Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

For Examiner's Use

General Certificate of Education
June 2008
Advanced Subsidiary Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

PHYSICS (SPECIFICATION B) **PHB1**
Unit 1 Foundation Physics

Thursday 22 May 2008 1.30 pm to 3.00 pm

For this paper you must have:
- a pencil and a ruler
- a calculator
- a formulae sheet insert.

Time allowed: 1 hour 30 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in **Section A** and **Section B**.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Show all your working.

Information
- The maximum mark for this paper is 75.
- The marks for questions are shown in brackets.
- A *Formulae Sheet* is provided as a loose insert to this question paper.
- You are expected to use a calculator where appropriate.
- Questions 7(b) and 10 should be answered in continuous prose. In these questions you will be marked on your ability to use good English, to organise information clearly and to use specialist vocabulary where appropriate.

Advice
- You are advised to spend about 30 minutes on **Section A** and about 1 hour on **Section B**.

For Examiner's Use			
Question	Mark	Question	Mark
A		6	
		7	
		8	
		9	
		10	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

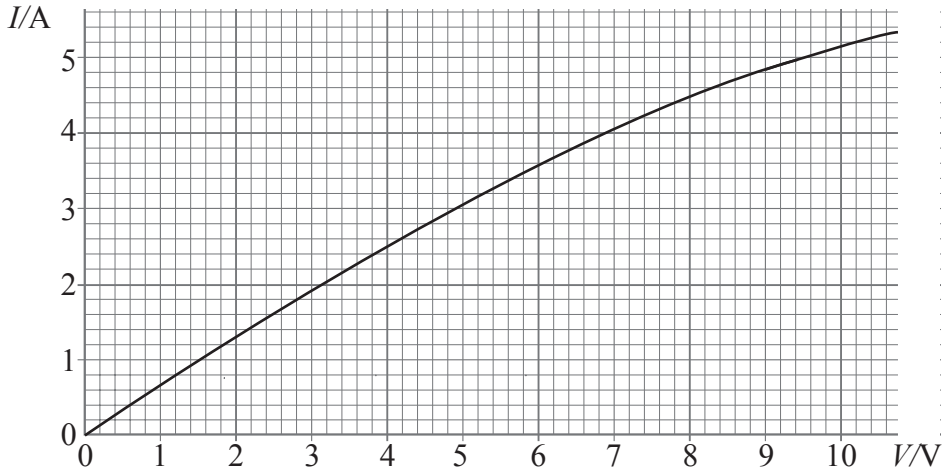
SECTION A

Answer **all** questions in the spaces provided.

There are 26 marks in this section.

1 **Figure 1** is a current-voltage graph for a metallic resistor.

Figure 1



1 (a) Calculate the resistance of the resistor when the voltage is 3.0 V.

resistance.....

(2 marks)

1 (b) Explain why the gradient of the graph in **Figure 1** decreases as the voltage increases.

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(2 marks)

2 (a) (i) Define the potential difference between two points in a circuit.

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2 (a) (ii) Define the volt.

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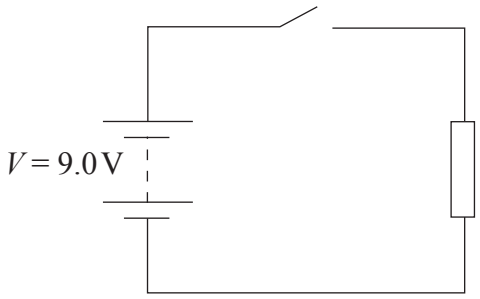
(2 marks)

2 (b) When the switch is closed, the current in the circuit in **Figure 2** is 1.3 A.
The circuit is on for 12 minutes.

Figure 2



2 (b) (i) Calculate the total charge that passes a point in the circuit while the circuit is on.

charge ……..

2 (b) (ii) Calculate the energy transformed in the resistor while the circuit is on.

energy ……

(4 marks)

Turn over ▶

3 A thermistor has a negative temperature coefficient of resistance. The resistance can vary between 50 Ω and 1200 Ω. An LDR has a resistance that can vary between 240 Ω and 900 Ω.

3 (i) Calculate the maximum possible resistance of a combination of the thermistor and the LDR.

maximum resistance.....

3 (ii) Calculate the minimum possible resistance of a combination of the thermistor and the LDR.

minimum resistance ……..

