Questions

Q1.

Figure 13 shows a diagram of a device for lifting heavy loads.

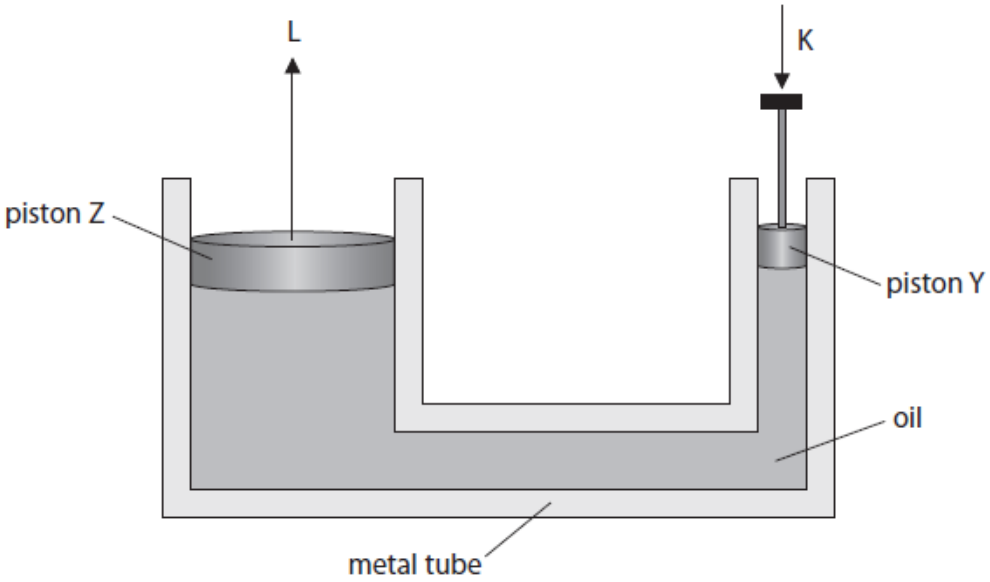

Figure 13

The metal tube is filled with oil.

The piston Y is pushed down with a force K.

This produces a force L on piston Z.

The pressure exerted on the oil by piston Y is the same as the pressure exerted by the oil on piston Z.

Explain the difference between the size of force K and the size of force L.

(3)

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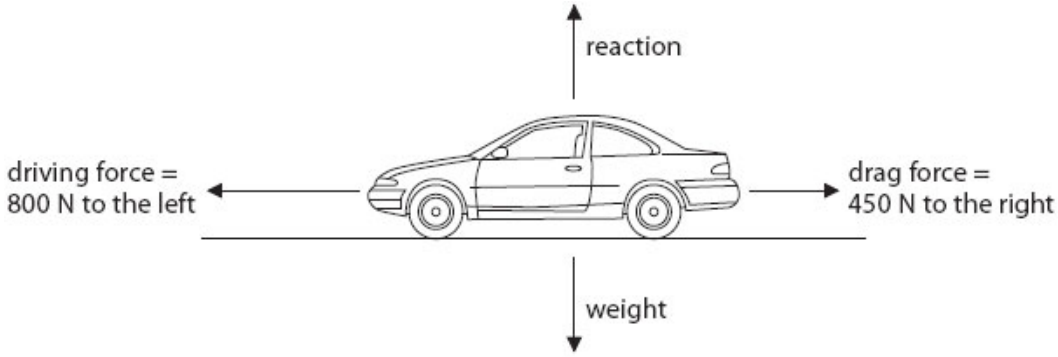
(Total for question = 3 marks)

Q2.

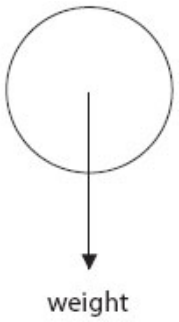
The diagram shows the forces acting on a car which is travelling along a flat straight road.



Forces also act on objects when they fall through the air.

There are two forces acting on this ball as it falls through the air.

The weight is shown on the diagram.



(i) Draw and label an arrow on the diagram to show the other force acting on the ball.

(2)

(ii) Use words from the box to complete the sentences.

