Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	7	3	1	/	0	1	Signature	

Paper Reference(s)

6731/01

Edexcel GCE

Physics

Advanced Subsidiary

Unit Test PHY1

Friday 9 June 2006 – 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	
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 signature, your surname and initial(s).
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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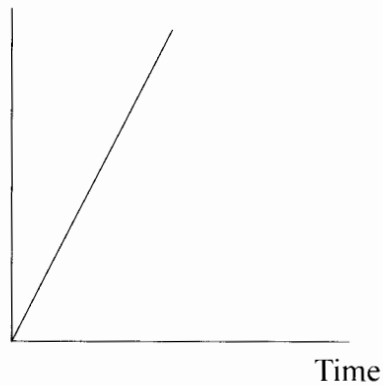
1. What physical quantity does the gradient of each of the following graphs represent? Give your answers in the table below the graphs.

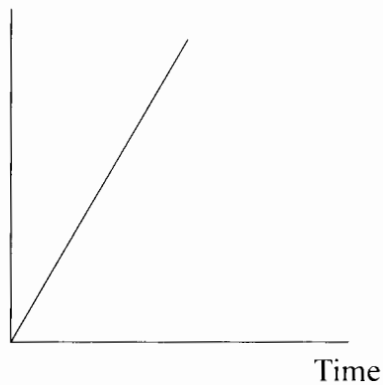
(i)

Displacement



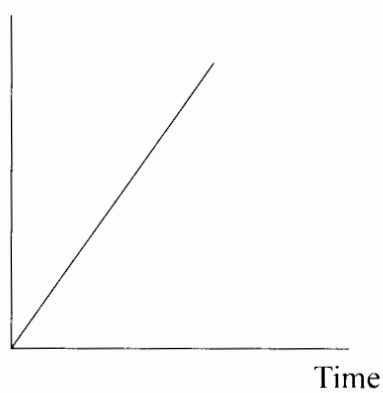
(ii)

Velocity



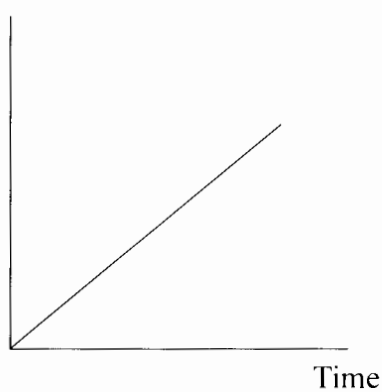
(iii)

Momentum



(iv)

Work done



Graph	Physical quantity represented by the gradient
(i)	
(ii)	
(iii)	
(iv)	

Q1

(Total 4 marks)

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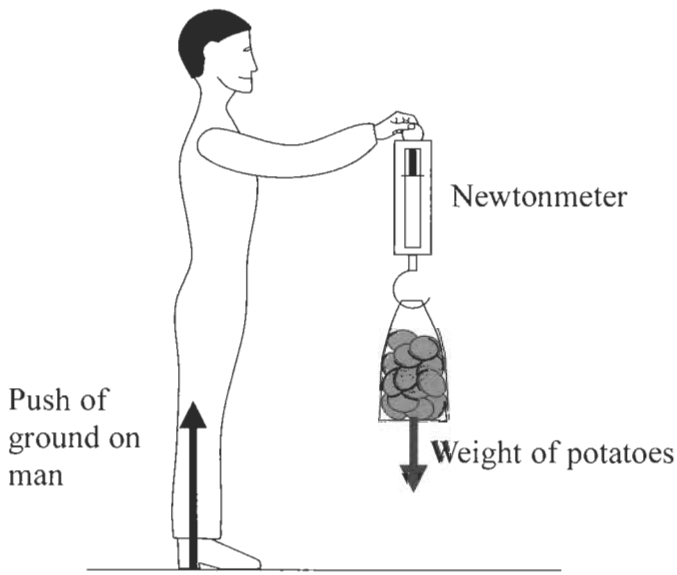
2. (a) Complete the following statement of Newton's third law of motion.

"If body A exerts a force on body B, then body B .....

.....".

(2)

(b) A man checks the weight of a bag of potatoes with a newtonmeter. Two of the forces acting are shown in the diagram.



The table below gives these forces. For each force there is a corresponding force, the 'Newton's third law pair force'. In each case state

- the body that the Newton's third law pair force acts upon
- the type of force (one has been done for you)
- the direction of the Newton's third law pair force.

