Centre No.						Paper Reference	Surname	Other names
Candidate No.						6 7 3 3 / 2 B	Signature	

Edexcel
GCE

Physics

Advanced Subsidiary

Unit Test PHY3 Practical Test Group 2

Thursday 14 May 2009 – Morning

Time: 1 hour 30 minutes

For Examiner's use only
For Team Leader's use only

Question numbers	Leave blank
2A	
2B	
Total	

Supervisor's Data and Comments			
2A	a	Tick if circuit set up for candidate (Give details below)	
2A	b(i)	Length *l* to 0.1 mm	
2A	b(i)	Width *w* to 0.1 mm	
2A	b(i)	Thickness *t* to 0.01 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 2A and 2B. 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.

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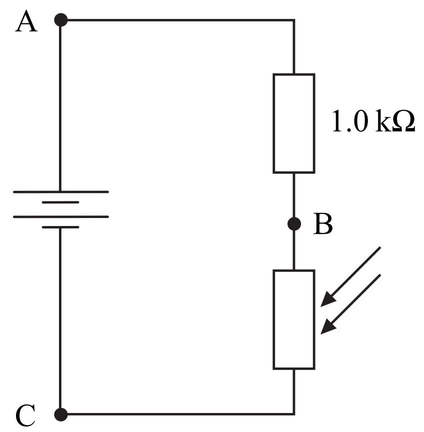
Question 2A

(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 lose only two marks for this.



(2)

(ii) Connect the voltmeter between points A and C to measure the terminal potential difference V_{AC} of the power supply.

V_{AC} = ...

Now connect the voltmeter between points B and C to measure the potential difference V_{BC} across the light dependent resistor (LDR).

V_{BC} = ...

Hence calculate the potential difference V_{AB} across the 1.0 kΩ resistor.

V_{AB} = ...

Calculate the current I in the circuit and the resistance R of the LDR.

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(5)

Leave blank

(iii) Keeping the voltmeter between points B and C, cover the LDR with the disc. Using your knowledge of potential dividers and light dependent resistors, explain what happens to V_{BC} when the LDR is covered by the disc.

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Calculate a value for the resistance R of the LDR when it is covered by the disc.

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(6)

(b) (i) Determine accurate values for the length l, the width w and the thickness t of the microscope slide.

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(4)

Leave blank

(ii) Measure the mass m of the slide and hence determine the density of the glass from which the slide is made.

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(4)

(iii) Determine the percentage uncertainty in your values for l, w and t.

Percentage uncertainty in l ....

....

....

Percentage uncertainty in w..

....

....

Percentage uncertainty in t ....

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....

Hence discuss which of your measurements would contribute most to the uncertainty in your value of the density.

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(3)

Q2A

(Total 24 marks)

Leave blank

Question 2B

(a) (i) The apparatus has been set up ready for you to use and should not be moved.

Approximately half fill the beaker with the hot water provided. Quickly pour this water into the plastic cup up to the marked line, which is calibrated to give $100\,cm^3$ of water in the cup.

Observe the temperature of the water in the cup and start the stopwatch when the temperature reaches 80.0 °C. Record the temperature θ at regular intervals of time t for five minutes.

Tabulate your readings in the space below.

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(5)

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(ii) Plot a graph of θ against t on the grid below.

(4)

Leave blank

(iii) Determine the gradient $\Delta\theta/\Delta t$ of your graph when $\theta = 70.0$ °C.

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Hence calculate the rate at which the water is losing energy when $\theta = 70.0$ °C, given that the density of water is 1.0 g cm^{-3} (1000 kg m^{-3}) and its specific heat capacity is 4.2 J g^{-1} K^{-1} (4200 J kg^{-1} K^{-1}).

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(4)

(b) (i) It is suggested that an insulated cup could be made by using two cups with an air gap between them.

Draw a labelled diagram to show how you could do this with the apparatus provided.

(2)

(ii) Outline the steps you would take in repeating the experiment with the double cup in order to test its insulating properties compared with the single cup.

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(3)

Leave blank

(iii) In the space below, sketch the results you would expect to get. You should sketch the curves for the single cup and the double cup on the same set of axes. Label your curves.

(3)

(iv) Explain how you would use the graphs to compare the insulation provided by the double cup with that of the single cup.

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(1)

(c) Explain how this experiment could be carried out using a datalogger.

Your explanation should include:

(i) a block diagram showing the equipment required,

(ii) an indication of the set time interval between temperature readings.

....

(2)

Q2B

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

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)
	$\cos\theta \approx 1$	

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