Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

For Examiner's Use

General Certificate of Education
January 2009
Advanced Subsidiary Examination

AQA

PHYSICS (SPECIFICATION A) PA02
Unit 2 Mechanical and Molecular Kinetic Theory

Tuesday 13 January 2009 1.30 pm to 2.30 pm

For this paper you must have:
- a calculator
- a ruler
- a data sheet insert.

Time allowed: 1 hour

Instructions
- Use black ink or a black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Show all your working.
- Do all rough work in this book. Cross through any work you do not want to be marked.

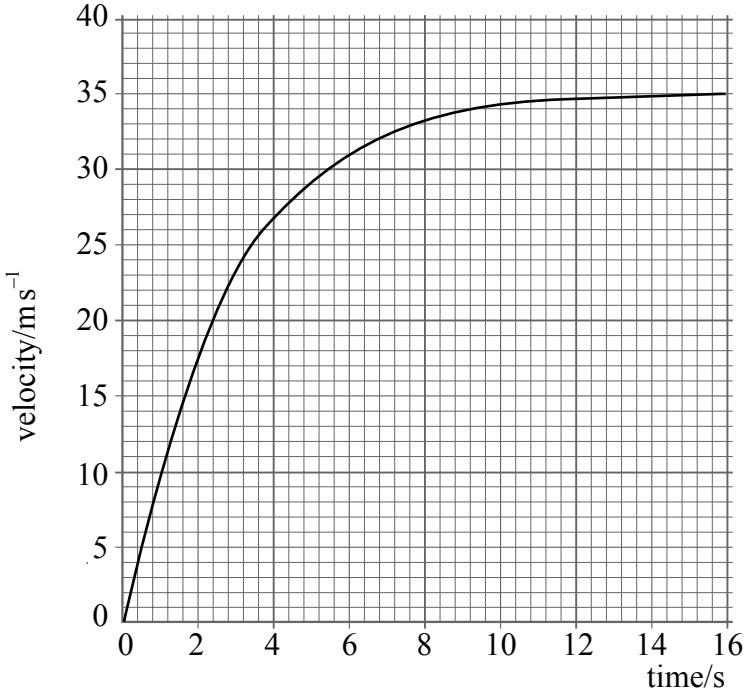
Information
- The maximum mark for this paper is 50. This includes up to two marks for the Quality of Written Communication.
- The marks for questions are shown in brackets.
- A *Data Sheet* is provided as a loose insert to this question paper.
- Questions 1(a) and 4(b)(iii) should be answered in continuous 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.

For Examiner's Use			
Question	Mark	Question	Mark
1			
2			
3			
4			
5			
6			
Total (Column 1) →			
Total (Column 2) →			
Quality of Written Communication			
TOTAL			
Examiner's Initials			

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

1 An object of mass 1.5 kg is released from a stationary hot air balloon. **Figure 1** shows how the velocity of the object varies with time.

Figure 1



1 (a) With reference to the graph describe, without calculation, how the acceleration of the falling object changes over the first 16s.

You may be awarded additional marks to those shown in brackets for the quality of written communication in your answer.

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(3 marks)

1 (b) State **two** forces that act on the falling object and explain how these forces cause the changes in acceleration described in part (a).

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(4 marks)

1 (c) Use the graph to determine the acceleration of the object 5.0 s after it was released.

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(3 marks)

1 (d) Show that the distance fallen in the first 16 s is approximately 430 m.

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(2 marks)

Question 1 continues on the next page

1 (e) (i) Using your answer from part (d) calculate the change in potential energy, ΔE_p, of the object that occurred during the first 16s.

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1 (e) (ii) Calculate the change in kinetic energy, ΔE_k, of the object over the same period.

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1 (e) (iii) Explain why ΔE_p and ΔE_k are not equal to each other.

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(5 marks)

17

2 (a) State what is meant by the conservation of linear momentum.

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(2 marks)

2 (b) In a collision, ball A collides with ball B. During the collision, ball A exerts a force F_A, on ball B and ball B exerts a force F_B, on ball A.

2 (b) (i) What is the relationship between F_A and F_B?

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2 (b) (ii) The balls are in contact for time, t. State the change of momentum of ball B in terms of F_A and t.

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(3 marks)

5

Turn over for the next question

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

3 (a) State what is meant by the *specific heat capacity* of a substance.

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(2 marks)

3 (b) In an experiment to measure the specific heat capacity of the metal in a metal beaker, hot water is poured into the beaker. The temperature of the water falls and the temperature of the beaker rises until they are in thermal equilibrium.

3 (b) (i) State what quantities need to be known in order to calculate the heat transferred to the beaker by the hot water.

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3 (b) (ii) Assuming that the heat lost by the water is equal to the heat gained by the beaker, what additional quantities are required if the specific heat capacity of the metal in the beaker is to be calculated?

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(5 marks)

7

Turn over for the next question

4 (a) Define the moment of a force.

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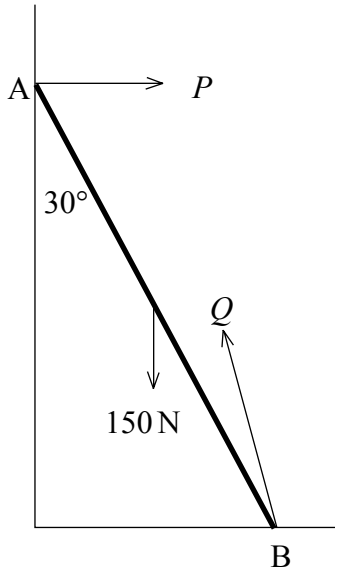
(2 marks)

4 (b) **Figure 2** shows the forces acting on a uniform ladder, AB, resting against a smooth vertical wall. The angle between the ladder and the wall is 30°.

