Centre No.						Paper Reference	Surname	Initial(s)
Candidate No.						6 7 5 1 / 0 1	Signature	

Paper Reference(s)

6751/01

Edexcel GCE

Salters Horners Physics

Advanced Subsidiary

Unit Test PSA1

Friday 8 June 2007 – Morning

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
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 initial(s) and your signature.
Answer **ALL** of the questions, writing your answers in this question booklet.
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 mark for individual questions and the parts of questions are shown in round brackets.
There are six 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. An earthquake under the ocean floor may cause a tidal wave. It has been suggested that elephants may be able to give advance warning of the arrival of such a tidal wave by detecting the seismic p-waves produced by the earthquake.

(a) P-waves travel through the Earth's crust as longitudinal waves. Describe how longitudinal waves propagate.

....

....

....

(2)

(b) Some p-waves have a frequency of 9.0 Hz and a wavelength of 0.8 km.

Calculate the speed of these waves.

....

....

....

Wave speed = ...

(2)

(c) An elephant is 2500 km from the epicentre of an earthquake. A tidal wave would take about two hours to travel this distance. Determine whether it is possible for the elephant to detect the earthquake significantly earlier than the arrival of the tidal wave.

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(2)

Q1

(Total 6 marks)

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2. Fuses are used to protect electrical appliances from excess currents. A student takes some measurements to estimate the time it would take for the wire in a 15 A fuse to melt when the current in the circuit is 20 A.

The student has a length of 15 A fuse wire. She measures its length and resistance.

Length = 0.99 m

Resistance = 0.11 Ω

(a) (i) The length of wire used in a 15 A fuse is only 0.050 m. Show that the resistance of a 15 A fuse is about 0.006 Ω.

....

....

(1)

(ii) Suggest why she measured the resistance of the full length of 0.99 m rather than measuring the resistance of the fuse length directly.

....

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....

....

(1)

(b) (i) Calculate the rate at which a 20 A current generates heat energy in this fuse.

....

....

....

Rate of heat generation = ...

(2)

Leave blank

(ii) She assumes that the 15 A fuse would initially be at a temperature of 20 °C. Calculate the energy required to raise the temperature of the wire to its melting point of 1080 °C.

Mass of wire in fuse = 8.70×10^{-5} kg, specific heat capacity = 385 J kg^{-1} °C^{-1}

....

....

....

Energy = ...

(2)

(iii) Calculate the time for the wire in the fuse to reach its melting point. Assume the current in the wire remains at 20 A.

....

....

Time = ...

(1)

(iv) In fact, the resistance of the wire will be much larger by the time it reaches its melting point. Explain why the increase in the temperature of the wire causes the resistance to increase.

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....

....

(2)

Q2

(Total 9 marks)

N 2 6 1 5 5 A 0 5 1 6

Turn over

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3. (a) On 20 July 1969, Neil Armstrong became the first human to step onto the surface of the moon.

One experiment carried out was to film a hammer and a feather dropped at the same time from rest. They fell side by side all the way to the ground, falling a distance of 1.35 m in a time of 1.25 s.

(i) Show that this gives a value for their acceleration of about 1.7 m s^{-2}.

....

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....

(2)

(ii) Explain why the acceleration of both the hammer and the feather was constant throughout their fall.

....

....

....

(2)

In the questions that follow, assume that on the Moon

acceleration of free fall g = 1.7 m s^{-2}

gravitational field strength g = 1.7 N kg^{-1}.

(b) Neil Armstrong and his space suit had a total mass of 105 kg. Calculate his weight, including the spacesuit, on the Moon.

....

....

Weight = ...

(2)

Leave blank

(c) In 1971 another astronaut, Alan Shepherd, hit a golf ball on the Moon. He later said that it went ' ... miles and miles ...'

(i) Suppose that he hit the ball so that it left his club at a speed of $45\,m\,s^{-1}$, at an angle of 20° to the horizontal. Calculate the time of flight of the ball.

....

....

....

....

....

....

Time = ...

(3)

(ii) Calculate the horizontal distance travelled by the ball before landing.

....

....

....

Distance = ...

(2)

(iii) Comment on this distance in relation to his statement. 1 mile = 1.6 km

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....

(1)

Q3

(Total 12 marks)

Leave blank

4. (a) Explain what is meant by superposition of waves.

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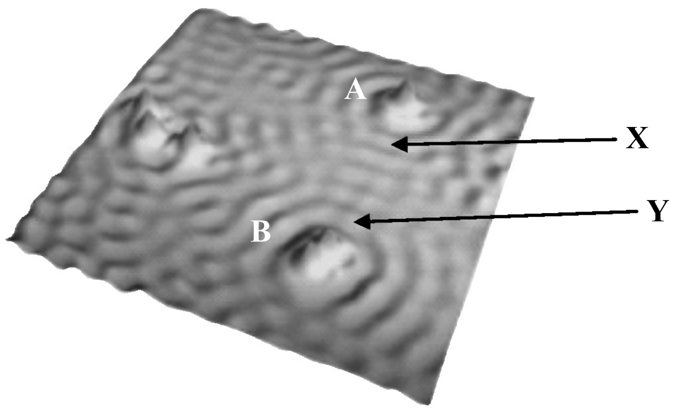
....
(2)

(b) The electron micrograph shows a small area of the surface of a copper sample.



