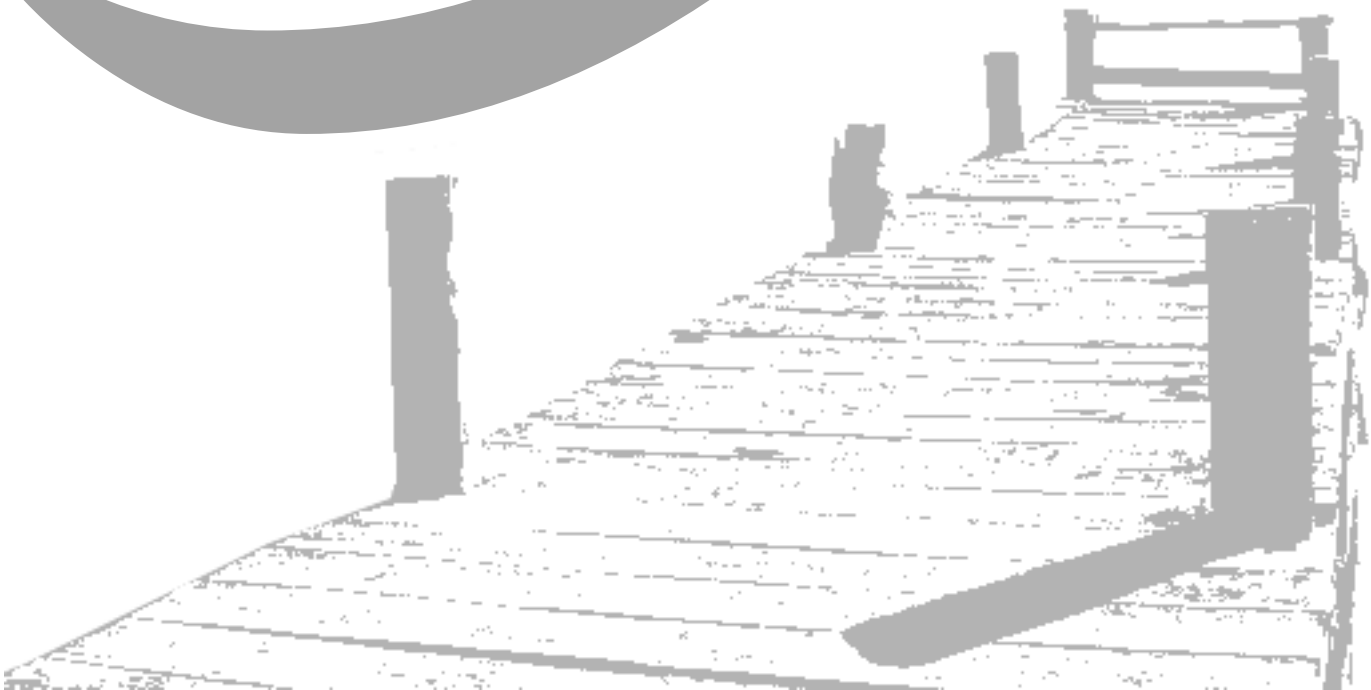
GCE
AS and A Level

Physics B: Physics In Context

AS exams 2009 onwards
A2 exams 2010 onwards

Unit 2: Approved specimen question paper

Version 1.1



Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

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General Certificate of Education
2009
Advanced Subsidiary Examination

AQA
ASSESSMENT and QUALIFICATIONS ALLIANCE

version 1.1

PHYSICS IN CONTEXT PHYB2
Unit 2 Physics Keeps us Going:

Module 1 Moving People, People Moving
Module 2 Energy and the Environment

SPECIMEN PAPER

Time allowed: 1 ¼ hours

Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- A *Formulae and Data Booklet* is provided as a loose insert.

Information
- The maximum mark for this paper is 70.
- The marks for the questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers. You will be assessed on the quality of your written communication where indicated in the question.

For Examiner's Use			
Number	Mark	Number	Mark
1		7	
2		8	
3		9	
4		10	
5		11	
6		12	
Total (Column 1)			
Total (Column 2)			
TOTAL			
Examiner's Initials			

Section A. There are 20 marks in this section.

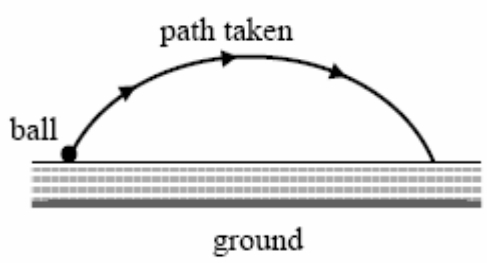
Answer **all** questions in the spaces provided.

