SUVAT Past Paper Questions

Jan 2002 to Jan 2009

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

Q7 Jun 2002

(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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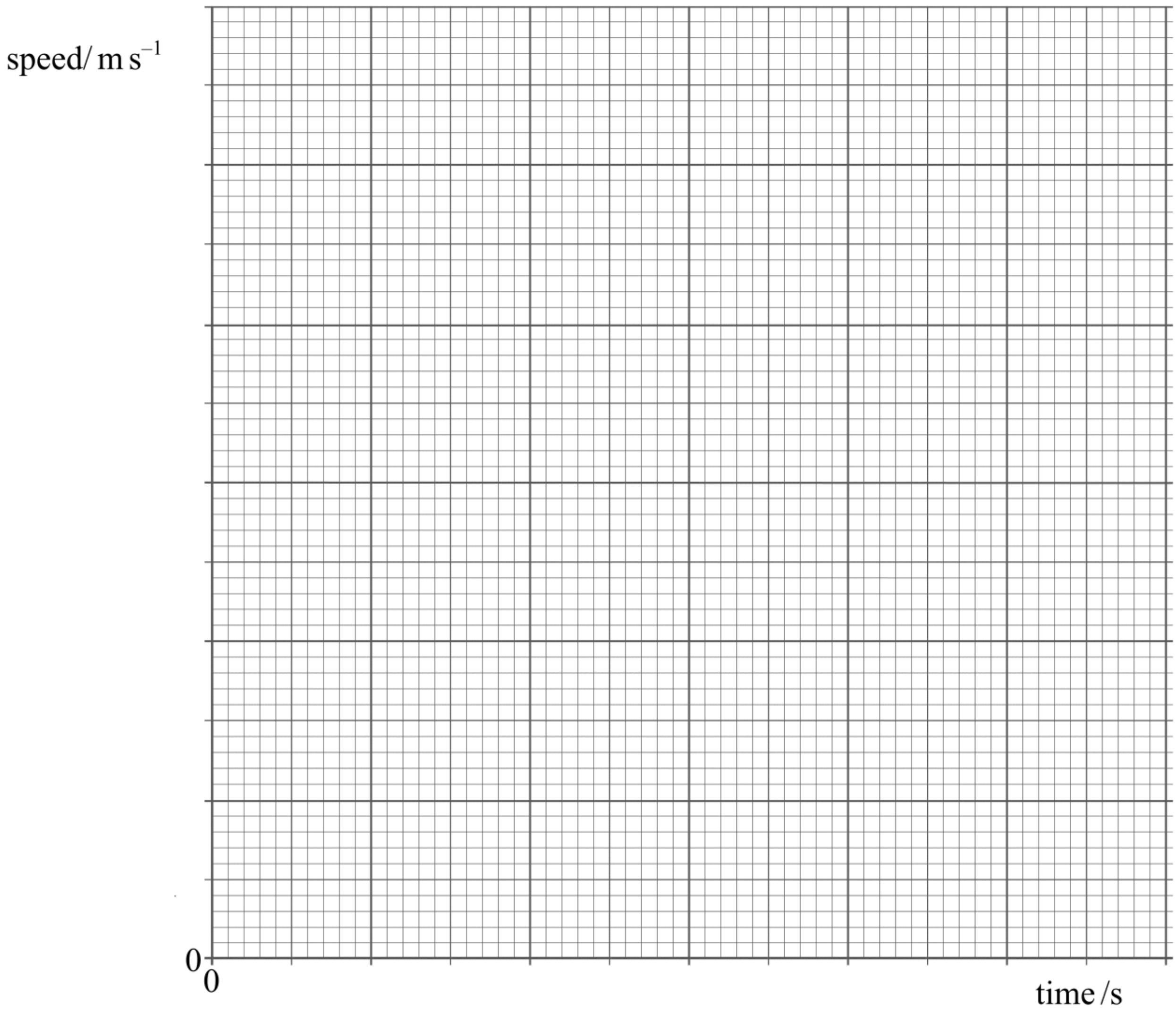
(2 marks)

1 A car accelerates from rest to a speed of $26\,\mathrm{m\,s^{-1}}$. The table shows how the speed of the car varies over the first 30 seconds of motion.

Q1 Jan 2006

time/ s	0	5.0	10.0	15.0	20.0	25.0	30.0
speed/ m s^{-1}	0	16.5	22.5	24.5	25.5	26.0	26.0

(a) Draw a graph of speed against time on the grid provided.



(3 marks)

(b) Calculate the average acceleration of the car over the first 25 s.

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(2 marks)

(c) Use your graph to estimate the distance travelled by the car in the first 25 s.

