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

Wednesday 17 January 2007 – Afternoon

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**
Protractor	Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, 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.

Printer's Log. No.
N24570A
W850/R6751/57570 6/7/6/6/4/3200

N 2 4 5 7 0 A 0 1 1 6

Turn over

edexcel
advancing learning, changing lives

Leave blank

1. A student is working on a spreadsheet to model the fall of a golf ball from rest from the window of a tall building.

(a) He assumes that the acceleration remains constant at 9.81 m s^{-2} for the first two seconds of the fall. Comment on whether this is a reasonable assumption.

....

....
(1)

	A	B	C	D
1	time from start / s	velocity reached / m s^{-1}	distance fallen during 0.20 s time interval / m	total distance from the start / m
2				
3	0.00	0.00	0.00	0.00
4	0.20	1.96	0.20	0.20
5	0.40	3.92	0.59	0.78
6	0.60	5.89	0.98	1.77
7	0.80	7.85	1.37	3.14
8	1.00	9.81	1.77	4.91
9	1.20	11.77	2.16	7.06
10	1.40	13.73	2.55	9.61
11	1.60	15.70	2.94	12.56
12	1.80	17.66	3.34	15.89
13	2.00	19.62	3.73	19.62

(b) Cell B6 is calculated using the formula B6 = 9.81*A6. Explain why this is appropriate.

....

....

....

....
(2)

(c) Cell C7 is calculated using the formula C7 = ((B6+B7)/2)*0.20.

(i) Explain what (B6+B7)/2 represents.

....

....
(1)

Leave blank

(ii) Why is this fraction multiplied by 0.20?

....

....
(1)

(d) Give an appropriate spreadsheet formula that uses cell D9 to calculate cell D10.

....

....
(1)

(e) You can check that this spreadsheet model is giving sensible answers for the total distance fallen by calculating the distance using an equation from the list of formulae at the back of the paper. Calculate the answer for cell D11.

....

....

....

....
(2)

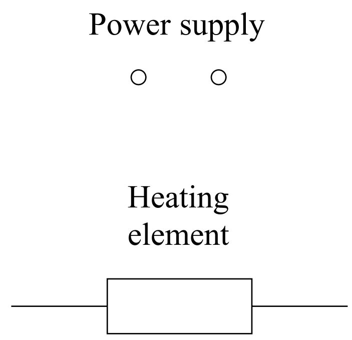
Q1

(Total 8 marks)

Leave blank

2. A student connects a circuit to find the resistance of a washing machine heating element.

(a) Complete the circuit diagram below and explain how he uses it to obtain the necessary measurements to calculate resistance.



....

....

....

(2)

(b) The following results are obtained.

Voltage = 3.00 V

Current = 0.12 A

Calculate the resistance of the element from these values.

....

....

....

Resistance = ...

(2)

Leave blank

(c) The element is marked “1800 W, 230 V”.

Calculate the resistance of the element in normal use.

....

....

....

Resistance = ...

(2)

(d) Explain why the two values of resistance you have calculated are different.

....

....

....

....

(2) **Q2**

(Total 8 marks)

Leave blank

3. Sodium street lamps are usually red when first switched on in the evening. After several minutes they take on their normal yellow colour.

In these lamps, light is emitted as a current passes through the sodium vapour. However, when the lamp is first switched on the sodium is solid, so little vapour is present until it warms up. The red colour in the first few minutes is due to neon gas which the lamp also contains.

(a) Explain how atoms in a vapour emit light.

....

....

....

....

....

(2)

(b) The light appears yellow because the spectrum of the sodium is dominated by two lines with wavelengths of 589.0×10^{-9} m and 589.6×10^{-9} m respectively.

(i) Explain what is meant by a spectral line.

....

....

....

....

(1)

(ii) Calculate the frequency of the light with a wavelength of 589.0×10^{-9} m.

....

....

Frequency = ...

(2)

Leave blank

(c) The light emitted by neon vapour appears red. Explain why atoms of different elements produce light of different colours.

....

....

....

....

....

....

(3)

(d) Light is a transverse wave. Explain the meaning of transverse.

....

....

