6733/2A
Physics

Edexcel GCE

Centre Number					
Candidate Number					
Paper reference					
Surname					
Other names					
Candidate's signature					

Supervisor's data and comments			
A	(b)	Tick if circuit set up for candidate (Give details below)	
Comments			

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

Monday 12 January 2004 – Morning

Time: 1 hour 30 minutes

Instructions to Candidates

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

The paper reference is shown in the top left-hand corner. If more than one paper reference is shown, you should write the one for which you have been entered.

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.

Turn over

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Success through qualifications

Question A

Leave blank

(a) (i) You are to determine the volume V of the Plasticene by a displacement method. Shape the Plasticene so that it will fit into the measuring cylinder. (You are advised to wear a disposable glove.) After you have shaped it, measure its mass m.

$m =$ ....

Now place sufficient water in the measuring cylinder to ensure that the Plasticene is fully immersed. This may take several trials. Draw diagrams showing the sequence of your experimental arrangements and record all your measurements in the space below.

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State any special precautions which you took when determining V.

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Use your values of m and V to calculate a value for the density of Plasticene.

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(7)

Leave blank

(ii) Calculate the percentage uncertainty in your value for V.

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Manufacturers quote the density of Plasticene as 1800 kg m^{-3} (1.8 g cm^{-3}) ± 10%.

Calculate the percentage difference between your value for the density and that quoted by the manufacturers.

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Assuming that the percentage uncertainty in the mass is negligible, comment on the extent to which the Plasticene you used meets the manufacturers' specification.

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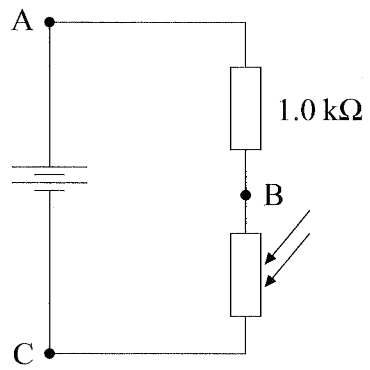
(4)

(b) (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, 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)

(Total 24 marks)

Leave blank

QA

Question B

Leave blank

(a) The apparatus has been set up for you. Do not adjust it in any way. Determine the mean time t for the trolley to descend a distance s of 0.80 m from rest down the runway.

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Hence calculate the speed v of the trolley after moving 0.80 m, which is given by

$$v = \frac{2s}{t}$$

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(3)

(b) Explain with the aid of a diagram how you ensured that the trolley travelled a distance of exactly 0.80 m.

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(3)

(c) Determine the vertical height h through which the trolley moves as it travels a distance of 0.80 m down the runway. Draw a diagram to show how this height was determined.

Leave blank

$h =$ ....

Using the mass of the trolley, which is given on the card, calculate the potential energy E_p lost by the trolley as it moves through the height h.

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Using your results from part (a), determine the kinetic energy E_k gained by the trolley as it moves down the runway.

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In this experiment it is expected that $E_p = E_k + k$ where k is a constant. Calculate a value for k.

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(6)

Leave blank

(d) You are to plan an experiment to further investigate the equation in part (c). Your plan should include

(i) a description of how E_p can be changed,

(ii) a description of the experiment to be performed,

(iii) a sketch graph, showing the expected results.

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How would you find k from the graph?

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(8)

(e) The speed of the trolley at the end of the 0.80 m run has been found by doubling the average speed of the trolley as it moves down the runway. Describe how this final speed could be measured directly using a datalogging system.

Leave blank

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(4)

QB

(Total 24 marks)

TOTAL FOR PAPER: 48 MARKS

END

List of data, formulae and relationships

Data

Speed of light in vacuum	$c = 3.00\times10^{8}\ \mathrm{m\ s^{-1}}$	
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	$e = 1.60\times10^{-19}\ \mathrm{C}$	
Electronic mass	$m_e = 9.11\times10^{-31}\ \mathrm{kg}$	
Electronvolt	$1\ \mathrm{eV} = 1.60\times10^{-19}\ \mathrm{J}$	
Unified atomic mass unit	$\mathrm{u} = 1.66\times10^{-27}\ \mathrm{kg}$	
Molar gas constant	$R = 8.31\ \mathrm{J\ K^{-1}\ mol^{-1}}$	

Rectilinear motion

For uniformly accelerated motion:

$$\upsilon = u + at$$

$$x = ut + \tfrac{1}{2}at^2$$

$$\upsilon^2 = u^2 + 2ax$$

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 $\quad F = m\dfrac{\Delta \upsilon}{\Delta t} = \dfrac{\Delta p}{\Delta t}$

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

Mechanical energy

Power $\quad P = F\upsilon$

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

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)

$\cos\theta \approx 1$