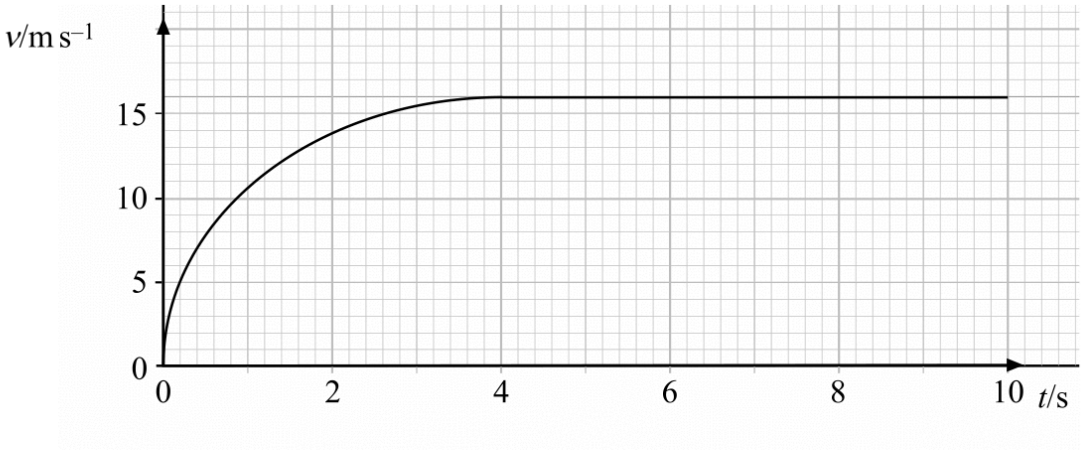
Energy Past Paper Questions

Jan 2002 to Jan 2009

5 The graph represents the motion of a car of mass 1.4×10^3 kg, travelling in a straight line.

Q5 Jan 2002



(a) Describe, without calculation, how the *resultant* force acting on the car varies over this 10 second interval.

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(2 marks)

(b) Calculate the maximum kinetic energy of the car.

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(2 marks)

(c) At some time later, when the car is travelling at a steady speed of 30 m s^{-1}, the useful power developed by the engine is 20 kW. Calculate the driving force required to maintain this speed.

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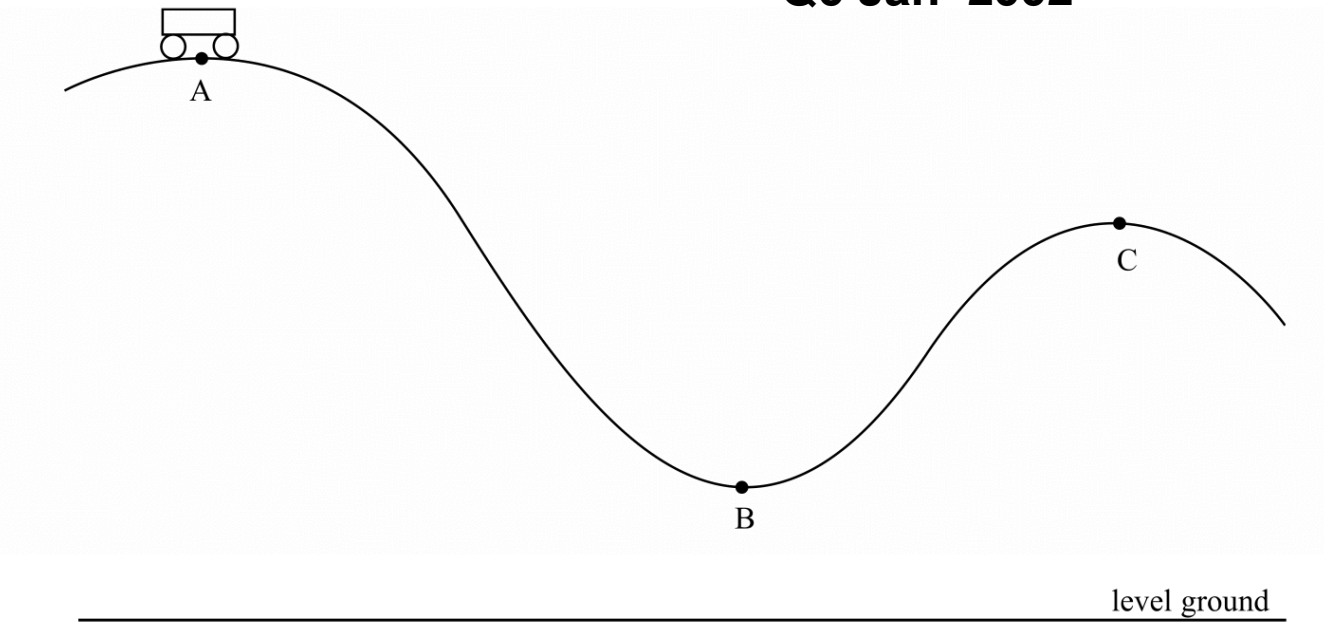
(2 marks)

6 The figure shows the track of a funfair ride.

Q6 Jan 2002



Carriages are pulled up to the highest point, A, of the ride and then released so that they follow the path ABC.

(a) Point A is 18 m above the ground and point C is 12 m above the ground. Show that the maximum possible speed of the carriage at C is 11 m s^{-1}.

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(3 marks)

(b) The actual speed at C is less than 11m s^{-1}. Describe the energy changes that take place as the carriage moves from A to B to C.

