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

Friday 10 June 2005 – Morning

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	
9	
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 and initials and your 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 nine 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. Below is a list of words associated with circuits.

Current	Volt	Resistance
Ohm	Charge	Ampere

For each of the following choose **one** example from the above list.

Base unit ....

Derived quantity ....

Derived unit..

Base quantity ....

Q1

(Total 4 marks)

Leave blank

2. Io is one of Jupiter's moons. Some of the electrons released from the volcanic surface of Io have an average velocity of $2.9 \times 10^7 \text{ m s}^{-1}$ towards Jupiter. The distance between Jupiter and Io is 4.2×10^5 km.

(a) Show that the time taken for these electrons to reach Jupiter is about 14 s.

....

....

(2)

(b) In this way a current of 3.0×10^6 A is created between Io and Jupiter. Calculate the number of electrons that arrive at Jupiter every second.

....

....

....

Number of electrons = ...

(2)

(c) State the direction of the current.

....

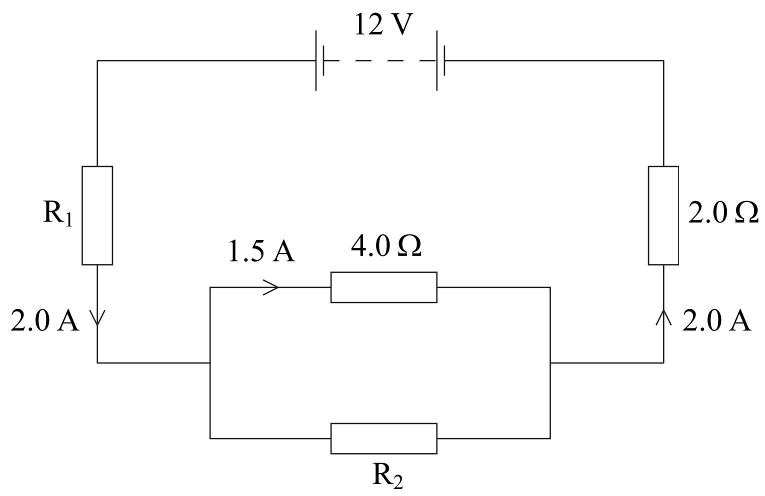
(1)

Q2

(Total 5 marks)

Leave blank

3. The circuit diagram shows a 12 V d.c. supply of negligible internal resistance connected to an arrangement of resistors. The current at three places in the circuit and the resistance of two of the resistors are given on the diagram.



(a) Calculate the potential difference across the 4.0 Ω resistor.

....

....

Potential difference = ...

(1)

(b) Calculate the resistance of resistor R_2.

....

....

....

Resistance of R_2 = ...

(2)

Leave blank

(c) Calculate the resistance of resistor R_1.

....

....

....

....

....

....

....

Resistance of R_1 = ...

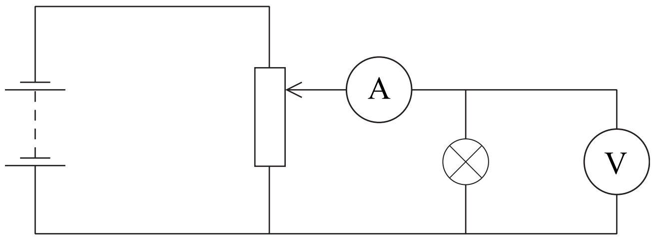
(3)

Q3

(Total 6 marks)

Leave blank

4. The circuit shown is used to produce a current-potential difference graph for a 12 V, 24 W filament lamp.



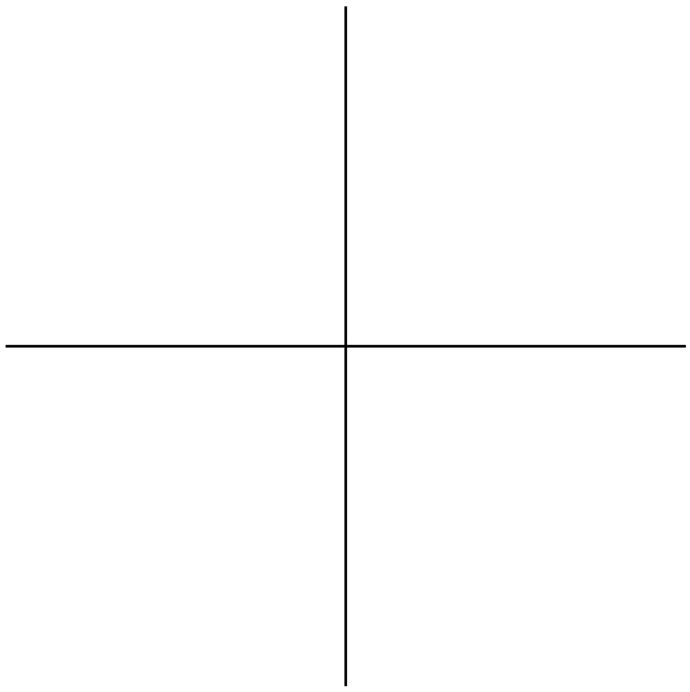
(a) Calculate the current in the filament lamp when the potential difference across it is 12 V.