Force	Body the Newton's third law pair force acts upon	Type of force	Direction of the Newton's third law pair force
Weight of potatoes			
Push of ground on man		Normal contact force	

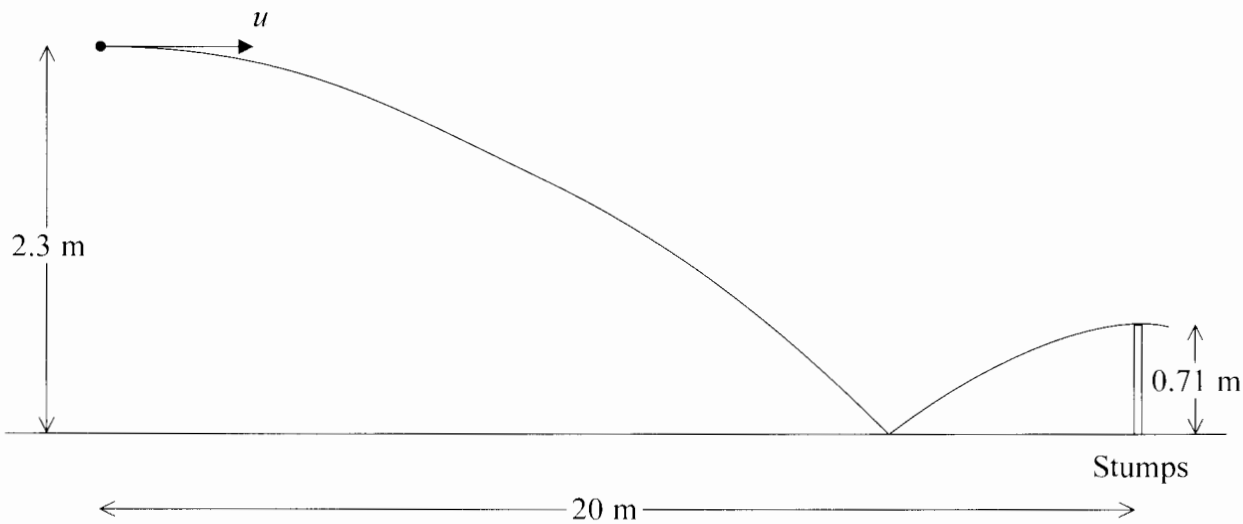
(3)

Q2

(Total 5 marks)

Leave blank

3. A cricketer bowls a ball from a height of 2.3 m. The ball leaves the hand horizontally with a velocity u. After bouncing once, it passes just over the stumps at the top of its bounce. The stumps are 0.71 m high and are situated 20 m from where the bowler releases the ball.



(a) Show that from the moment it is released, the ball takes about 0.7 s to fall 2.3 m.

.....

.....

.....

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.....

(2)

(b) How long does it take the ball to rise 0.71 m after bouncing?

.....

.....

.....

.....

.....

.....

Time = ...

(3)

Leave blank

(c) Use your answers to parts (a) and (b) to calculate the initial horizontal velocity u of the ball. You may assume that the horizontal velocity has remained constant.

.....

.....

.....

.....

Velocity = ...

(2)

(d) In reality the horizontal velocity would not be constant. State one reason why.

.....

.....

(1)

Q3

(Total 8 marks)

Leave blank

4. (a) State Newton's second law of motion in terms of momentum.

.....

.....

.....

.....

(2)

(b) A wind blows steadily against a tree. The area of the tree perpendicular to the direction of the wind is $10\,m^2$ and the velocity of the wind is $20\,m\,s^{-1}$.

(i) Show that the mass of air hitting the tree each second is about 250 kg. (Density of air is $1.23\,kg\,m^{-3}$.)

.....

.....

.....

.....

(2)

(ii) Calculate the momentum of this mass of air when it is moving at $20\,m\,s^{-1}$.

.....

.....

Momentum = ...

(iii) Assuming that all the air is stopped by the tree, state the magnitude of the force exerted on the tree by the wind.

.....

Force = ...

(2) **Q4**

(Total 6 marks)

Leave blank

5. (a) State the principle of moments.

.....