3 (iii) State the physical conditions in which the thermistor and the LDR have to be placed to achieve the maximum resistance of the combination.

physical condition for thermistor .....

physical condition for LDR .....

(6 marks)

4 (i) The resistance wire in a heating coil has 1.7×10^{28} free electrons per m^3.
It carries a current of 6.3 A and has a cross-sectional area of $2.5 \times 10^{-6}\ m^2$.
Calculate the mean drift velocity of the electrons in the resistance wire.
electron charge $e = -1.6 \times 10^{-19}$ C

drift velocity .....

4 (ii) The copper cables supplying current to the resistance wire are likely to have a smaller resistance per unit length than the resistance wire.
State **two** reasons why.

first reason .....

.....

second reason .....

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(5 marks)

5 (a) Explain why electrical telephone wires need repeater stations every few kilometres.

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(3 marks)

5 (b) State **two** examples of the use of remote sensing in data collection on the Earth. For each use state why remote sensing is advantageous.

first use .....

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.....

second use .....

.....

.....

(2 marks)

26

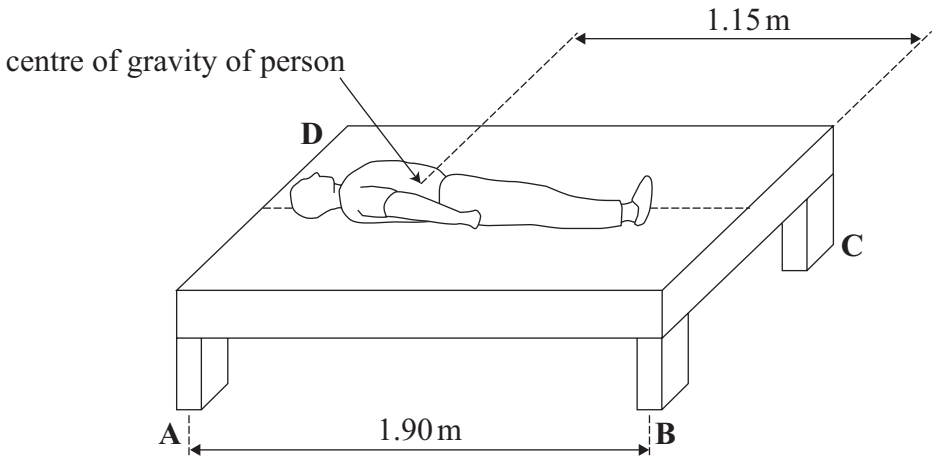
SECTION B

Answer **all** questions in this section.

There are 49 marks in this section.

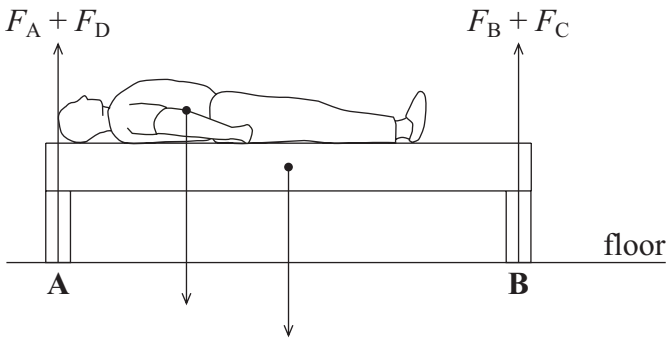
6 **Figure 3** shows a bed supported by four legs **A**, **B**, **C** and **D**. It has a uniformly distributed mass of 140 kg. A person of mass 95 kg is lying along the centre line of the bed.

Figure 3



6 (a) On **Figure 4**, the normal reactions of the floor on the legs of the bed have been drawn and labelled. Assume that the weight of the person and weight of the bed act through their respective centres of gravity.

Figure 4



6 (a) (i) Label the magnitude of the weights of the person and the bed and their distances from **A** on **Figure 4**.

gravitational field strength, $g = 9.8\,\text{N kg}^{-1}$

6 (a) (ii) By taking moments about **A**, find the magnitude of the normal reaction, F_B, of the floor on leg **B**.

F_B = ...