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(4 marks)

Q7 Jun 2002

7 (a) An egg of mass 5.8×10^{-2} kg is dropped from a height of 1.5 m onto a floor. Assuming air resistance is negligible, calculate for the egg

(i) the loss of potential energy,

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(ii) the kinetic energy just before impact,

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(iii) the speed just before impact,

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(iv) the momentum just before impact.

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(7 marks)

(b) On hitting the floor, the egg is brought to rest in a time of 0.010 s. Calculate the magnitude of the average decelerating force on the egg.

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(2 marks)

(c) The egg is now placed in a container that crumples on impact. Explain why this type of container makes it far less likely that the egg will break.

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(2 marks)

4 A skydiver of mass 70 kg, jumps from a stationary balloon and reaches a speed of 45 m s^{-1} after falling a distance of 150 m.

Q4 Jun 2004

(a) Calculate the skydiver's

(i) loss of gravitational potential energy,

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(ii) gain in kinetic energy.

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(4 marks)

(b) The difference between the loss of gravitational potential energy and the gain in kinetic energy is equal to the work done against air resistance. Use this fact to calculate

(i) the work done against air resistance,

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(ii) the average force due to air resistance acting on the skydiver.

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(3 marks)

2 **Figure 1** shows apparatus that can be used to investigate energy changes.

Figure 1

Q2 Jan 2006

The trolley and the mass are joined by an inextensible string. In an experiment to investigate energy changes, the trolley is initially held at rest, and is then released so that the mass falls vertically to the ground.

You may be awarded marks for the quality of written communication in your answer.

(a) (i) State the energy changes of the falling mass.

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(ii) Describe the energy changes that take place in this system.

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(4 marks)

(b) State what measurements would need to be made to investigate the *conservation of energy.*

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(2 marks)

(c) Describe how the measurements in part (b) would be used to investigate the conservation of energy.

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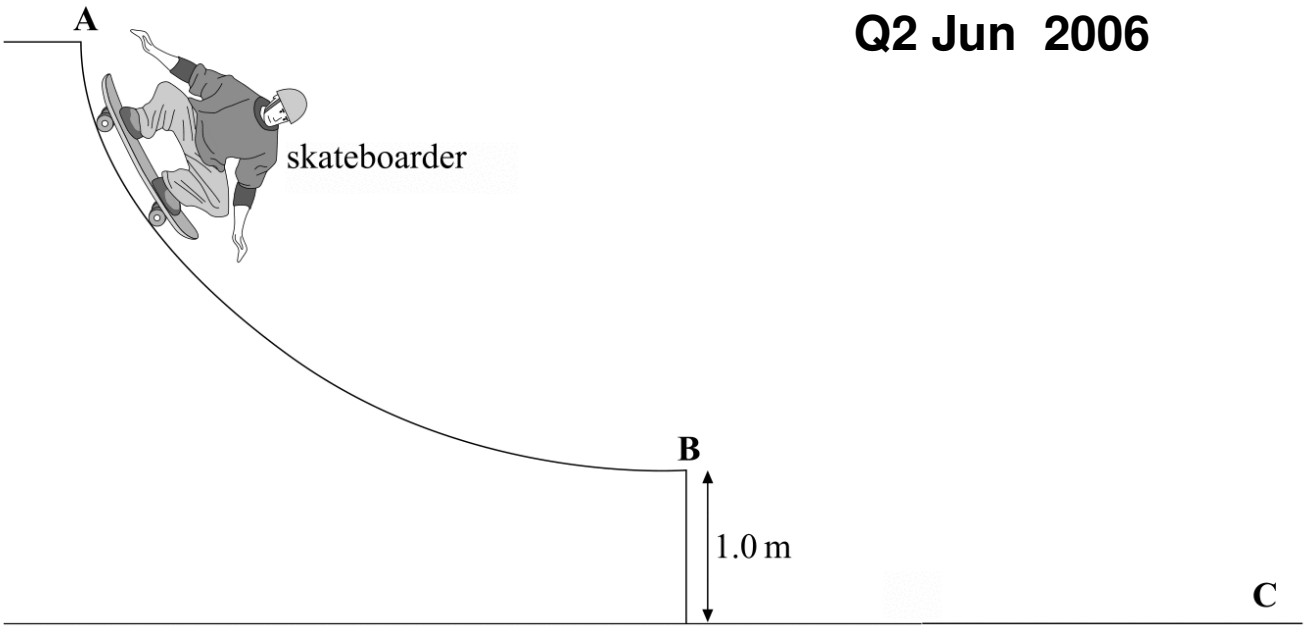
(4 marks)

2 **Figure 1** shows a skateboarder descending a ramp.

Figure 1



Q2 Jun 2006

The skateboarder starts from rest at the top of the ramp at **A** and leaves the ramp at **B** horizontally with a velocity *v*.

(a) State the energy changes that take place as the skateboarder moves from **A** to **B**.

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(2 marks)

(b) In going from **A** to **B** the skateboarder's centre of gravity descends a vertical height of 1.5 m. Calculate the horizontal velocity, *v*, stating an assumption that you make.

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(3 marks)

(c) Explain why the acceleration decreases as the skateboarder moves from **A** to **B**.

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(2 marks)

(d) After leaving the ramp at **B** the skateboarder lands on the ground at **C** 0.42 s later.

Calculate for the skateboarder

(i) the horizontal distance travelled between **B** and **C**,

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(ii) the vertical component of the velocity immediately before impact at **C**,

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(iii) the magnitude of the resultant velocity immediately before impact at **C**.

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(5 marks)