Electrons move over the surface and behave like waves. When a wave reaches an edge or an atom, it reflects, and a standing wave is formed.

(i) Explain how a standing wave is formed by the reflection of a wave.

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....
(3)

N 2 6 1 5 5 A 0 8 1 6

Leave blank

(ii) A standing wave is visible on the micrograph between atoms A and B. There are nodes at X and Y. The dark lines between X and Y show antinodes.

The distance between points X and Y on the micrograph is 4.2×10^{-9} m.
Use this information to calculate the wavelength of the electron waves.

....

....

....

....

Wavelength = ...

(2)

(iii) Explain the meaning of the terms amplitude and antinode.

Amplitude

....

....

....

(1)

Antinode

....

....

....

(1)

Q4

(Total 9 marks)

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Turn over

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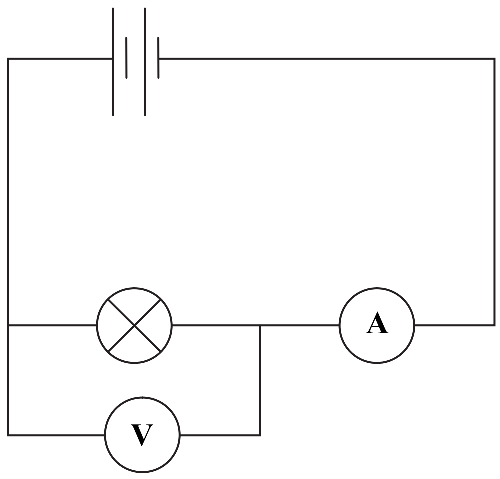
5. A student investigates the use of rechargeable cells in a torch.

The diagram shows the circuit used to obtain readings of voltage and current for the torch bulb.



The results obtained are voltage = 2.68 V, current = 0.31 A.

(a) (i) Calculate the resistance of the torch bulb.

....

....

....

Resistance = ...

(2)

(ii) The cells form a battery with an emf of 2.80 V.

Show that the internal resistance of the battery is about 0.4 Ω.

....

....

....

(2)

Leave blank

(iii) Comment on how well these values match the necessary condition for maximum power transfer between the battery of cells and the torch bulb.

....

....

....

(2)

(b) Each cell is labelled: 'capacity 2 A h'. (A h is amp hours).

(i) Show that this corresponds to a total stored charge of about 14 000 C for the battery of two cells.

....

....

....

(2)

(ii) Calculate the time for which the battery could maintain a current of 0.31 A in the torch bulb.

....

....

....

Time = ...

(2)

(c) The internal resistance of the cells increases as they are used. Explain what effect this will have on the efficiency of the system.

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(2)

Q5

(Total 12 marks)

Leave blank

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6. A student films a car as it reduces speed by braking. By making measurements against a scale on the road he obtains values for the distance the car travels during each 0.5 s interval after the start of braking.

His measurements and calculations are shown in the spreadsheet.

	A	B	C	D	E	F
1	interval number	interval distance/m	total time/s	average speed during interval/m s^{-1}	distance from start/m	kinetic energy/kJ
2						
3						
4	1	13.2	0.5	26.4	13.2	209
5	2	11.8	1.0	23.6	25.0	167
6	3	10.5	1.5	21.0	35.3	
7	4	9.1	2.0	18.2	44.6	99
8	5	7.6	2.5		52.2	69
9						
10	interval time/s	mass of car/kg				
11	0.5	600				

(a) (i) Calculate the value for average speed missing from cell D8.

....

Speed = ... m s^{-1}
(1)

(ii) Write down a suitable formula for cell E7.

