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

Wednesday 16 January 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	
Total	

Materials required for examination	Items included with question papers
Nil	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 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.

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1. (a) (i) State the resistance of an **ideal** ammeter.

....
(1)

(ii) Explain why an ideal ammeter should have this value of resistance.

....

....

....

....
(2)

(b) (i) State the resistance of an **ideal** voltmeter.

....
(1)

(ii) Explain why an ideal voltmeter should have this value of resistance.

....

....

....

....
(2)

Q1

(Total 6 marks)

Leave blank

2. The current I in a conductor of cross-sectional area A is given by the formula

$$I = n\,A\,Q\,v$$

where Q is the charge on the charge carrier.

(a) State the meanings of n and v.

n: ....

v: ....
(2)

(b) Show that the equation is homogeneous with respect to units.

....

....

....

....

....

....
(3)

(c) Two pieces of wire A and B are made of the same material but have different diameters. They are connected in series with each other and a power supply.

(i) Which terms from the above equation will be the same for both wires?

....
(1)

(ii) The diameter of A is twice that of B. Calculate the ratio $v_A : v_B$.

....

....

....

....
(2)

Q2

(Total 8 marks)

Leave blank

3. A and B are two lamps.

(a) Lamp A is rated at 12 V, 24 W. Calculate the current in the lamp when it operates at its rated voltage.

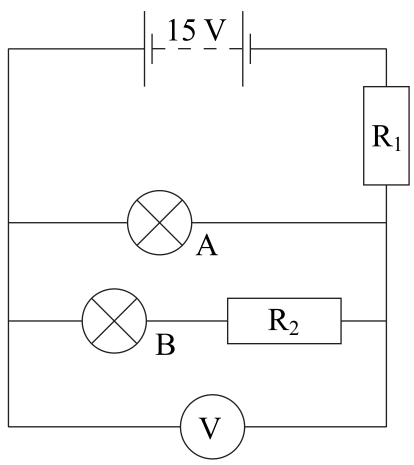
....

Current in lamp A= ....

(2)

(b) Lamp B is rated at 6.0 V. When it operates at its rated voltage, the current in it is 3.0 A.

Lamps A and B are connected in a circuit as shown below. The values of R_1 and R_2 are chosen so that both lamps operate at their rated voltage.



(i) State the reading on the voltmeter.

....

(1)

(ii) Calculate the resistance of R_2.

....

....

....

Resistance of R_2 = ...

(3)

(iii) Calculate the current in R_1.

....

Current in R_1 = ...

(1)

Leave blank

(iv) Calculate the potential difference across R_1.

....

Potential difference = ...

(1)

(v) Calculate the resistance of R_1.

....

....

Resistance of R_1 = ...

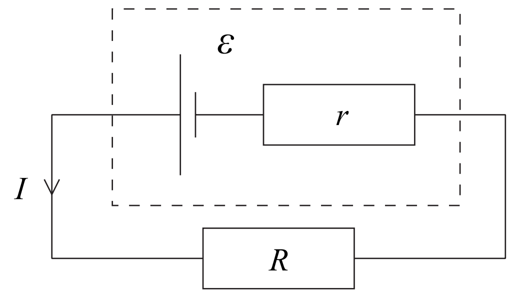
(1)

Q3

(Total 9 marks)

Leave blank

4. A cell of e.m.f. $\mathcal{E}$ and internal resistance r is connected in a circuit with a resistor of resistance R. The current in the circuit is I.



(a) Using the symbols in the diagram, write down a formula for

(i) the rate of conversion of chemical energy in the cell,

....

(ii) the power dissipated in the resistor of resistance R,

....

(iii) the power dissipated in r.

....

(3)

(b) Use these formulae to write an equation based on conservation of energy in the circuit.

....

(1)

N 2 6 5 1 7 A 0 6 1 6

Leave blank

(c) The current I in the above circuit is given by the formula $I = \mathcal{E}/(R + r)$. A laboratory E.H.T. supply is designed to produce a maximum potential difference of 5 kV. Give a typical value for the internal resistance of this supply and explain why it has this value.

