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 22 May 2008 – 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
Nil

Items included with question papers
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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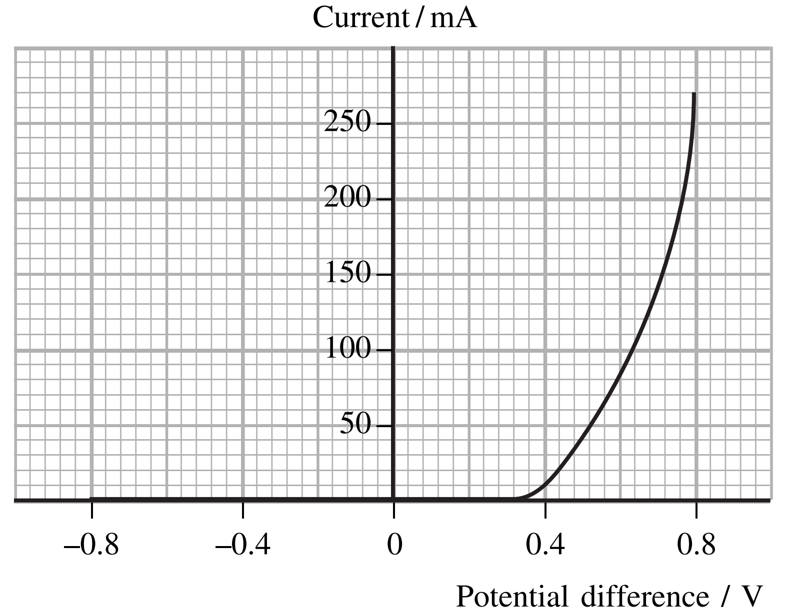
1. The current–potential difference characteristics of an electrical component are shown below.



(a) Name the component. ....

(1)

(b) (i) Calculate the resistance of this component when the potential difference is +0.60 V.

....

....

Resistance = ...

(2)

(ii) State its resistance when the potential difference is –0.80 V.

....

(1)

(c) State a practical use for this component.

....

(1)

Q1

(Total 5 marks)

N 3 0 4 2 4 A 0 2 1 6

Leave blank

2. (a) Define resistivity.

....

....

....

(2)

(b) (i) The heating element used in a hairdryer consists of a long nichrome wire coiled around an insulator. The hairdryer operates at 230 V and has a power of 1.0 kW. Calculate the resistance of the heating element.

....

....

....

....

Resistance = ...

(3)

(ii) The wire has a cross-sectional area of $1.3 \times 10^{-7}\,\text{m}^2$. The resistivity of nichrome is $1.1 \times 10^{-6}\,\Omega\,\text{m}$. Calculate the length of the nichrome wire.

....

....

....

....

Length = ...

(3)

(iii) The nichrome wire in this heating element has a diameter of 0.41 mm.

A manufacturer wishes to make a hairdryer of the same resistance but using half the length of nichrome wire. What diameter wire must be used?

....

....

....

....

Diameter = ...

(2)

Q2

(Total 10 marks)

Leave blank

3. (a) Define the term electromotive force (e.m.f.).

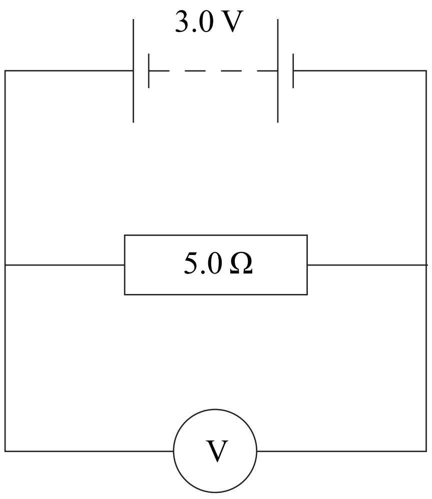
....

....

....

(2)

(b) A battery of e.m.f. 3.0 V is connected to a 5.0 Ω resistor with a very high resistance voltmeter placed across the resistor.



(i) The very high resistance voltmeter gives a reading of 2.8 V. Show that the internal resistance of the battery is about 0.4 Ω.

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....

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....

....