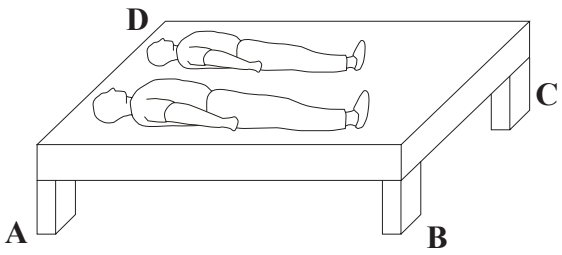
6 (a) (iii) Calculate the magnitude of the normal reaction, F_A, of the floor on leg **A**.

F_A = ...

(8 marks)

6 (b) **Figure 5** shows the same bed occupied by two people. The smaller person has a mass of 55 kg.

Figure 5



State and explain which leg of the bed exerts the smallest force on the floor.

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(2 marks)

7 Wave power is a renewable source used for generating electricity.

7 (a) Name another renewable and a non-renewable source for generating electricity.

Renewable .....

Non-renewable .....

(2 marks)

7 (b) Explain how wave power can be used to generate electricity. Go on to explain how the Sun is the origin of the energy supply. You may wish to draw a diagram to help make your explanation clear.

Two of the 7 marks are available for the quality of your written communication.

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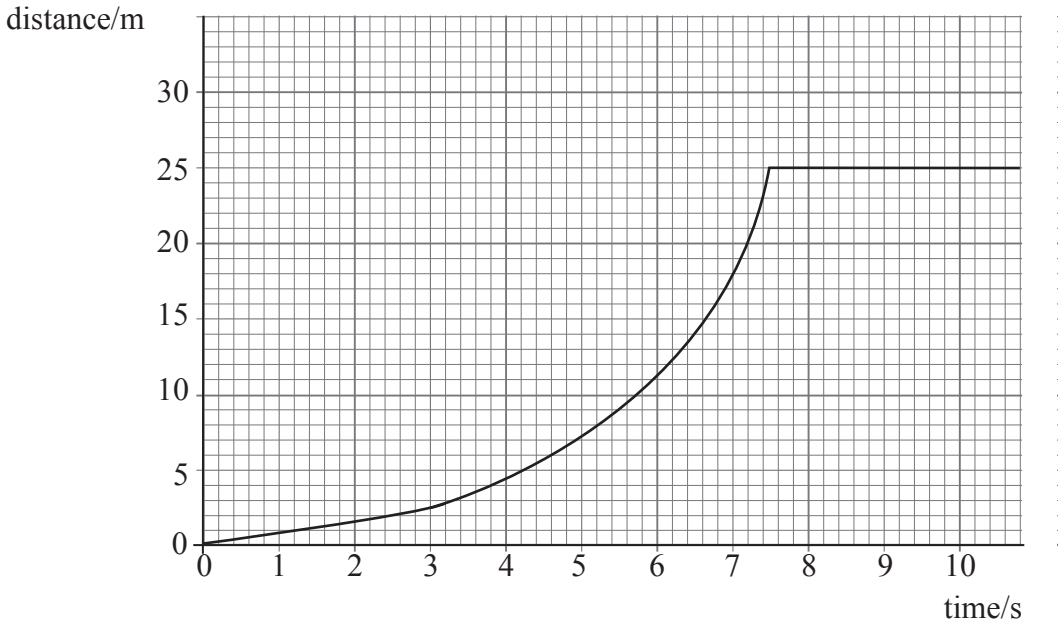
(7 marks)

9

8 **Figure 6** is a distance-time graph for an object.

Figure 6



8 (a) (i) Describe the motion of the object over the time shown by the graph.

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8 (a) (ii) Calculate the maximum speed of the object.