1 A consumer pays for the number of units of electricity used. A unit is one kilowatt-hour (kW h). Calculate the number of joules in 1 kW h?

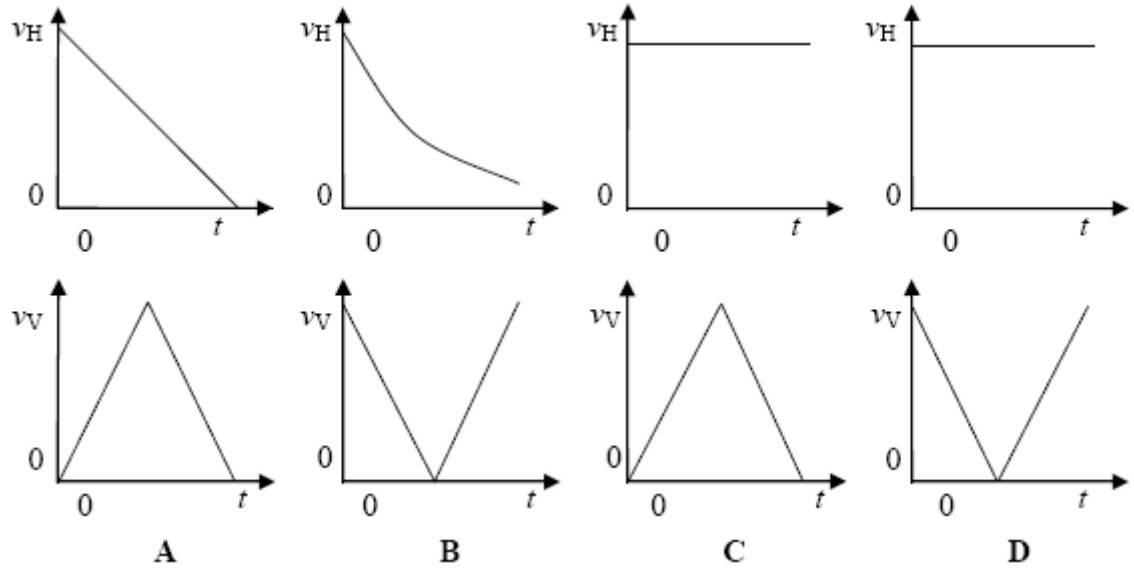
energy……J
(1 mark)

2 **Figure 1** shows the path of a ball.

Figure 1



Which pair of the following graphs best represents the variations of the horizontal and vertical speeds v_H and v_V of the ball with time t, assuming that air resistance is negligible?



answer **A, B, C or D**……
(1 mark)

3 Explain why some of the melting ice in the arctic regions does not produce a rise in the water level of the oceans.

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(2 marks)

4 When transmitting electricity, energy is lost owing to the resistance of the cables. Calculate the resistance of a 200 km of copper cable with cross sectional area 1.5×10^{-5} m^2.

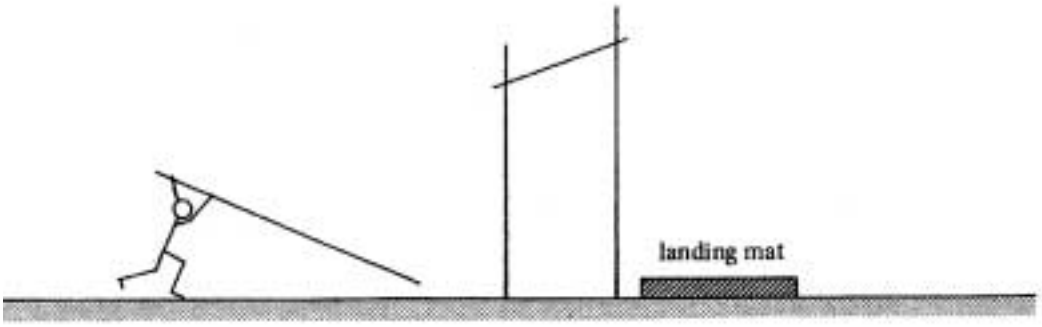
resistivity of copper = 1.7×10^{-8} Ω m

resistance …….

(3 marks)

5 **Figure 2** shows an athlete of mass 65 kg about to perform a pole vault.

Figure 2



The centre of mass of the athlete rises 4.2 m during the vault.