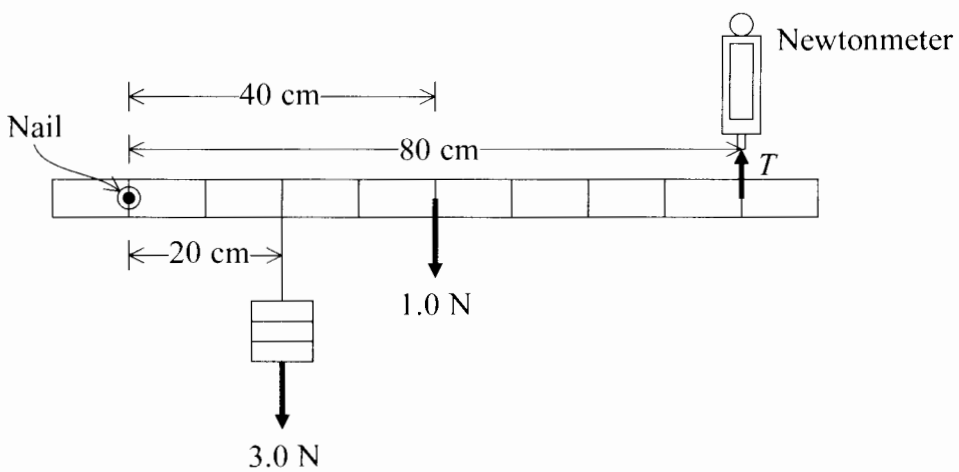
.....

.....

.....

(2)

(b) A metre rule of weight 1.0 N is pivoted on a nail passing through a hole drilled at the 10 cm mark. A weight of 3.0 N is suspended at the 30 cm mark. A newtonmeter supports the rule at the 90 cm mark so that it is horizontal.



(i) Use the principle of moments to calculate the magnitude of force T needed to keep the rule horizontal.

.....

.....

.....

Force T = ...

(2)

(ii) The nail exerts a force on the rule. Determine the size and direction of this force.

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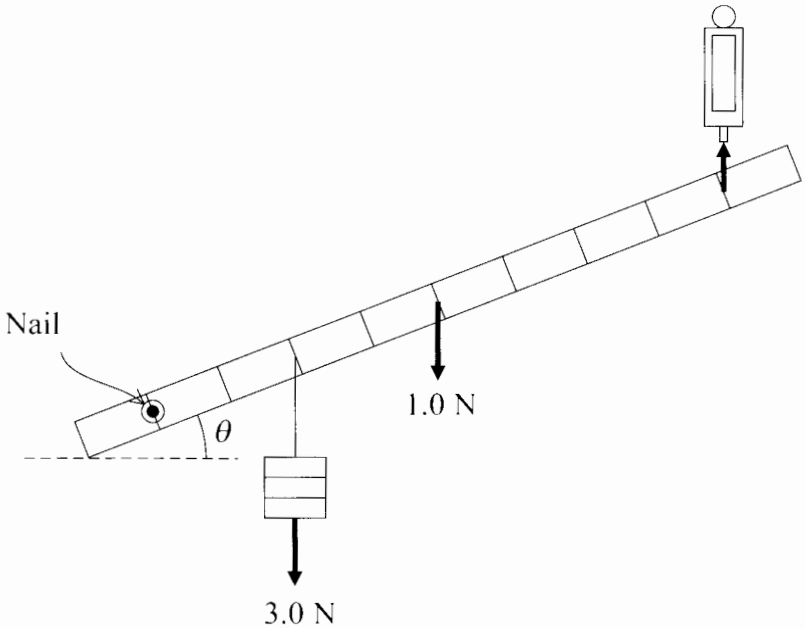
.....

(2)

Leave blank

(iii) The newtonmeter is raised until the rule makes an angle θ with the horizontal.



Without doing any further calculations, compare the magnitude of the force provided by the newtonmeter in this new position with the force T when the rule was horizontal. Explain your answer.

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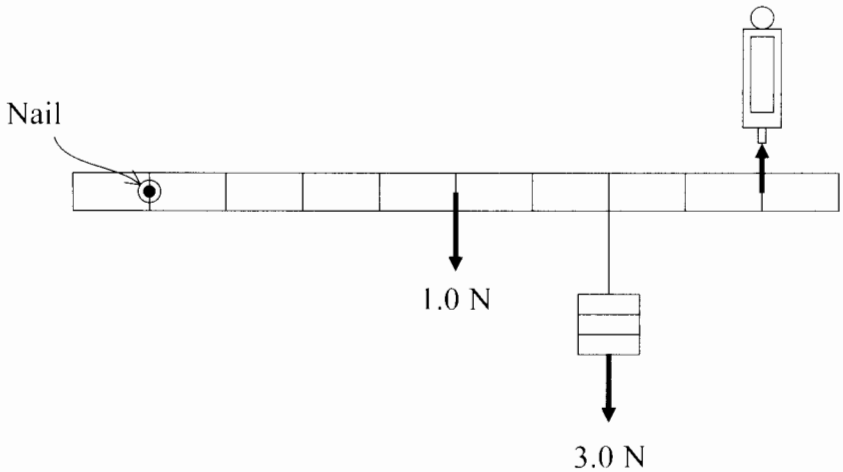
(2)

Leave blank

(iv) With the rule horizontal, the 3.0 N weight is placed in the new position shown.