(2)

balanced	changing	greater	smaller	zero

After a short time the ball falls at a steady speed.

The forces acting on the ball are now .....**.**

The acceleration of the ball is now .....**.**

Q3.

A student investigates the stretching of a long piece of rubber.

Figure 15 shows the apparatus to be used.

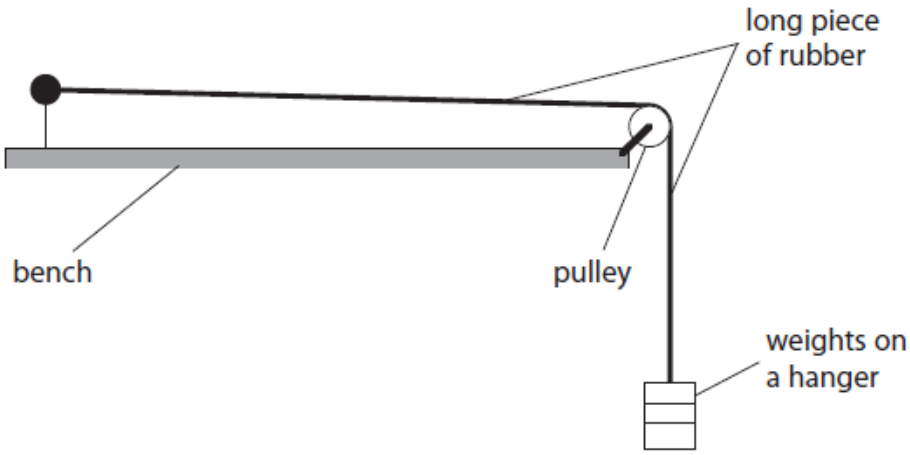


Figure 15

The student puts just enough weight on the weight hanger to make the piece of rubber just tight.

The student wants to plot a graph to show how the extension of the piece of rubber varies with the force used to stretch it.

The student adds a known weight to the weight hanger.

(i) Describe how the student could measure the extension of the rubber when

he adds another weight to the weight hanger.

(2)

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(ii) The student obtains a series of values of force and extension while loading the

piece of rubber and then unloading it.

Figure 16 shows the graph of the student's values.

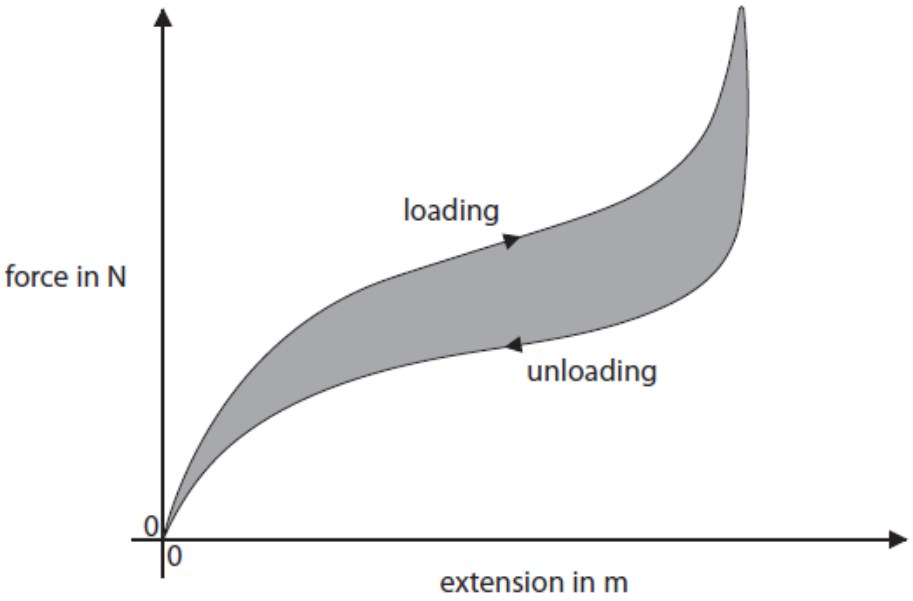

Figure 16

Explain how the shape of this graph shows that the distortion of the piece of rubber being stretched is different from the distortion of a spring being stretched.

(2)

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(Total for question = 4 marks)

Q4.