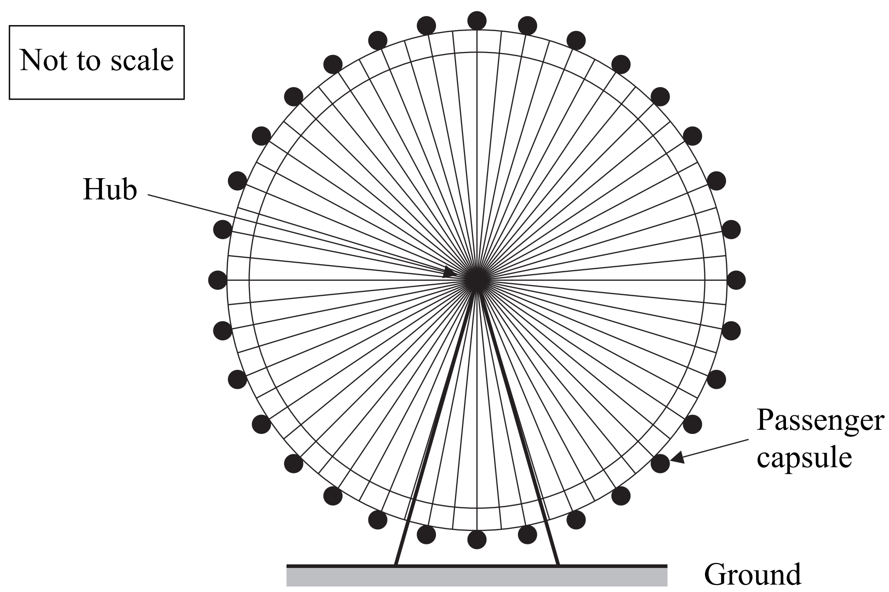
(1)

Q3

(Total 9 marks)

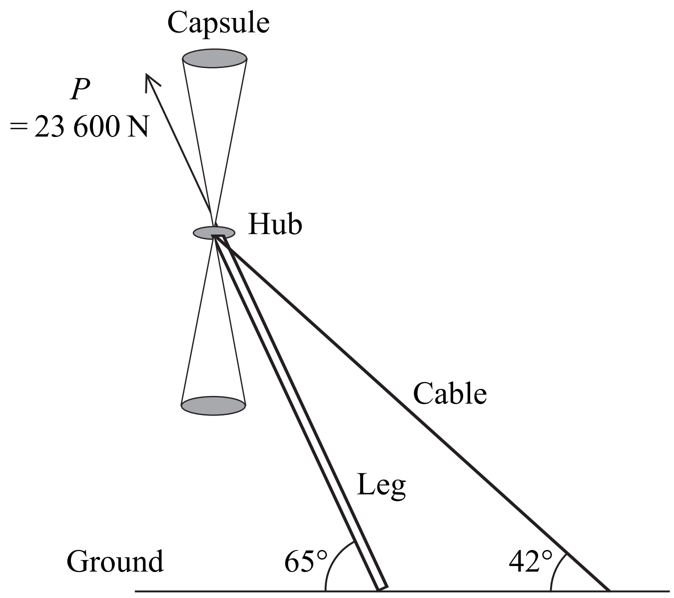
4. The London Eye is like a giant bicycle wheel supported in a vertical position, as shown in Figure 1.

Figure 1



This question is about modelling one way of supporting the wheel. In this model there is just one leg supporting the axle, and one cable exerting enough tension to hold the wheel upright, as shown in Figure 2 below.

Figure 2



The total weight W of the wheel and passengers is 12 400 N. Assume that the weights of the leg and cable are negligible.

In this model we will assume that there are only three forces acting on the wheel: its weight W, the tension from the cable T and the push from the leg P.

(a) The direction of P is marked on Figure 2. Use labelled arrows to show the direction of W and the direction of T.

(2)

N 2 4 5 7 0 A 0 8 1 6

Leave blank

(b) The magnitude of P is 23 600 N. Calculate the horizontal component of P.

....

....

Horizontal component of P = ...

(2)

(c) (i) State the magnitude of the horizontal component of T.

Horizontal component of T = ...

(1)

(ii) Calculate the magnitude of T.

....

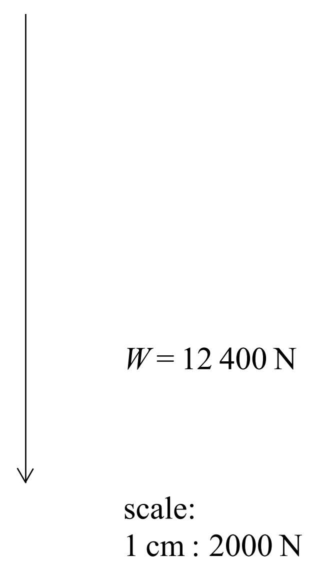
....

....

Magnitude of T = ...

(2)

(d) Complete the drawing to find the resultant of W and P.