Without doing any further calculations, explain what happens to the force exerted by the newtonmeter. You may be awarded a mark for the clarity of your answer.

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(4) **Q5**

(Total 12 marks)

Leave blank

6. A weightlifter raised a bar of mass of 110 kg through a height of 2.22 m. The bar was then dropped and fell freely to the floor.

(i) Show that the work done in raising the bar was about 2400 J.

.....

.....

.....

(2)

(ii) It took 3.0 s to raise the bar. Calculate the average power used.

.....

.....

.....

Power = ...

(2)

(iii) State the principle of conservation of energy.

.....

.....

.....

(2)

Leave blank

(iv) Describe how the principle of conservation of energy applies to

(1) lifting the bar,

(2) the bar **falling** to the floor. Do not include the impact with the floor.

(1) .....

.....

.....

(2) .....

.....

.....

.....

(3)

(v) Calculate the speed of the bar at the instant it reaches the floor.

.....

.....

.....

.....

Speed = ...

(3)

Q6

(Total 12 marks)

Leave blank

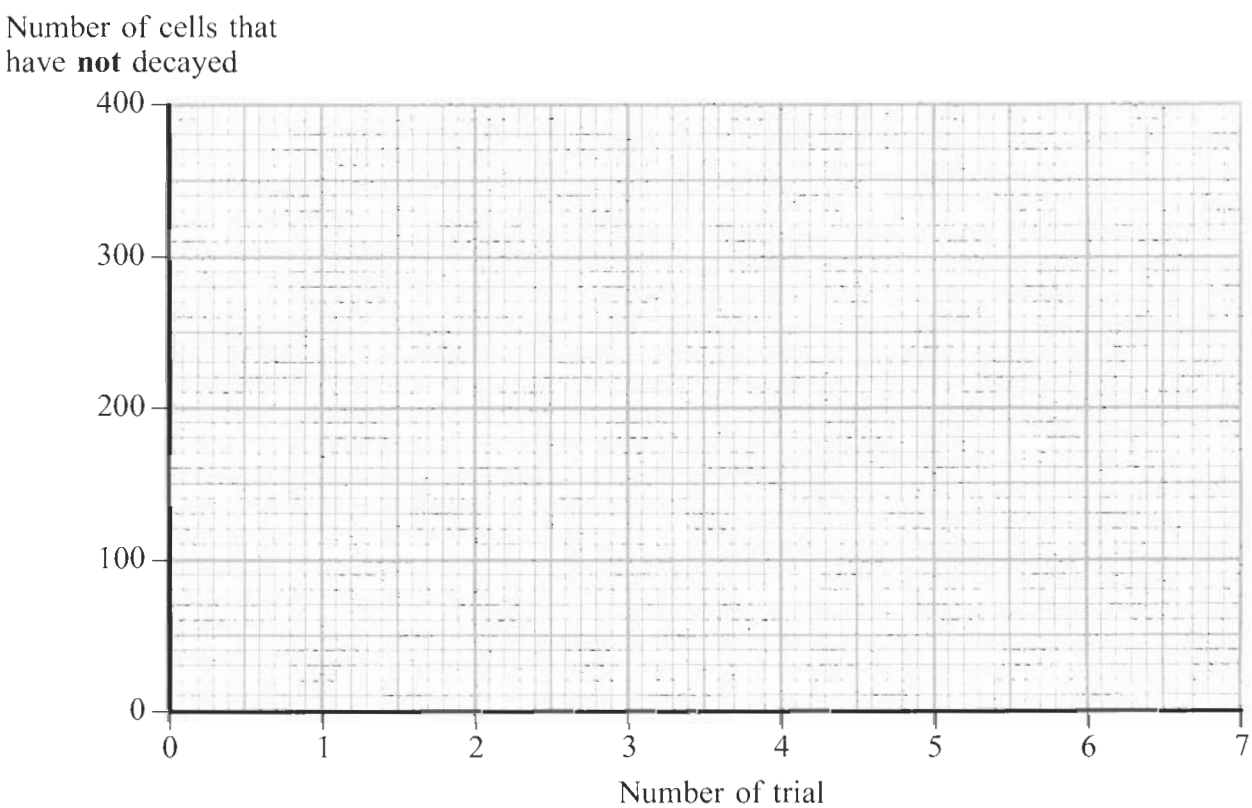
7. A student uses a computer program to model radioactive decay. The program draws a grid of 300 cells on the computer screen.