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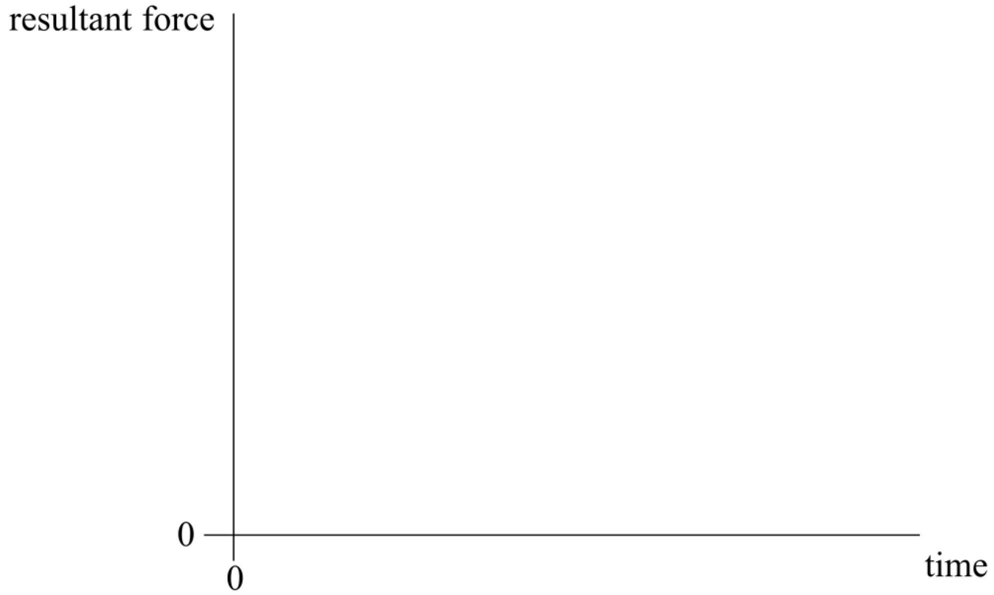
(2 marks)

(d) Using the axes below, sketch a graph to show how the resultant force acting on the car varies over the first 30 s of motion.



(2 marks)

(e) Explain the shape of the graph you have sketched in part (d), with reference to the graph you plotted in part (a).

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(2 marks)

6 A supertanker of mass 4.0×10^{8} kg, cruising at an initial speed of $4.5\,\mathrm{m\,s^{-1}}$, takes one hour to come to rest.

(a) Assuming that the force slowing the tanker down is constant, calculate

Q6 Jun 2006

(i) the deceleration of the tanker,

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(ii) the distance travelled by the tanker while slowing to a stop.

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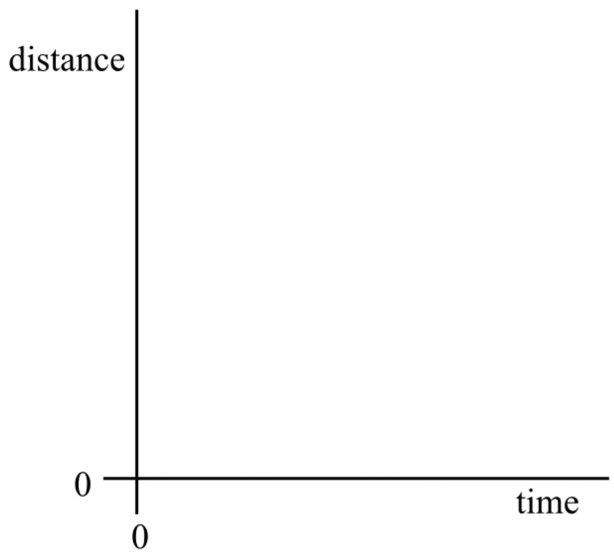
(4 marks)

(b) Sketch, using the axes below, a distance-time graph representing the motion of the tanker until it stops.



(2 marks)

(c) Explain the shape of the graph you have sketched in part (b).

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(2 marks)

2 (a) A cheetah accelerating uniformly from rest reaches a speed of $29\,\mathrm{m\,s^{-1}}$ in 2.0 s and then maintains this speed for 15 s. Calculate

Q2 Jan 2007

(i) its acceleration,

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(ii) the distance it travels while accelerating,

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(iii) the distance it travels while it is moving at constant speed.

