Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Q1.

Some students investigate a model of the craters produced by meteorite impacts.

They drop balls into a tray filled with sand.

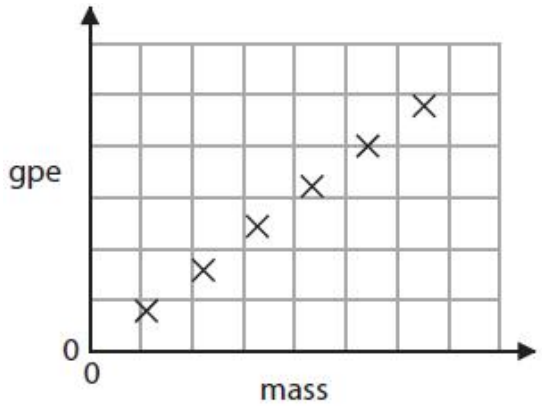
They use six balls with different masses.

They drop each ball from the same height.

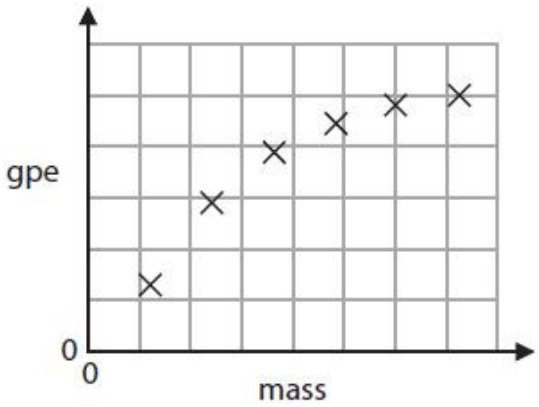
(a) (i) Which one of these graphs shows the relationship between the gravitational potential energy (gpe) of the balls and their mass when they are all at the same height?

Put a cross (☒) in the box next to your answer.

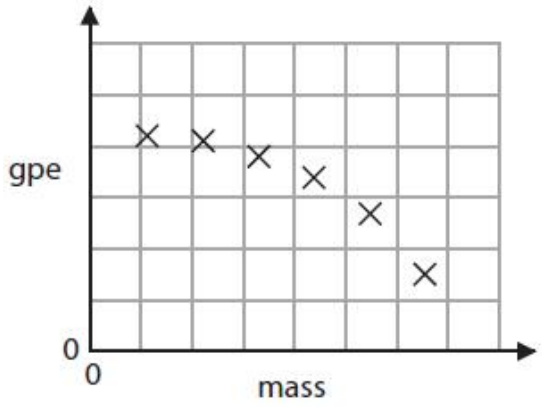
(1)



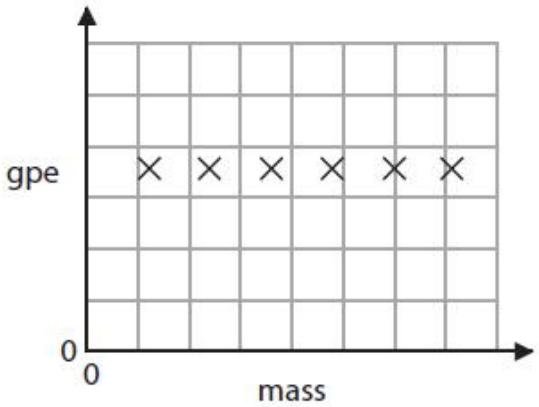
☐ **A**



☐ **B**



☐ **C**



☐ **D**

(ii) Describe how the energy of a ball changes as it drops towards the sand.

(2)

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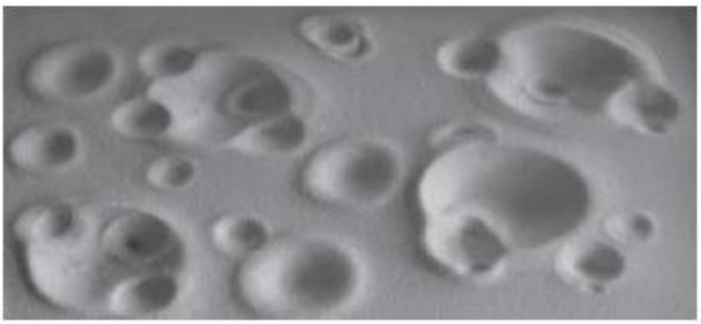
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(b) This photograph shows the sand after several balls have hit it.



The students read this information in a textbook:

'When work is done, energy is transferred.'

Explain how work is done when the balls impact on the sand.

(2)

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(c) When one ball hits the sand, it has a velocity of 6.2 m/s.

It has a momentum of 0.46 kg m/s.

(i) Calculate the mass of the ball.

(3)

mass of ball = ... kg

(ii) The ball takes 0.17 s to come to rest after it hits the sand.
Calculate the average impact force.

(2)

average impact force = ... N

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Q2.

An aeroplane is powered by an engine that burns fuel.

The fuel supplies a total of 6500 kJ of energy every minute.

The efficiency of the engine is 0.70 (70%).

(i) Calculate the power output of the engine.

Give your answer in kW.

(4)

power = ... kW

(ii) Explain why the efficiency of the engine is less than 1 (100%).

(2)

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(Total for question = 6 marks)

Q3.

Figure 6 shows a 'Mars rover' descending to the surface of the planet Mars.

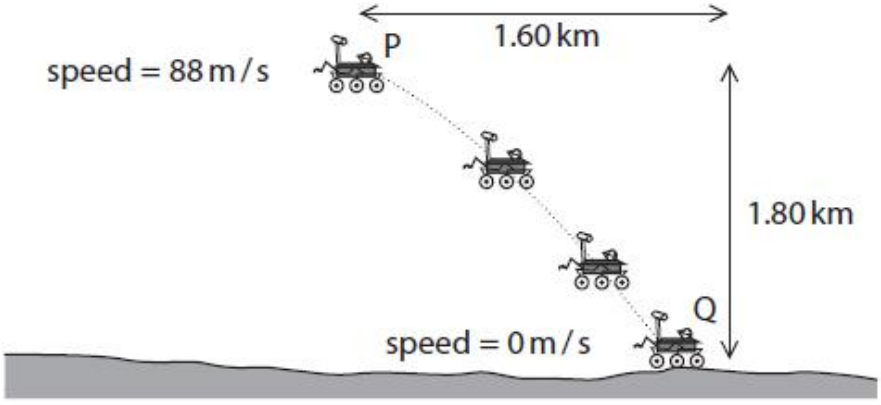


Figure 6

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The rover uses solar panels for its power needs.

The solar panels can provide 1200 W of power.

(i) Show that the solar panels can provide 2.16 MJ of energy in 30 minutes.

(1)

(ii) The solar panels convert 27% of the energy they receive from the Sun into electricity.

Calculate the solar energy received by the panels that provides the 2.16 MJ of energy.

(2)

energy received = ... J

(Total for question = 3 marks)

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