how you obtained accurate values for l and w.

....

....

....

....

....

....

(3)

(ii) Determine the thickness t of the sheet by folding it so that a total thickness of $16t$ is recorded. Estimate the percentage uncertainty in your value of t.

....

....

....

....

....

....

Leave blank

Explain one advantage and one disadvantage of measuring t in this way.

....

....

....

....

....

....

(6)

(iii) Calculate the volume V of the sheet.

....

....

Measure the mass of the sheet using the balance provided and hence determine the density of the material from which the sheet is made.

....

....

....

....

(3)

QA

(Total 24 marks)

Leave blank

Question B

(a) (i) Pour hot water into the glass beaker up to the 200 ml (cm^3) mark.

Starting at a temperature of above 80 °C record the temperature θ of this water at regular intervals until the temperature falls below 70 °C.

....

....

....

....

....

....

....

....

(4)

(ii) Plot a graph of temperature θ against time t on the grid opposite.

(4)

(iii) Use your graph to determine the rate at which the temperature is falling, $\Delta\theta/\Delta t$, when $\theta = 75$ °C.

....

....

....

....

Assuming that it takes 900 J of energy to raise the temperature of the beaker and water by 1 K (1 °C), estimate the power P of the heater that would be required to maintain the temperature of the water at a steady 75 °C.

....

....

....

(4)

Leave blank

Leave blank

(b) (i) A student performs a similar experiment using a datalogger to capture the data and a computer to determine $\Delta\theta/\Delta t$. She finds that the required power is 30 W.

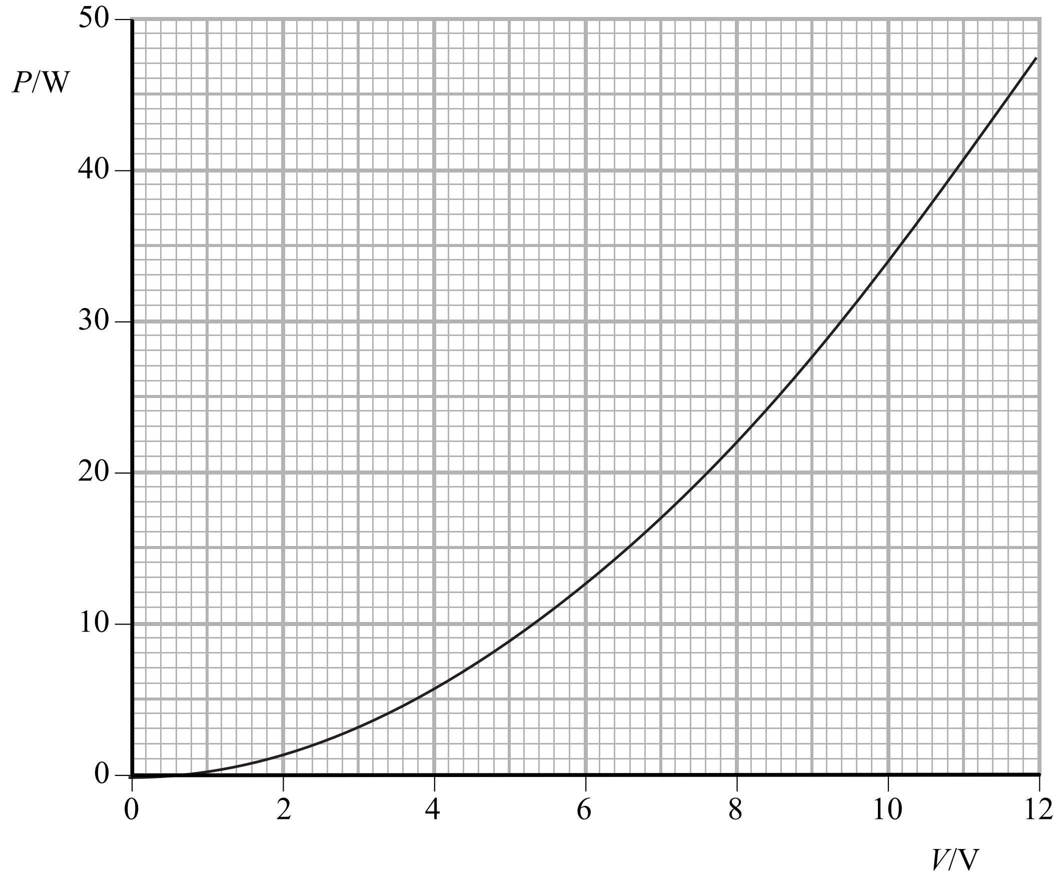
Draw a schematic (block) diagram to show the experimental arrangement and suggest a suitable sampling rate for the datalogger.

....

....

(4)

(ii) In a catalogue she finds a heater rated at 12 V, 48 W. Its power P varies with the applied potential difference V according to the following curve.



Leave blank

What potential difference would be required to provide a power of 30 W?

....

Draw a diagram of the circuit she could use to set the potential difference across the heater at the required value. You may assume that normal laboratory equipment is available.

(4)

(iii) After immersing the heater in 200 ml of water and setting the power to 30 W she wants to monitor the temperature of the water in this arrangement overnight and analyse the results next morning.

Explain how she could do this.

....

....

....

Suggest two reasons why she might find that the temperature had not remained at 75 °C.

....

....

....

....

(4)

QB

(Total 24 marks)

TOTAL FOR PAPER: 48 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	$1\ \text{eV} = 1.60 \times 10^{-19}\ \text{J}$	
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	$\theta/°\text{C} = T/\text{K} - 273$	

Kinetic theory of matter

$T \propto$ Average kinetic energy of molecules

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

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	$= \frac{T_1 - T_2}{T_1}$	

Experimental physics

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

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