A letter can be generated at random in each cell. If a vowel (a, e, i, o, u) is generated, the cell is considered to have 'decayed' and is not available for the next trial of the decay process.

The table shows the number of the trial along with the number of cells which have **not** decayed.

Number of trial	Number of cells that have **not** decayed
0	300
1	242
2	196
3	158
4	128
5	103
6	83

(i) On the grid below, plot these data and draw the line of best fit through your points.



(2)

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(ii) What is meant by the term **half-life** of a radioactive nuclide?

.....

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.....

(iii) Use your graph to find the 'half-life' in terms of the number of trials of this computer model of radioactive decay.

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.....

Half-life = ... trials

(3)

(iv) In what way is this model **similar** to radioactive decay?

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.....

.....

(1)

(v) In what way is this model **different** from radioactive decay?

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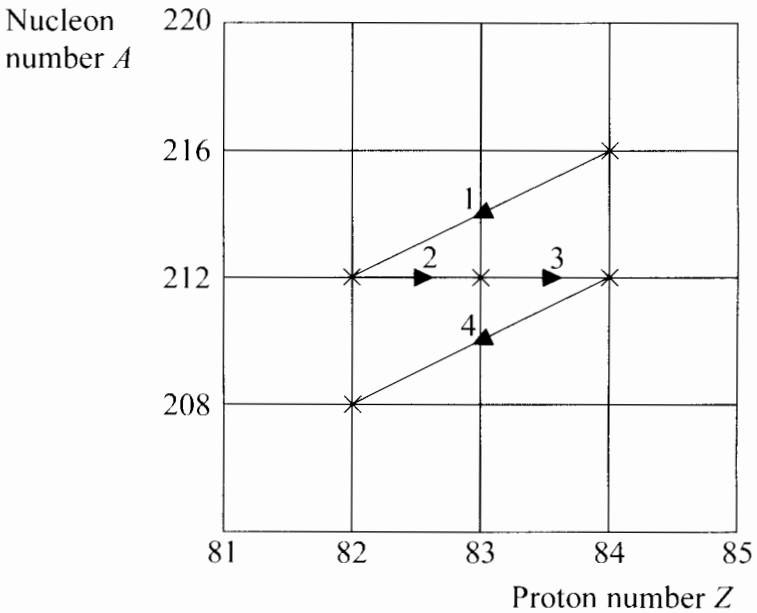
(1) **Q7**

(Total 7 marks)

Leave blank

8. The final four stages of the naturally occurring thorium-232 decay series are shown. The series ends with a stable isotope of lead, $^{208}_{82}Pb$.



(i) What are isotopes?

.....

.....

.....

(2)

(ii) Write down the symbol for the unstable isotope of lead which is part of the series shown.

.....

(1)

(iii) Complete the table to show the missing information.

Decay path	Change of A	Change of Z	Type of decay
1			
2			

(3)

Q8

(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)

Rectilinear motion

For uniformly accelerated motion:

$$v = u + at$$

$$x = ut + \tfrac{1}{2}at^2$$

$$v^2 = u^2 + 2ax$$

Forces and moments

$$\text{Moment of } F \text{ about O} = F \times (\text{Perpendicular distance from } F \text{ to O})$$

$$\begin{array}{l}\text{Sum of clockwise moments}\\ \text{about any point in a plane}\end{array} = \begin{array}{l}\text{Sum of anticlockwise moments}\\ \text{about that point}\end{array}$$

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	$A = \lambda N$	(Decay constant λ)
Half-life	$\lambda t_{\frac{1}{2}} = 0.69$	

Experimental physics

$$\text{Percentage uncertainty} = \frac{\text{Estimated uncertainty} \times 100\%}{\text{Average value}}$$

Mathematics

$$\sin(90° - \theta) = \cos\theta$$

Equation of a straight line $\quad y = mx + c$

Surface area $\quad$ cylinder $= 2\pi rh + 2\pi r^2$

$\quad$ sphere $= 4\pi r^2$

Volume $\quad$ cylinder $= \pi r^2 h$

$\quad$ sphere $= \frac{4}{3}\pi r^3$

For small angles: $\quad \sin\theta \approx \tan\theta \approx \theta$ (in radians)

$\quad \cos\theta \approx 1$

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