(a) Calculate the change in potential energy of the athlete between take off and reaching the highest point.

change in potential energy…….J
(2 marks)

(b) Assuming that the centre of mass falls the same distance when falling. Calculate the vertical speed, in m s^{-1}, of the athlete when he lands.

vertical speed……m s^{-1}
(2 marks)

(c) Explain how the landing mat reduces the force experienced by the athlete to an acceptable level when landing.

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(2 marks)

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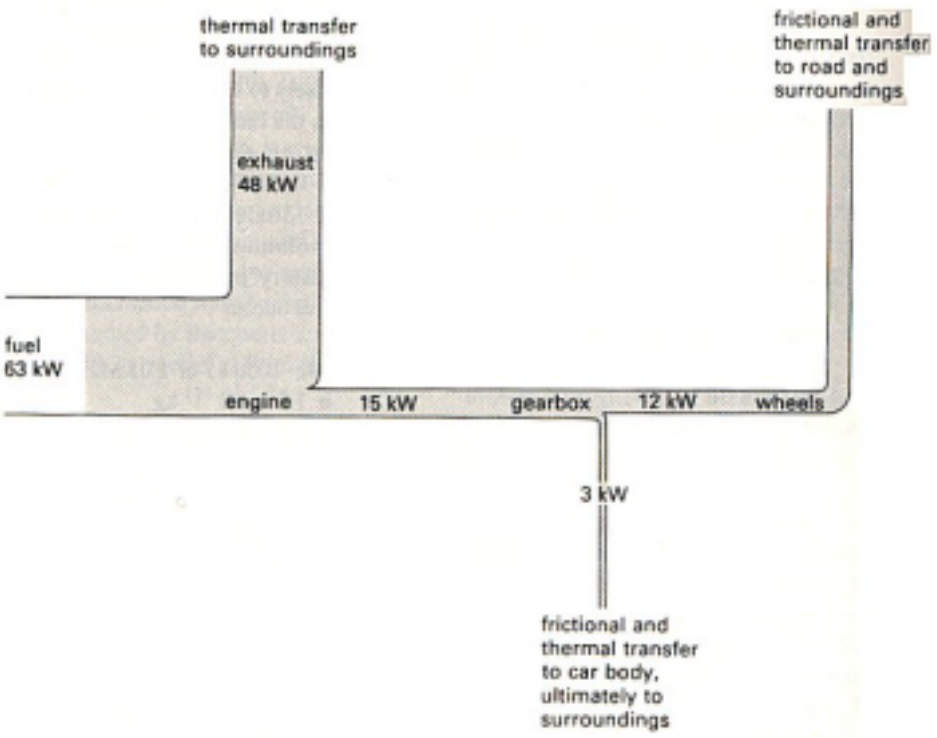
6 **Figure 3** shows a Sankey diagram for a car engine.

Figure 3



(a) Calculate the efficiency of the engine.

efficiency……

(2 marks)

(b) How would a Sankey diagram for a more efficient engine with the same power input differ from the one shown in **Figure 3**?

……

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……

(2 marks)

7 The temperature difference between the inside and outside surface of the skylight of 12 K.

(a) Calculate the energy per second transmitted through the skylight if the U-value for the glass used is 1.2 W m^{-2} K^{-1}.

energy transmitted…….

(2 marks)

(b) State and explain the effect on the U-value for the skylight if the single pane of glass in part (a) were replaced with two panes of glass of half the original thickness separated by a layer of air.

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(1 mark)

Total for Section A 20 marks

Section B. There are 50 marks in this section.

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

8 In the leisure pursuit called parascending a person attached to a parachute is towed by a towrope attached to a motor boat as shown in **Figure 4**.

Figure 4

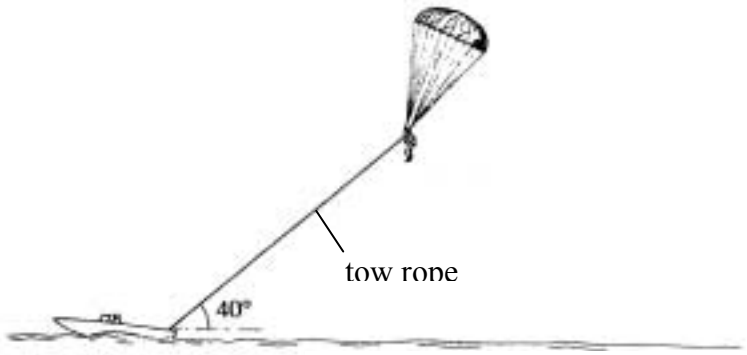

Figure 5

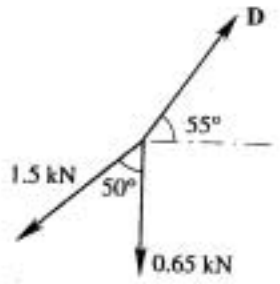

Figure 5 shows the directions of the forces acting on a person of weight 0.65 kN when being towed horizontally at a constant speed of 8.5 m s^{-1}.