Magnitude of resultant = ...

Angle of resultant with horizontal = ...

(4)

(e) State one other force which might act on the real wheel.

....

....

(1)

(Total 12 marks)

Leave blank

Q4

Leave blank

5. A student decides to find the efficiency of a lamp at producing light by measuring how much energy it wastes as heat. The lamp is connected in a circuit and placed, upside down, in a beaker of water, and the temperature rise of the water is measured. [Do **not** try this at home.]

mass of water	0.150 kg
initial temperature of water	20.5 °C
final temperature of water	69.5 °C
voltage across lamp	11.8 V
current through lamp	1.85 A
time for which lamp switched on	1800 s
specific heat capacity of water	4180 J kg^{-1} $°C^{-1}$

(a) Show that the electrical energy supplied to the lamp is about 39 000 J.

....

....

....

....

(2)

(b) Show that the heat energy gained by the water is about 31 000 J.

....

....

....

....

(2)

(c) Calculate the efficiency of the bulb at converting electrical energy to light.

....

....

....

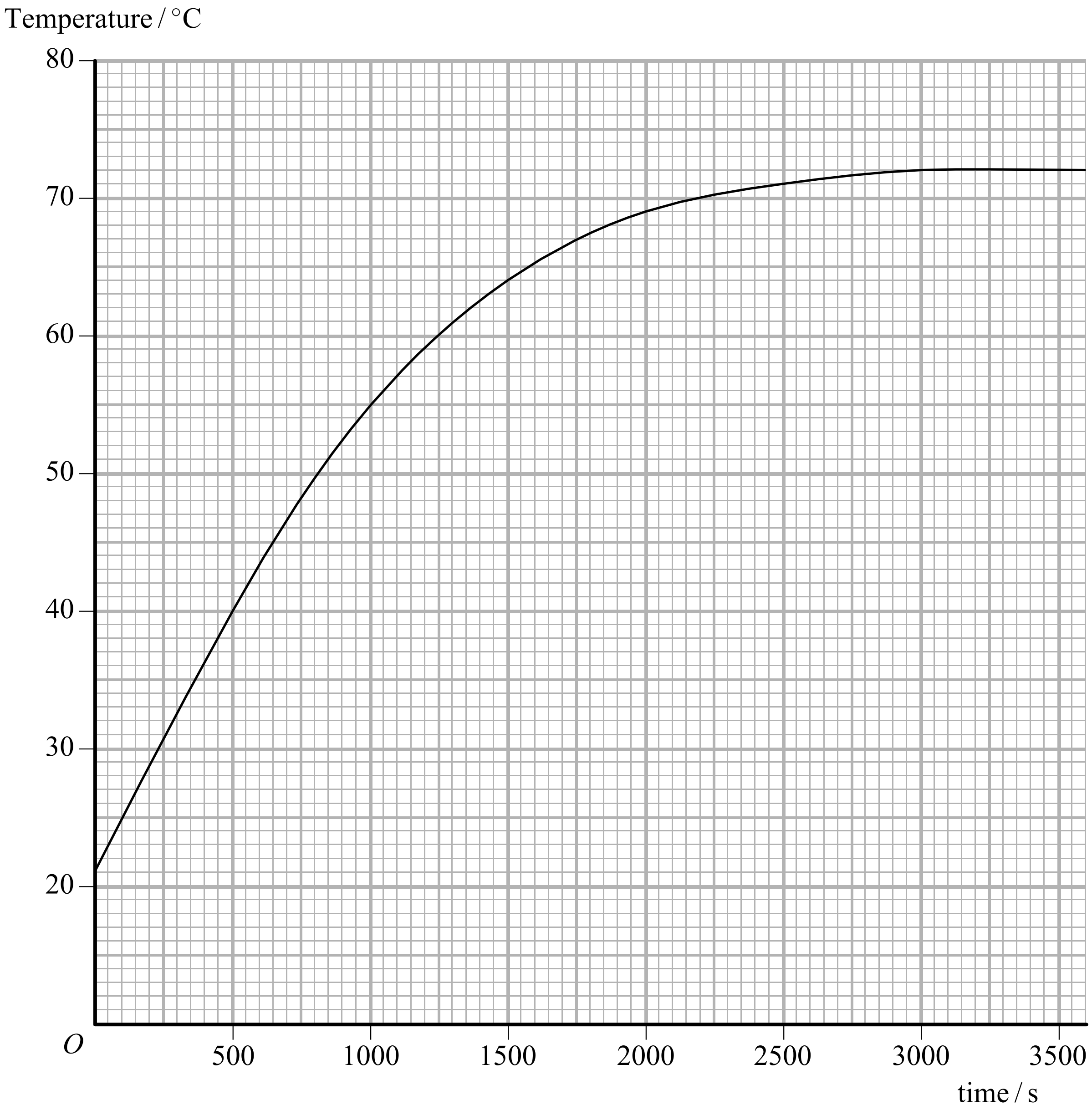
....