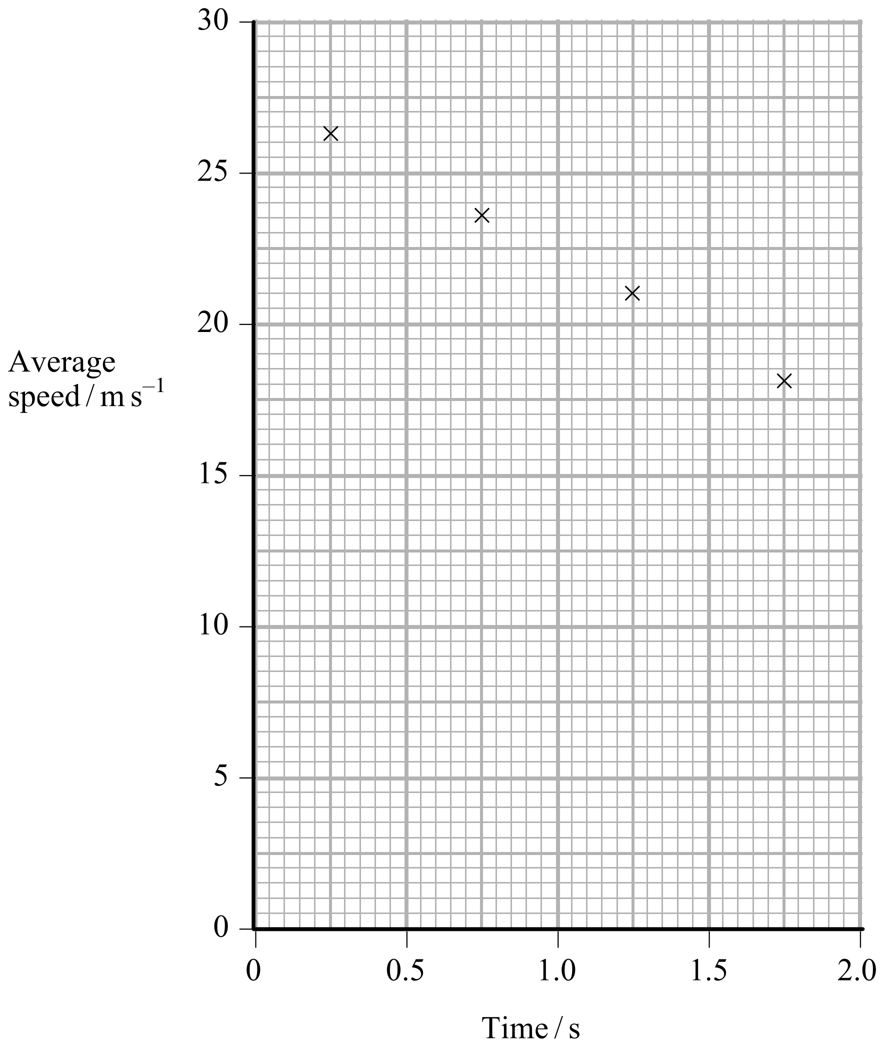
....
(1)

N 2 6 1 5 5 A 0 1 3 1 6

Turn over

Leave blank

Values of average speed against time for the car are plotted on the grid below.



(iii) Use the graph to find the average deceleration of the car.

....

....

Average deceleration = ...

(3)

Leave blank

(b) (i) Calculate the average braking force on the car.

....

....

Average braking force = ...
(2)

(ii) State the origin of this force on the car.

....
(1)

(c) (i) Calculate the value for kinetic energy missing from cell F6.

....

....

Kinetic energy = ... kJ
(2)

(ii) The student decides to plot a graph of the kinetic energy of the car against the distance it has travelled since the brakes were applied.

Explain why the gradient of this graph is equal to the braking force on the car.

....

....

....

....
(2)

Q6

(Total 12 marks)

TOTAL FOR PAPER: 60 MARKS

END

List of data, formulae and relationships

Data

Gravitational constant	$G = 6.67 \times 10^{-11}\ \mathrm{N\,m^2\,kg^{-2}}$	
Acceleration of free fall	$g = 9.81\ \mathrm{m\,s^{-2}}$	(close to Earth's surface)
Gravitational field strength	$g = 9.81\ \mathrm{N\,kg^{-1}}$	(close to Earth's surface)
Electronic charge	$e = -1.60 \times 10^{-19}\ \mathrm{C}$	
Electronic mass	$m_e = 9.11 \times 10^{-31}\ \mathrm{kg}$	
Electronvolt	$1\ \mathrm{eV} = 1.60 \times 10^{-19}\ \mathrm{J}$	
Proton mass	$m_p = 1.67 \times 10^{-27}\ \mathrm{kg}$	
Planck constant	$h = 6.63 \times 10^{-34}\ \mathrm{J\,s}$	
Speed of light in a vacuum	$c = 3.00 \times 10^{8}\ \mathrm{m\,s^{-1}}$	
Molar gas constant	$R = 8.31\ \mathrm{J\,K^{-1}\,mol^{-1}}$	
Boltzmann constant	$k = 1.38 \times 10^{-23}\ \mathrm{J\,K^{-1}}$	
Permittivity of free space	$\varepsilon_0 = 8.85 \times 10^{-12}\ \mathrm{F\,m^{-1}}$	
Permeability of free space	$\mu_0 = 4\pi \times 10^{-7}\ \mathrm{N\,A^{-2}}$	

Unit 1

Physics at work, rest and play

Mechanics

Kinematic equations of motion $s = ut + \frac{1}{2}at^2$

$v^2 = u^2 + 2as$

Energy

% *efficiency* = [*useful energy* (or power) *output/total energy* (or power) *input*] × 100%

Heating $\Delta E = mc\Delta\theta$

Quantum Phenomena

Photon model $E = hf$

Waves and Oscillations

For waves on a wire or string $v = \sqrt{(T / \mu)}$

For a lens $P = 1/f$