Figure 14 shows an athlete using a fitness device.

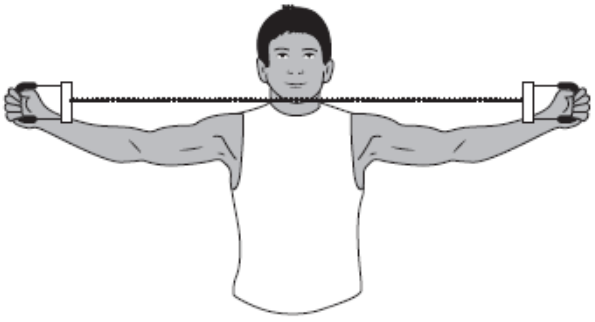

Figure 14

The athlete stretches the spring in the device by pulling the handles apart.

The spring constant of the spring is 140 N/m.

The athlete does 45 J of work to extend the spring.

The athlete takes 0.6 s to expand the spring.

(i) Calculate the useful power output of the athlete when stretching the spring.

(2)

useful power output of the athlete = ... W

(ii) Calculate the extension of the spring.

Use an equation selected from the list of equations at the end of this paper.

(3)

extension of the spring = ... m

(Total for question = 5 marks)

Q5.

A student sets up the apparatus shown in Figure 9.

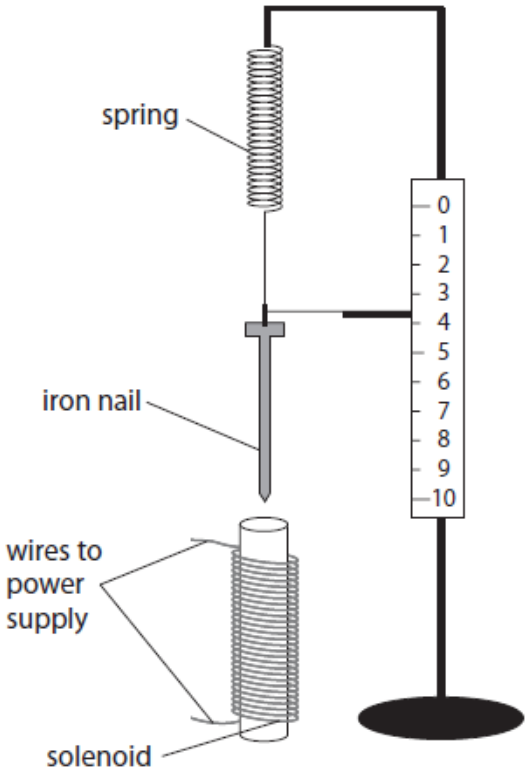

Figure 9

(i) When the current in the solenoid is switched on, the solenoid attracts the iron nail.

Describe how the student could use this apparatus to investigate how the size of the current in the solenoid affects the force of attraction between the solenoid and the iron nail.

(4)

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(ii) The spring constant of a different spring is 24 N/m.

The spring is extended from its unstretched length by 12 cm.

Calculate the energy transferred in extending the spring by 12 cm.

Use an equation selected from the list of equations at the end of this paper.

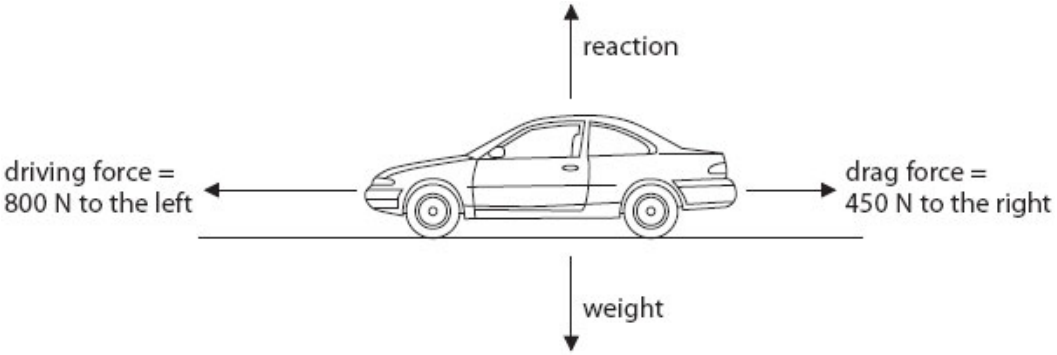
(2)

energy transferred = ... J

(Total for question = 6 marks)

Q6.