Efficiency = ...

(3)

Leave blank

(d) The experiment is repeated, recording the temperature at regular intervals for 1 hour. The graph shows the results.



(i) Explain the shape of the graph.

....

....

....

....

....

(3)

Leave blank

(ii) Students A and B study the graph. Student A suggests that a better value of the efficiency can be obtained by using the results for the complete hour. Student B says that it would be better to use the results only for the first 10 minutes. Explain who is correct.

....

....

....

....

....

....

(2)

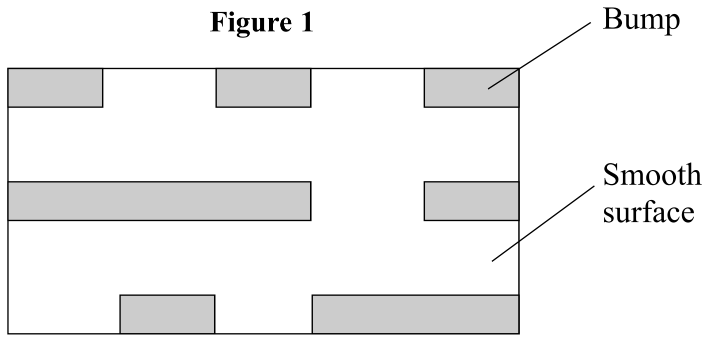
Q5

(Total 12 marks)

Leave blank

6. Figure 1 shows an enlargement of a small rectangular area of the surface of a compact disc (CD). It shows a series of small bumps on an otherwise smooth surface.

Figure 1



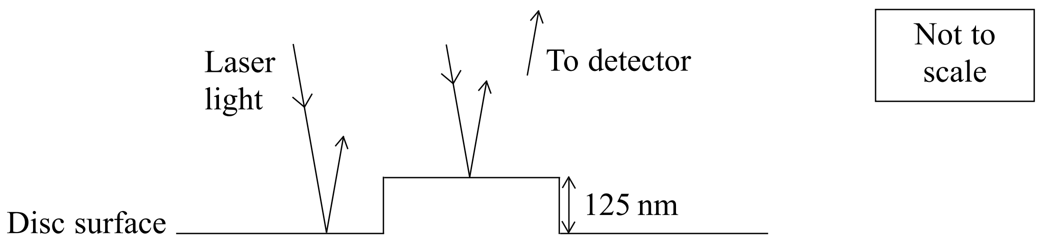
(a) Information is stored on the surface in digital form. Explain the meaning of the word digital.

....

(1)

The presence or absence of a bump is detected by shining laser light perpendicularly onto the disc surface. Where there is a bump, some of the light hits the top of the bump, and some hits the disc surface next to the bump.

Figure 2



The height of the bumps on the surface of the disc is 125 nm. The wavelength of the light used to read the disc is 500 nm.

(b) Explain whether the light received by the detector when a bump is present has a maximum or minimum intensity.

....

....

....

....

(3)

N 2 4 5 7 0 A 0 1 4 1 6

Leave blank

(c) For this detection system to work, the light reflected from the disc must be coherent. Explain the meaning of coherent.

....

....

....

(1)

(d) The laser light is sent through a lens, with the compact disc positioned a distance from the lens equal to the focal length of the lens. State what is meant by focal length.

....

....

....

....

....

(2)

(e) (i) The rectangle represents an area of $1.7 \times 10^{-11}\,m^2$ on the CD. The full area for information storage on a CD is $9.0 \times 10^{-3}\,m^2$. The total number of bits on this CD is 8.1×10^9. Calculate the number of bits of data within this rectangle.

....

....

....

....

Number of bits = ...

(2)

(ii) Number the bits on Figure 1 to confirm this answer.

(2)

Q6

(Total 11 marks)

TOTAL FOR PAPER: 60 MARKS

END

List of data, formulae and relationships

Data

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

Unit 1

Physics at work, rest and play

Mechanics

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

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

Momentum and 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 $P = 1/f$

N 2 4 5 7 0 A 0 1 6 1 6