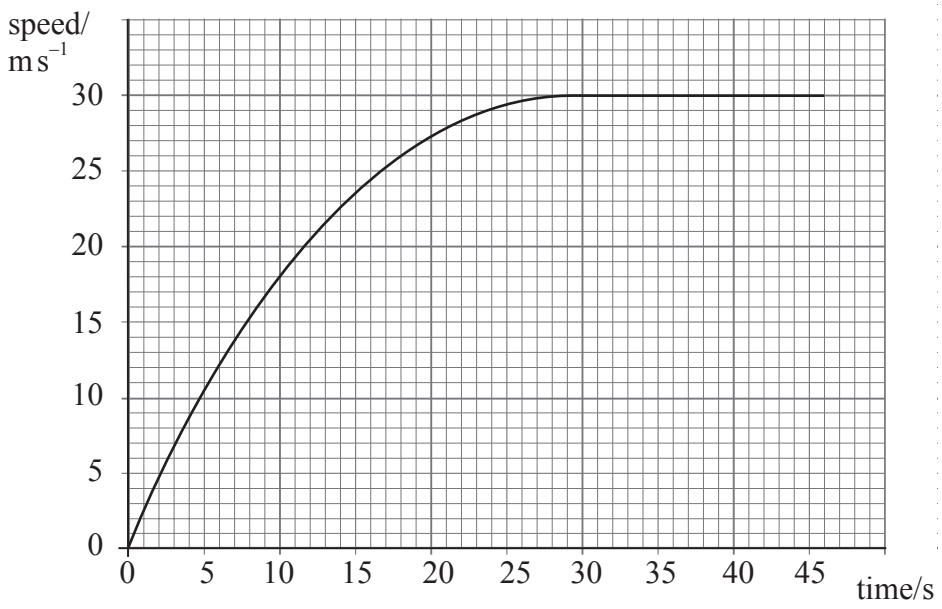
maximum speed.....

(6 marks)

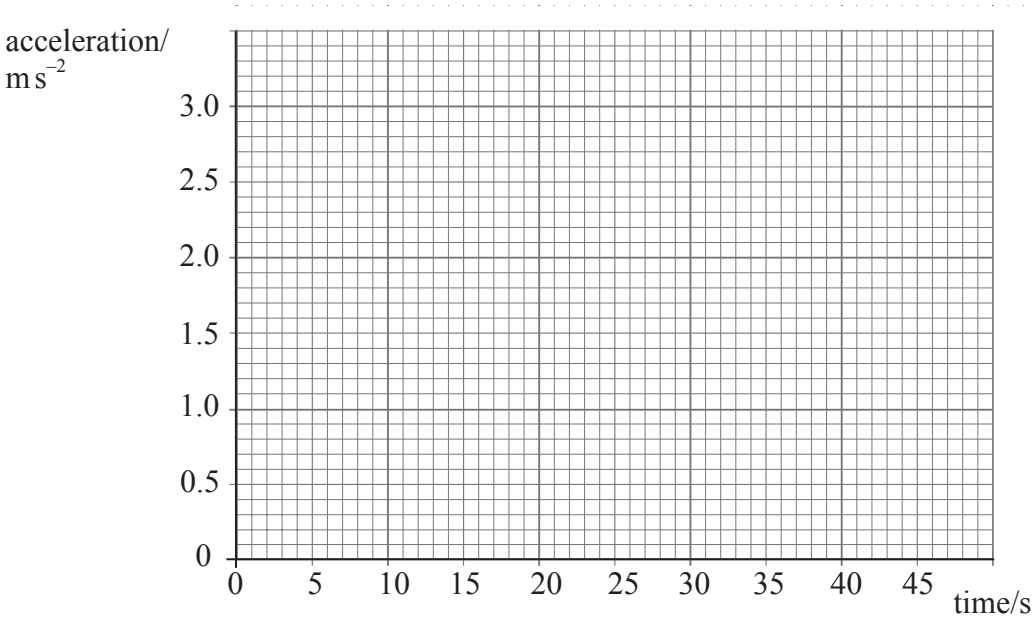
Question 8 continues on the next page

8 (b) **Figure 7** is a speed-time graph for a different object.

Figure 7



8 (b) (i) The maximum acceleration of the object from **Figure 7** is 2.9 m s^{-2}. On the axes below, draw a graph showing the variation of acceleration with time.



8 (b) (ii) Calculate the distance travelled by the object in 45 s.

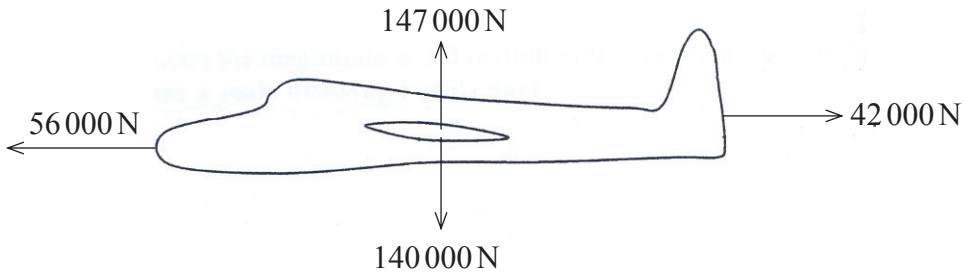
distance travelled.....