The diagram shows the forces acting on a car which is travelling along a flat straight road.



(a) (i) The size of the resultant force on the car is 350 N.

In which direction is the resultant force acting?

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

(1)

☒ **A** down ↓

☒ **B** to the left ←

☒ **C** to the right →

☒ **D** up ↑

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The car is

(1)

☒ **A** accelerating

☒ **B** decelerating

☒ **C** moving at a constant speed

☒ **D** not moving

(2)

(iii) The mass of the car is 625 kg.

Calculate the weight of the car.

gravitational field strength = 10N/kg

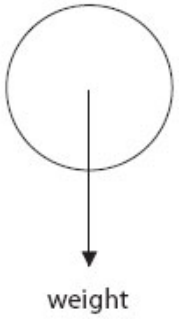
(2)

weight of car = ...N

(b) Forces also act on objects when they fall through the air.

There are two forces acting on this ball as it falls through the air.

The weight is shown on the diagram.



(i) Draw and label an arrow on the diagram to show the other force acting on the ball.

(2)

(ii) Use words from the box to complete the sentences.

(2)

balanced	changing	greater	smaller	zero

After a short time the ball falls at a steady speed.

The forces acting on the ball are now .....**.**

The acceleration of the ball is now .....**.**

(Total for Question is 8 marks)

Q7.

Figure 17 shows a crane lifting a concrete block from the bottom of a deep pool of water.
The top of the block is a distance, *h*, below the surface of the water.

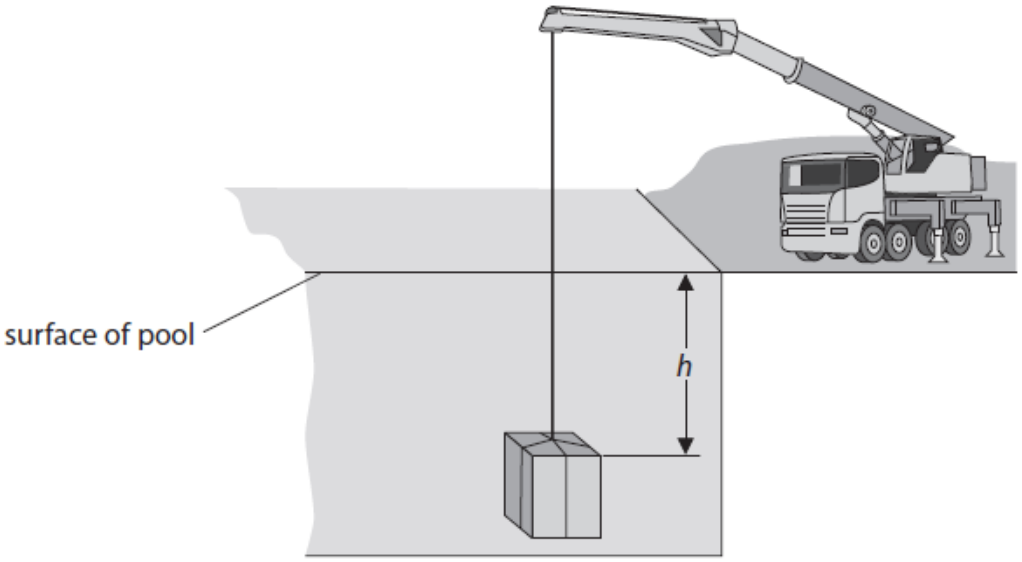


Figure 17

The force on the top of the block due to the water above it is 41 000 N.

The pressure due to the water on the top surface of the block is 66 000 Pa.

(i) Calculate the area of the top surface of the block.

(2)

area of the top surface of the block = ... m^2

(ii) The density of water is 1000 kg/m^3.

Calculate the distance, *h*, between the top of the block and the surface of the water.

Gravitational field strength, *g*, is 10 N/kg.

Use an equation selected from the list of equations at the end of this paper.