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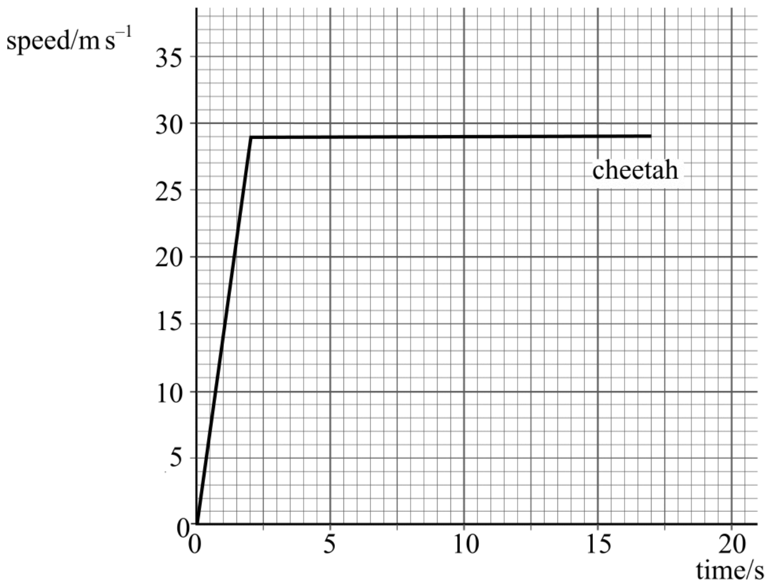
(4 marks)

(b) The cheetah and an antelope are both at rest and 100 m apart. The cheetah starts to chase the antelope. The antelope takes 0.50 s to react. It then accelerates uniformly for 2.0 s to a speed of $25\,\mathrm{m\,s^{-1}}$ and then maintains this speed. The graph shows the speed-time graph for the cheetah.



(i) Using the same axes plot the speed-time graph for the antelope during the chase.

(ii) Calculate the distance covered by the antelope in the 17 s after the cheetah started to run.

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(iii) How far apart are the cheetah and the antelope after 17 s?

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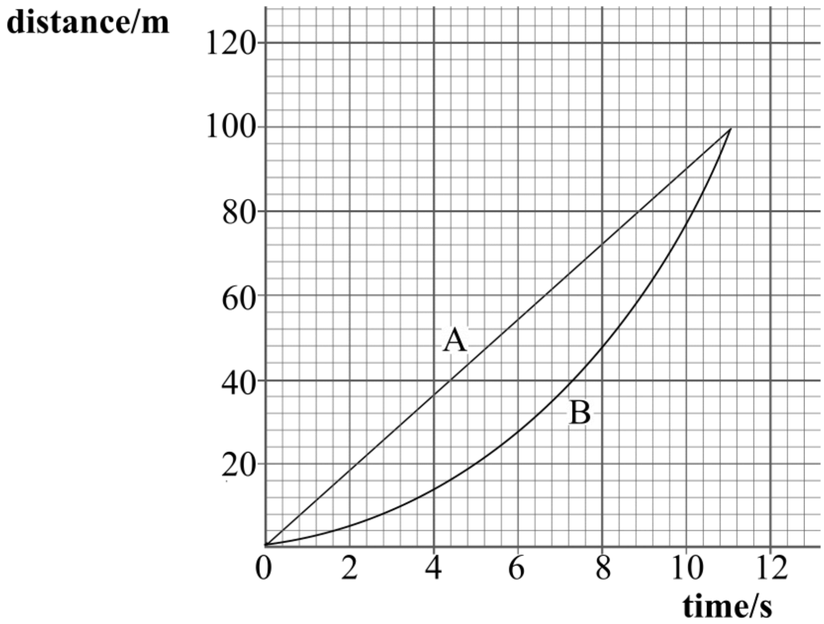
(6 marks)

1 The distance-time graphs for two runners, A and B, in a 100 m race are shown.



Q1 Jun 2007

(a) Explain how the graph shows that athlete B accelerates throughout the race.

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(1 mark)

(b) Estimate the maximum distance between the athletes.

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(1 mark)

(c) Calculate the speed of athlete A during the race.

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(1 mark)

(d) The acceleration of athlete B is uniform for the duration of the race.

(i) State what is meant by uniform acceleration.

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(ii) Calculate the acceleration of athlete B.

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(3 marks)

5 An aircraft accelerates horizontally from rest and takes off when its speed is $82\,\text{m s}^{-1}$. The mass of the aircraft is 5.6×10^4 kg and its engines provide a constant thrust of 1.9×10^5 N.

(a) Calculate

Q5 Jan 2008

(i) the initial acceleration of the aircraft,

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(ii) the minimum length of runway required, assuming the acceleration is constant.

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(3 marks)

(b) In practice, the acceleration is unlikely to be constant. State a reason for this and explain what effect this will have on the minimum length of runway required.

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(2 marks)

(c) After taking off, the aircraft climbs at an angle of 22° to the ground. The thrust from the engines remains at 1.9×10^5 N. Calculate

(i) the horizontal component of the thrust,

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(ii) the vertical component of the thrust.

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(2 marks)