(6 marks)

12

9 **Figure 8** shows an aircraft of mass 14 300 kg in flight. The aircraft has been travelling at a constant velocity and a constant height. At the instant shown, the thrust is increased and the aircraft starts to climb. The lift, thrust, drag and weight are indicated on **Figure 8**.

Figure 8



9 (a) (i) Show that the upward acceleration of the aircraft is approximately 0.5 m s^{-2}.

9 (a) (ii) Calculate the increase in height as the aircraft climbs for 3 minutes.

increase in height.....

(6 marks)

Question 9 continues on the next page

9 (b) (i) Calculate the resultant horizontal force acting on the aircraft.

resultant horizontal force.....

9 (b) (ii) Calculate the magnitude and direction of the resultant force acting on the aircraft. **You must not use a scale drawing in this part**.

magnitude of the resultant force.....

direction of the resultant force.....

(5 marks)

11

10 Galileo is reported to have dropped a heavy cannon ball and a lighter, smaller musket ball from a tower at the same time. He observed that they both hit the ground at the same time. However, a musket ball and a table tennis ball dropped simultaneously would not hit the ground together. Explain these two sets of observations.

Two of the 7 marks are available for the quality of your written communication.

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(7 marks)

7

END OF QUESTIONS

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PHYSICS (SPECIFICATION B) **PHB1**
Unit 1 Foundation Physics

Formulae Sheet

Foundation Physics Mechanics Formulae

moment of force $= Fd$

$v = u + at$

$s = ut + \frac{1}{2}at^2$

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

$s = \frac{1}{2}(u + v)t$

for a spring, $F = k\Delta l$

energy stored in a spring $= \frac{1}{2}F\Delta l = \frac{1}{2}k(\Delta l)^2$

$T = \frac{1}{f}$

Foundation Physics Electricity Formulae

$I = nAvq$

terminal p.d. $= E - Ir$

in series circuit, $R = R_1 + R_2 + R_3 + ...$

in parallel circuit, $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + ...$

output voltage across $R_1 = \left(\frac{R_1}{R_1 + R_2}\right) \times$ input voltage

Waves and Nuclear Physics Formulae

fringe spacing $= \frac{\lambda D}{d}$

single slit diffraction minimum $\sin\theta = \frac{\lambda}{b}$

diffraction grating $n\lambda = d\sin\theta$

Doppler shift $\frac{\Delta f}{f} = \frac{v}{c}$ for $v << c$

Hubble law $v = Hd$

radioactive decay $A = \lambda N$

Properties of Quarks

Type of quark	Charge	Baryon number
up u	$+\frac{2}{3}e$	$+\frac{1}{3}$
down d	$-\frac{1}{3}e$	$+\frac{1}{3}$
$\overline{\text{u}}$	$-\frac{2}{3}e$	$-\frac{1}{3}$
$\overline{\text{d}}$	$+\frac{1}{3}e$	$-\frac{1}{3}$

Lepton Numbers

Particle	Lepton number L		
	L_e	L_μ	L_τ
e^-	1		
e^+	−1		
υ_e	1		
$\overline{\upsilon}_e$	−1		
μ^-		1	
μ^+		−1	
υ_μ		1	
$\overline{\upsilon}_\mu$		−1	
τ^-			1
τ^+			−1
υ_τ			1
$\overline{\upsilon}_\tau$			−1

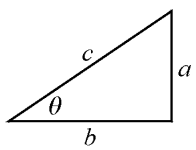
Geometrical and Trigonometrical Relationships

circumference of circle $= 2\pi r$

area of a circle $= \pi r^2$

surface area of sphere $= 4\pi r^2$

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



$\sin\theta = \frac{a}{c}$

$\cos\theta = \frac{b}{c}$

$\tan\theta = \frac{a}{b}$

$c^2 = a^2 + b^2$

This insert page should **not** be sent to the examiner