....

....

Current = ...
(2)

(b) (i) Sketch a graph of current against potential difference for this filament lamp.



(2)

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(ii) Explain, with reference to the filament, the shape of your graph, as the potential difference across the filament increases from 0 V to 12 V.

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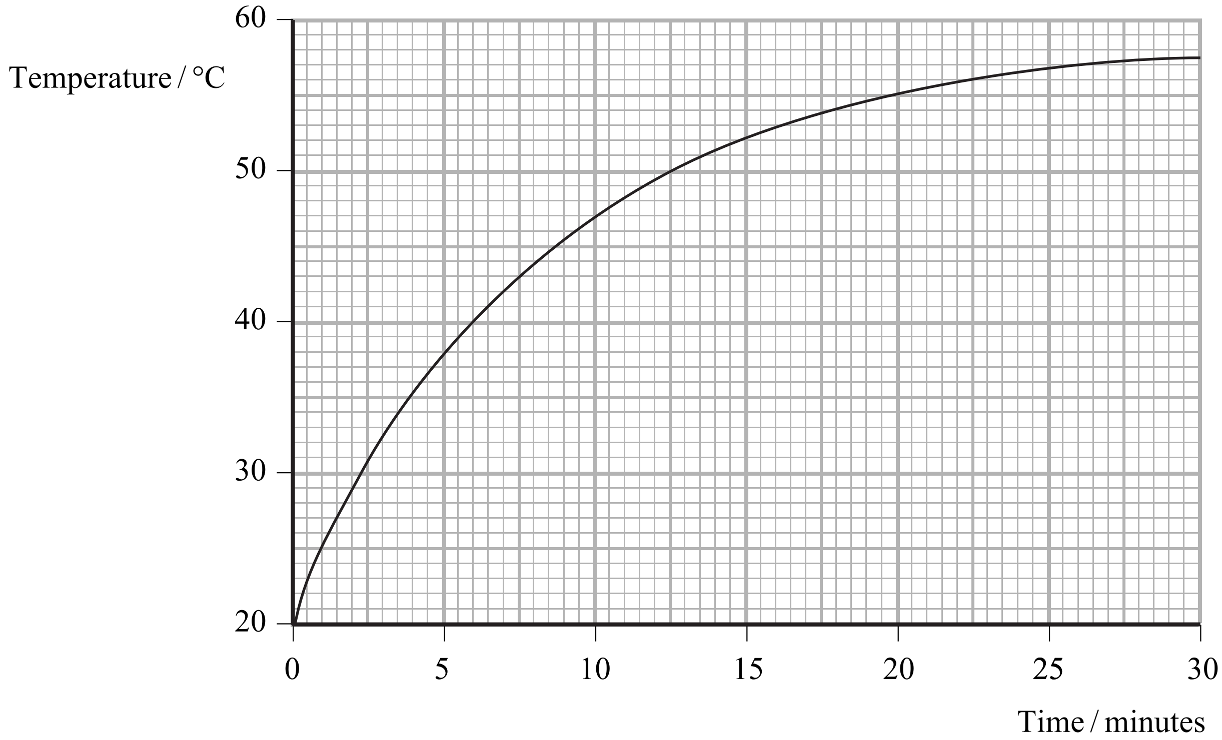
(4)

Q4

(Total 8 marks)

Leave blank

5. A small electrical heater, operating at a constant power, was used to heat 64 g of water in a thin plastic cup. The mass of the cup was negligible. The temperature of the water was recorded at regular intervals for 30 minutes and a graph drawn of temperature against time.



(a) (i) Use the graph to determine the initial rate of temperature rise of the water.

....

....

Rate of temperature rise = ...

(2)

(ii) The specific heat capacity of water is 4200 J kg^{-1} K^{-1}. Determine the rate at which energy was supplied to the water by the heater.

....

....

....

Rate of energy supply = ...