Figure 2



The ladder is 6.0m long and has a weight of 150N.

4 (b) (i) By taking moments about B, determine the magnitude of the horizontal force, *P*.

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4 (b) (ii) Force, *Q*, can be resolved into two components. State the values of the horizontal and vertical components of *Q*.

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4 (b) (iii) State and explain whether the direction of P would change if there is friction between the ladder and the vertical wall.

You may be awarded additional marks to those shown in brackets for the quality of written communication in your answer.

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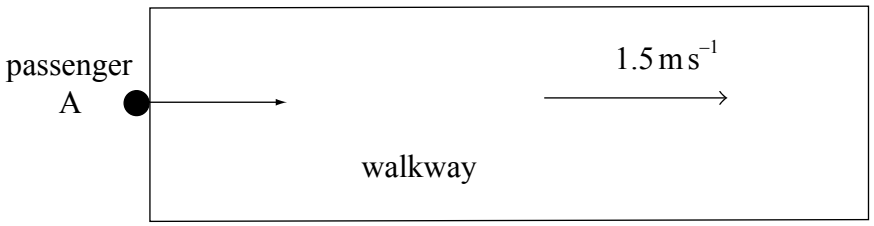
(7 marks)

9

Turn over for the next question

5 **Figure 3** shows a walkway at an airport which travels in the direction shown at a constant velocity of $1.5\,m\,s^{-1}$.

Figure 3



5 (a) Passenger A steps on the moving walkway and walks 20m along its surface. The time taken to walk this distance is 8.0s. Calculate,

5 (a) (i) the velocity of passenger A with respect to the moving walkway,

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5 (a) (ii) the resultant velocity of passenger A.

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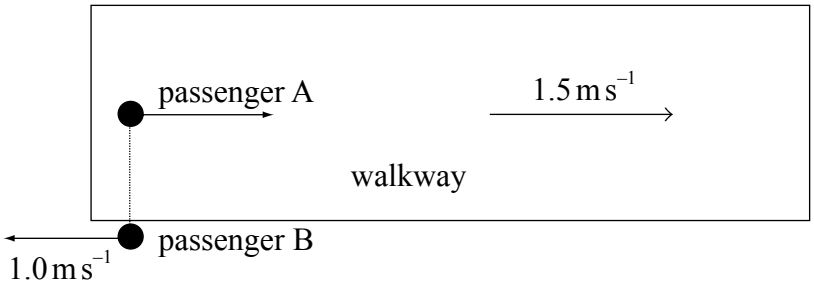
(2 marks)

5 (b) **Figure 4** shows a passenger B who is not on the walkway and is initially level with passenger A.

Figure 4



Passenger B is walking with a speed of 1.0 m s^{-1} in the opposite direction to passenger A who is walking along the walkway as in part (a). Calculate the displacement from the starting point after 5.0 s for,

5 (b) (i) passenger A,

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5 (b) (ii) passenger B.

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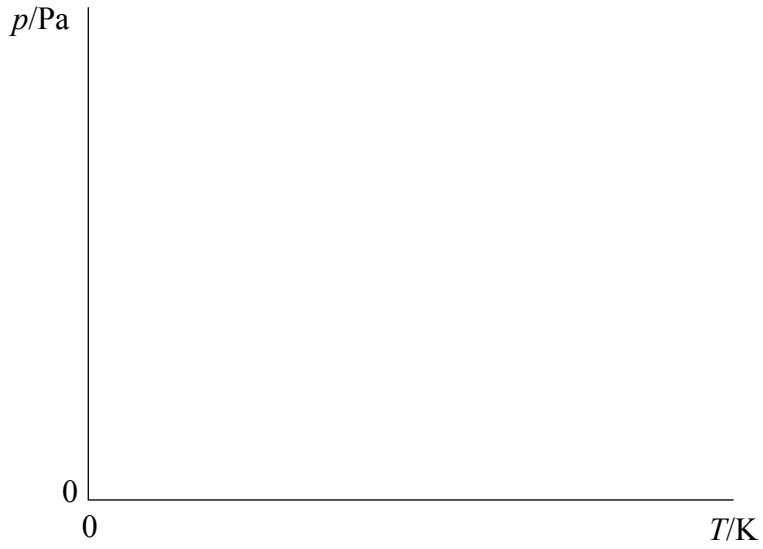
(3 marks)

5

Turn over for the next question

6 (i) On the axes below sketch a graph to show how the pressure, p, of a fixed mass of ideal gas varies with absolute temperature, T, if the gas is kept at a constant volume. Label this graph A.



6 (ii) Determine the gradient of your graph if the amount of gas is 4.0 mol and its volume is 1.0 m^3.

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6 (iii) The volume of the gas is increased to 2.0 m^3. On the same axes sketch a graph that shows how the pressure of the same amount of gas varies with absolute temperature. Label this graph B.

(5 marks)

5

Quality of Written Communication *(2 marks)*

2

END OF QUESTIONS