(3)

(ii) A voltmeter with a resistance of 10 Ω is used instead of the original one. Calculate the combined resistance of this voltmeter and the 5.0 Ω resistor.

....

....

....

....

Combined resistance = ...

(2)

(iii) Calculate the reading on this voltmeter.

....

....

....

....

Voltmeter reading = ...

(3)

(c) State and explain what the resistance of an ideal voltmeter should be.

....

....

....

....

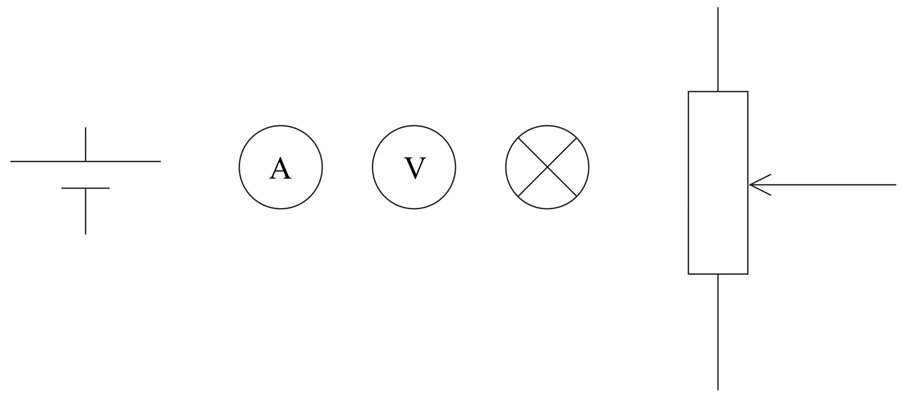
(2)

Q3

(Total 12 marks)

Leave blank

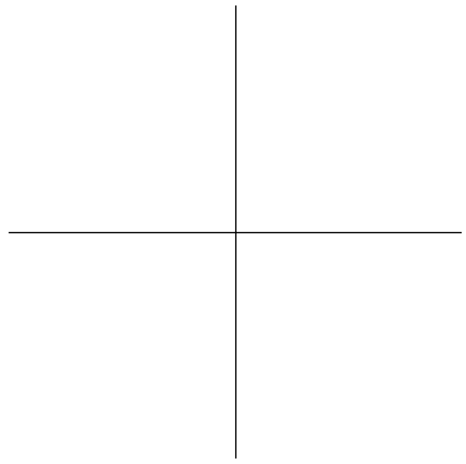
4. An experiment is set up to investigate how the current I in a filament lamp varies with the potential difference V across it. The components used are shown below.



(a) Readings are taken over the full range from 0 V to the cell's maximum potential difference. In the space below, draw a circuit diagram for this experiment.

(2)

(b) (i) Sketch on the axes below the shape of the graph you would expect the results to give.



(2)

N 3 0 4 2 4 A 0 6 1 6

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

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....

....

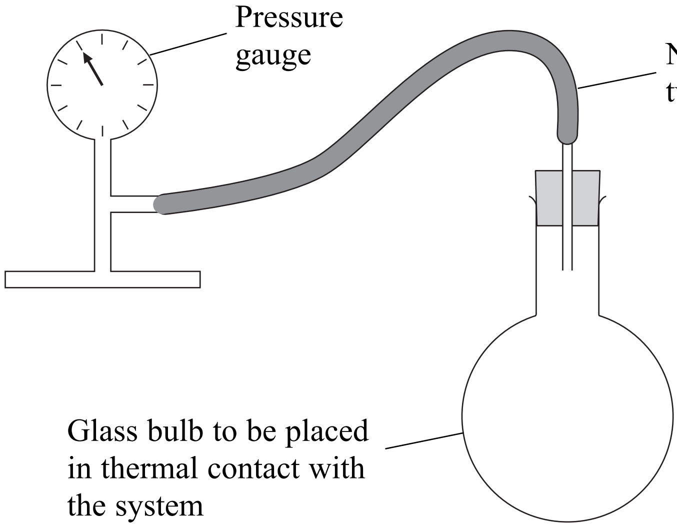
....