....

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....

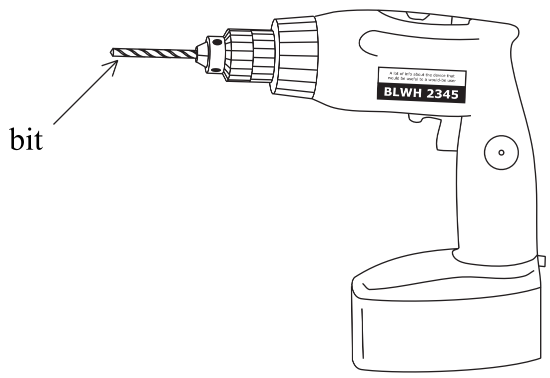
(3)

Q4

(Total 7 marks)

Leave blank

5. The electric drill shown below is labelled 230 V, 200 W. It has a removable steel drill bit that is used to drill into a wall for 30 s.



(a) Calculate how much electrical energy is used by the drill during this time.

....

....

Electrical energy = ...
(2)

(b) After use the steel drill bit is very hot. The mass of the drill bit is 15 g. The room temperature is 20 °C. Calculate the maximum possible temperature of the drill bit. State an assumption you have made.

Specific heat capacity of steel = 510 J kg^{-1} K^{-1}

....

....

....

....

Temperature = ...

Assumption ....

....
(5)

N 2 6 5 1 7 A 0 8 1 6

Leave blank

(c) The actual temperature of the drill bit will be less than this. Suggest a reason why.

....

....

....

(1)

Q5

(Total 8 marks)

Leave blank

6. (a) Describe how the concept of an absolute zero of temperature arises from

(i) the ideal gas laws,

....

....

....

....
(2)

(ii) the kinetic model of an ideal gas.

....

....

....

....
(2)

(b) Name the temperature scale based on absolute zero.

....
(1)

Leave blank

(c) The oven of a cooker has a volume of $0.10\,m^3$. The air in the oven is at normal atmospheric pressure, 1.0×10^5 Pa.

(i) Calculate the mass of air in the oven at 27 °C.

1 mole of air has a mass of 0.029 kg.

....

....

....

....

Mass of air = ...

(4)

(ii) When the oven is heated the pressure of the air in the oven stays at atmospheric pressure but the density of the air changes. Calculate the ratio of the density of air at 227 °C to its density at 27 °C.

....

....

....

....

....

....

(3)

Q6

(Total 12 marks)

Leave blank

7. (a) A student investigates how the pressure of a gas depends on its temperature.

(i) To carry out this experiment, two variables must be kept constant. What are they?

1 ....

2 ....

(2)

(ii) Draw a labelled diagram of the apparatus the student could use.

(4)

(iii) State **one** precaution the student should take to improve the quality of the results.

....

(1)

Leave blank

(b) In the space below sketch a graph to show how the pressure of an ideal gas depends on its temperature. Add any key values to your temperature axis.

(3) **Q7**

(Total 10 marks)

TOTAL FOR PAPER: 60 MARKS

END

List of data, formulae and relationships

Data

Speed of light in vacuum	$c = 3.00 \times 10^{8}\ \mathrm{m\ s^{-1}}$	
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	$e = 1.60 \times 10^{-19}\ \mathrm{C}$	
Electronic mass	$m_e = 9.11 \times 10^{-31}\ \mathrm{kg}$	
Electronvolt	$1\ \mathrm{eV} = 1.60 \times 10^{-19}\ \mathrm{J}$	
Planck constant	$h = 6.63 \times 10^{-34}\ \mathrm{J\ s}$	
Molar gas constant	$R = 8.31\ \mathrm{J\ K^{-1}\ mol^{-1}}$	

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	$\theta/°\mathrm{C} = T/\mathrm{K} - 273$	

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

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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