(3)

Leave blank

(b) After 26 minutes the rate of temperature rise became very small. Explain why.

....

....

....
(2)

(c) The experiment was repeated using the same mass of water in a thick ceramic mug. The initial temperature of the water was the same and the water was heated for the same length of time.

(i) Add to the axes opposite a possible graph of temperature against time for the water in the mug.
(2)

(ii) Explain your reasoning for your graph.

....

....

....

....
(2)

Q5

(Total 11 marks)

Leave blank

6. The pressure p of an ideal gas is related to its volume V and temperature T by the ideal gas equation

$$pV = nRT$$

(a) (i) State what is represented by the following symbols.

n ....

R ....

(2)

(ii) What is meant by the absolute zero of temperature?

....

....

(1)

(b) A room has a volume of 60 m^3. On a hot day the air temperature is 25 °C and the air pressure is 1.1×10^5 Pa.

Calculate how many moles of air there are in the room under these conditions. Assume that air behaves as an ideal gas.

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....

....

Number of moles = ...

(3)

Q6

(Total 6 marks)

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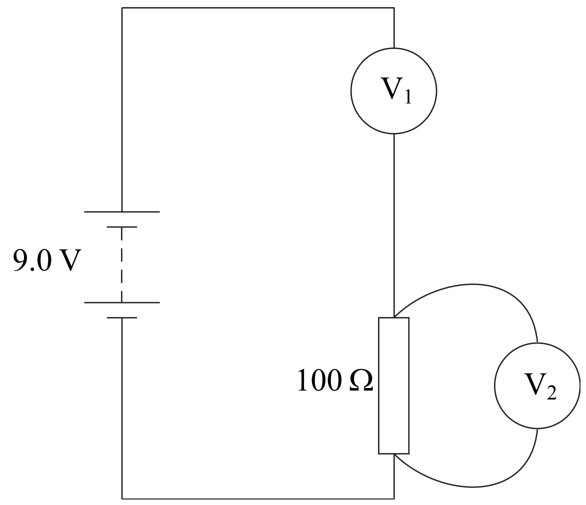
7. (a) A student sets up a circuit and accidentally uses two voltmeters V_1 and V_2 instead of an ammeter and a voltmeter. The circuit is shown below.



(i) Circle the voltmeter which should be an ammeter.

(1)

(ii) Both voltmeters have a resistance of 10 MΩ. The student sees that the reading on V_2 is 0 V. Explain why the potential difference across the 100 Ω resistor is effectively zero.

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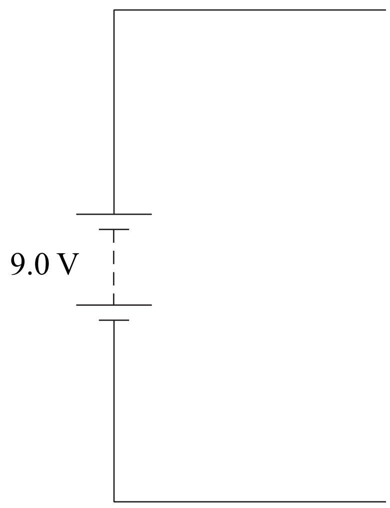
(2)

Leave blank

(b) The student replaces the 100 Ω resistor with another resistor of resistance R. The reading on V_2 then becomes 3.0 V.

(i) Complete the circuit diagram below to show the equivalent resistor network following this change.

Label the resistor R.



(2)

(ii) Calculate the value of R.

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....

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....

....

R = ...

(3)

Q7

(Total 8 marks)

Leave blank

8. The maximum efficiency of a heat engine is given by

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

(a) State what is represented by the terms

T_1 ....

T_2 ....
(2)

(b) (i) A modern power station works at an efficiency of 53% and releases steam into the atmosphere at a temperature of 100 °C. Use the formula to calculate the initial temperature of the steam.

....

....

....

....

....

....

Initial temperature = ...
(3)

(ii) In principle, how could the efficiency of this power station be improved?

....

....

....
(1)

(Total 6 marks)

Q8

N 1 6 8 6 0 A 0 1 4 2 0

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9. Smoke particles suspended in air were illuminated and viewed through a microscope.

(a) Describe what would have been observed. Explain how this experiment gives evidence for the particulate nature of a gas. You may be awarded a mark for the clarity of your answer.

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(4)

(b) Sketch the possible motion of one smoke particle.

(2)

Q9

(Total 6 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	$\theta/°\mathrm{C} = T/\mathrm{K} - 273$	

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	$= \frac{\text{Useful output}}{\text{Input}}$	
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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