(4) **Q4**

(Total 8 marks)

Leave blank

5. The apparatus shown can be used as a thermometer. It consists of a bulb containing a fixed volume of gas (connected to a pressure gauge). The bulb is placed in thermal contact with the system whose temperature is being measured and the pressure is measured using the pressure gauge. This pressure can be converted to a temperature.



(a) What is meant by thermal contact?

....

....

(1)

(b) Although this thermometer can give accurate results it is not a very practical instrument for measuring temperatures. Suggest and explain two difficulties you might have with using this thermometer.

Difficulty 1 ....

....

Explanation ....

....

Difficulty 2 ....

....

Explanation ....

....

(4) **Q5**

(Total 5 marks)

Leave blank

6. (a) What is meant by the absolute zero of temperature?

....

....

(1)

(b) (i) The Football Association rules require a football to have a maximum volume of $5.8 \times 10^{-3}\,m^3$ and a maximum pressure of $1.1 \times 10^5\,Pa$ above atmospheric pressure ($1.0 \times 10^5\,Pa$). Assuming that the thickness of the material used for the ball is negligible and that the air inside the ball is at a temperature of 10 °C, show that the maximum amount of air inside the football is about 0.5 mol.

....

....

....

....

(4)

(ii) One mole of air has a mass of 0.029 kg. Calculate the maximum mass of air allowed in the football.

....

....

Maximum mass = ...

(1)

(iii) A football is also required to have a minimum pressure $0.6 \times 10^5\,Pa$ above atmospheric pressure. Assuming the volume of the football remains constant, calculate the lowest temperature to which the air inside this ball could fall to while still meeting the pressure requirements.

....

....

....

Lowest temperature = ...

(3)

Q6

(Total 9 marks)

N 3 0 4 2 4 A 0 9 1 6

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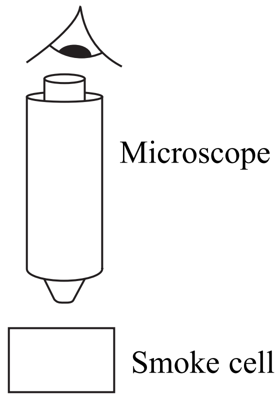
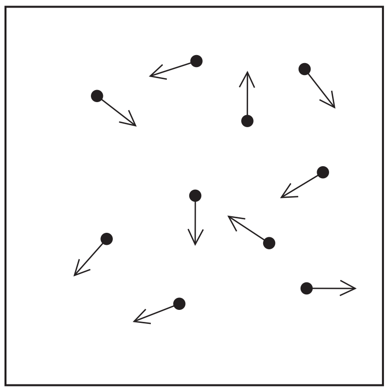
7. Brownian motion of smoke particles suspended in air can be observed by viewing light reflected from smoke particles through a microscope.



The diagram below shows the light reflected off a number of smoke particles suspended in air. The arrows show the direction of motion of the particles at one particular time.



(a) Explain why the smoke particles move.

....

....

....

....

....
(2)

N 3 0 4 2 4 A 0 1 0 1 6

Leave blank

(b) The smoke particles have different directions and speeds. State two conclusions that can be made about the air molecules and their motion, as a result of the motion of the smoke particles.

Conclusion 1 ....

....

....

Conclusion 2 ....

....

....

(2)

(c) Sketch below the possible path taken by one smoke particle.

(2) **Q7**

(Total 6 marks)

N 3 0 4 2 4 A 0 1 1 1 6

Turn over

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8. The pressure exerted by an ideal gas is given by

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

where the symbols have their usual meanings.

(a) Five gas molecules have speeds of $300\,\text{m s}^{-1}$, $450\,\text{m s}^{-1}$, $520\,\text{m s}^{-1}$, $680\,\text{m s}^{-1}$ and $730\,\text{m s}^{-1}$. Calculate the value of $\langle c^2\rangle$ for these molecules.

....

....

....

....

....

$\langle c^2\rangle$ = ...

(3)

(b) The molecules of a real gas have both kinetic and potential energy. Explain why an ideal gas only has kinetic energy.

....

....

....

....

....

(2)

Q8

(Total 5 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 $\theta/°\text{C} = T/\text{K} - 273$

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

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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