The tension in the tow rope is 1.5 kN and *D* is resultant force exerted by the parachute on the parascender.

(a) (i) State why the resultant force on the parascender must be zero.

……

……

(ii) Calculate the magnitude of *D*.

magnitude of .....kN
(4 marks)

(b) (i) Calculate the horizontal resistance to motion of the boat produced by the tow rope.

resistance……kN

(ii) The horizontal resistance to the motion of the boat produced by the water is 1200 N. Calculate the total power developed by the boat.

power……

(5 marks)

(c) State and explain the initial effect on the boat if the tow rope were to break.

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(2 marks)

Total 11 marks

9 **Figure 6** shows the speed-time graph for a swimmer performing one complete cycle of the breast stroke.

Figure 6

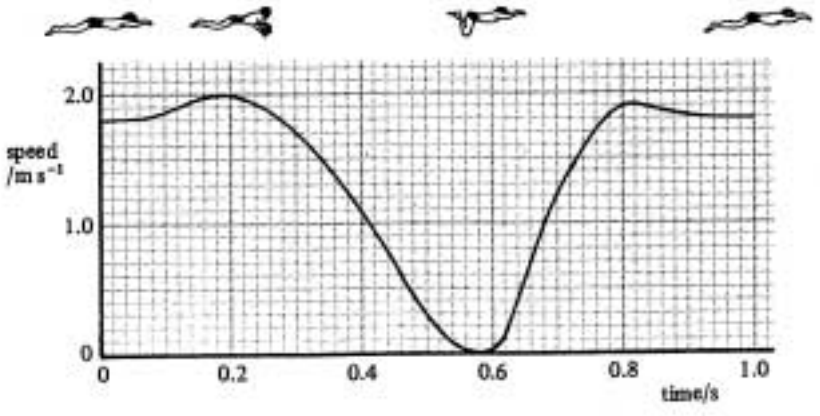
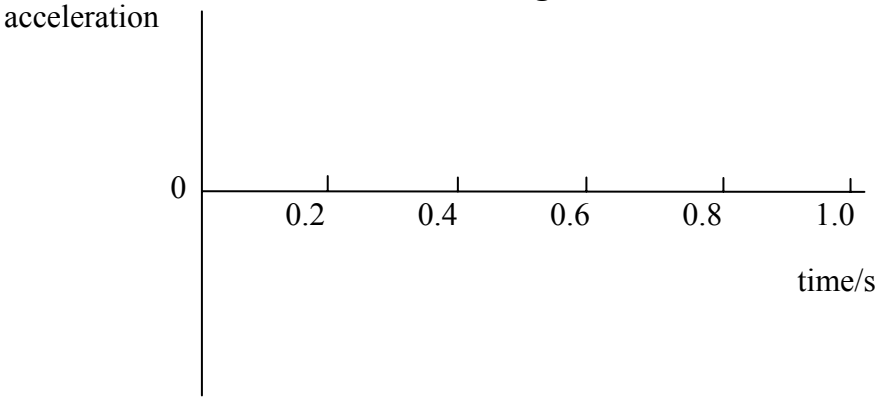


Figure 7



(a) (i) Find the acceleration of the swimmer at time 0.65 s.

acceleration……

(ii) Sketch, on the axes in **Figure 7**, a graph to show how the acceleration of the swimmer varies with time for the same time interval. You are not required to make any further calculations but your graph should show relative values.

(4 marks)

(b) Use the graph in **Figure 6** to estimate the distance travelled by the swimmer in one complete cycle of the stroke. Show your working clearly.