(2)

h = ... m

(iii) Explain why there is an upthrust produced by the water on the block.

(2)

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* (iv) The crane raises the block until it is high enough out of the water to be loaded on to a lorry.

The block moves upwards at a constant speed even though the lifting force in

the cable changes.

Figure 18 shows the graph of how the lifting force changes while the block is being raised.

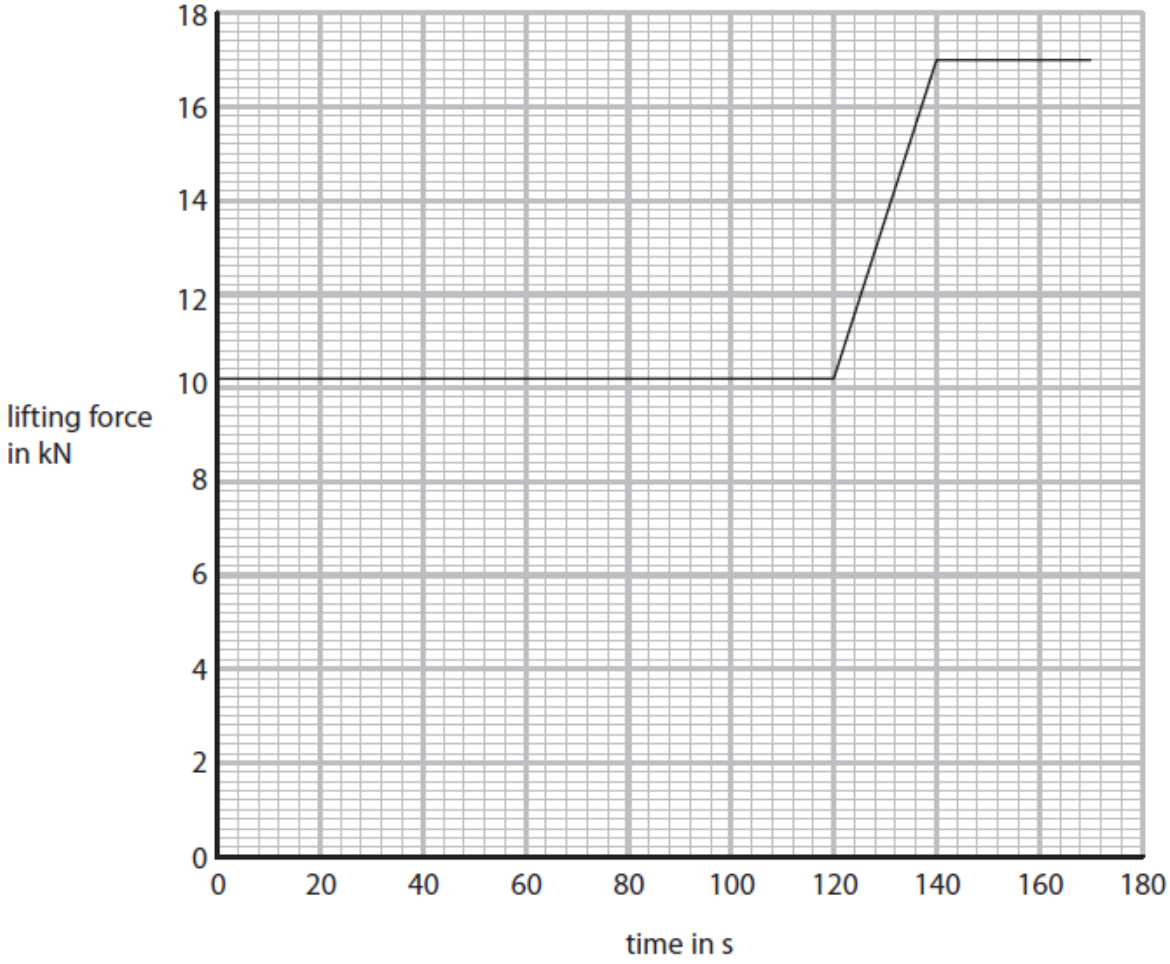

Figure 18

Explain why the lifting force changes as shown on the graph in Figure 18.
Include calculation(s) in your answer.

(6)

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(Total for question = 12 marks)