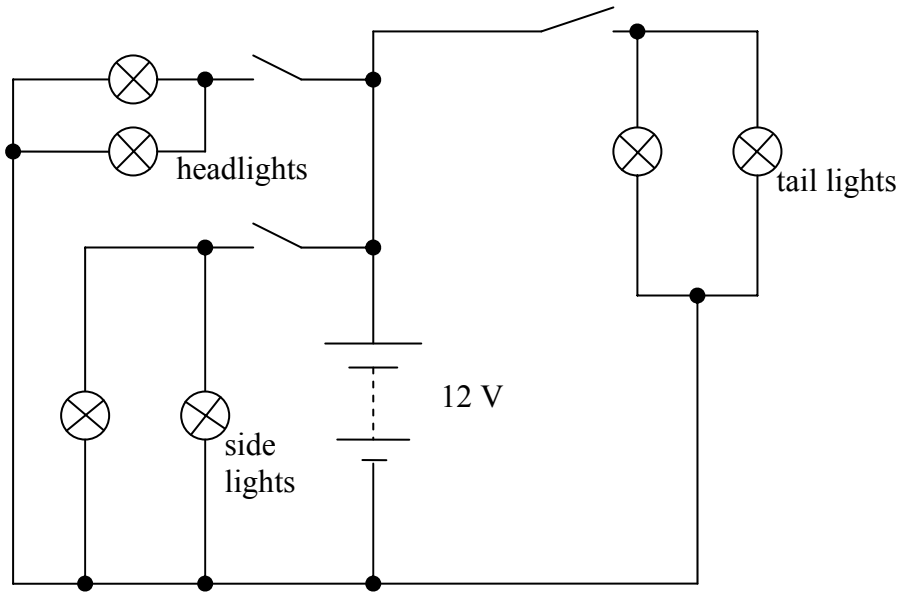
distance travelled……m

(4 marks)

Total 8 marks

10 **Figure 8** shows part of the circuit diagram for a car lighting circuit.

Figure 8



The table shows the power rating of the various lamps used in the circuit.

Lamp	Power/W
Tail light	8.0
Sidelight	5.0
Headlight	60

(a) Explain why all the lamps are connected in parallel.

……

……

……

(2 marks)

(b) The emf of the battery used in the circuit is 12 V and it has negligible internal resistance. Calculate the current through the battery when the headlights and tail lights are both on.

current…….A

(3 marks)

(c) (i) State which lamp filament has the least resistance.

……

……

(ii) Explain why this resistance is smaller when the lamp is first switched on.

……

……

(3 marks)

(d) The side and tail lamps are accidentally left on for 12 hours when the car is parked.

(i) Calculate the energy dissipated in the lamps during this time.

energy……J

(ii) The battery used by the car is capable of delivering a current of 1.5 A for 24 hours. The car's starter motor needs a current of 100 A which lasts for at least one second in order to start the engine. State and explain whether the car is likely to start after the 12 hours.

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(5 marks)

Total 13 marks

11 The table gives the power output of a wind turbine for increasing wind speeds.

wind speed/ m s^{-1}	0	2	4	6
power output/MW	0	0.0023	0.0190	0.0630

(a) Show that the data suggest that the power is proportional to the cube of the wind speed.

(3 marks)

(b) The power output of the turbine depends on the mass of air striking the turbine blades per second. State and explain the effect on the power output if the diameter of the circle swept out by the turbine blades is doubled.

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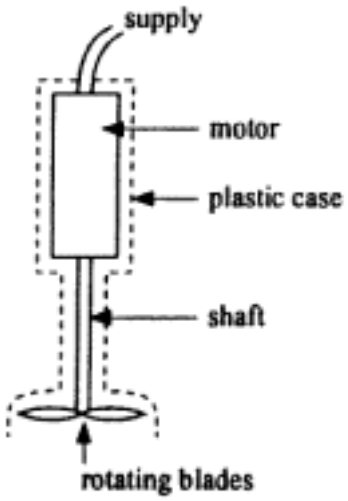
(3 marks)

Total 6 marks

12 **Figure 9** shows a prototype electric liquidiser used, for example, in making soup. It consists of a motor which is designed to run from a 110 V d.c supply and uses energy at a rate of 40 W when making 'thin' soups. The rate of using energy increases when thicker soup is being liquidised.

Figure 9



(a) Calculate the effective resistance when the mixer is operating at 40 W from a 110 V supply.

(2 marks)

(b) The mixer is to have the option of running from a 230 V supply. In this case, a resistor is included in series with the motor which itself can be treated as a pure resistor.

(i) Calculate the magnitude of the series resistor needed.

(ii) Determine the percentage of the input power that is dissipated in the series resistor.

(5 marks)

(c) The designer warns users against using the liquidiser to try to mix stiff materials such as pastry.
State and explain what is likely to happen if this warning is ignored.

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(3 marks)

(d) A cordless version of the mixer operates at 40 W from a 14 V battery that has a capacity of 1.3 A-h. For how long could a fully-charged battery operate the mixer?
Give your answer in h.

(2 marks)

Total 12 marks

Total for Section B 50 marks