PEARSON EDEXCEL GCSE PHYSICS (HIGHER) · 1PH0

PHYSICS



EXAM QUESTION PACK

TOPIC 8: ENERGY – FORCES DOING WORK (PACK 1)

SCORE	PERCENTAGE
/133	%

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Q1.

An athlete uses a training machine in a gym.

The display on the machine shows the time spent on the machine and the amount of energy transferred during a training session.

Figure 5 shows the displays for two different sessions by the same athlete.

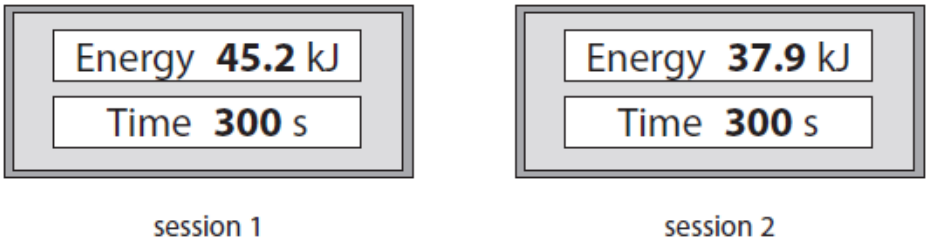


Figure 5

Explain what the displays show about the average power of the athlete in each of these two sessions.

(2)

.....

.....

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.....

(Total for question = 2 marks)

Q2.

An athlete uses a training machine in a gym.

The display on the machine shows the time spent on the machine and the amount of energy transferred during a training session.

Figure 5 shows the displays for two different sessions by the same athlete.

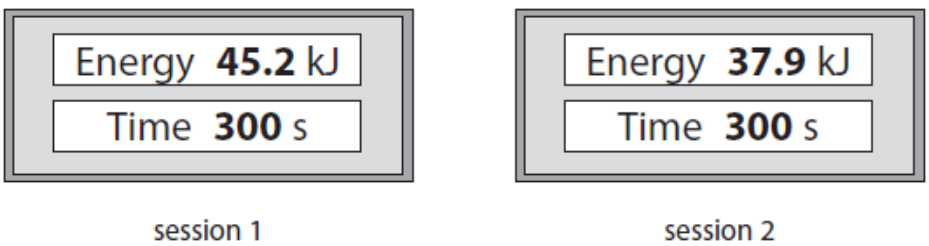


Figure 5

Explain what the displays show about the average power of the athlete in each of these two sessions.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q3.

A cyclist is riding a bicycle at a steady velocity of 12 m/s.

The cyclist and bicycle have a total mass of 68 kg.

The cyclist starts to cycle again.

The cyclist does 1600 J of useful work to travel 28 m.

Calculate the average force the cyclist exerts.

(3)

average force = ... N

(Total for question = 3 marks)

Q4.

A cyclist starts to cycle.

The cyclist does 1600 J of useful work to travel 28 m.

Calculate the average force the cyclist exerts.

(3)

average force = ... N

(Total for question = 3 marks)

Q5.

A rock falls off the top of a cliff of height *h*.

Figure 3 shows the rock falling.

The Earth exerts a force of 150 N on the rock.

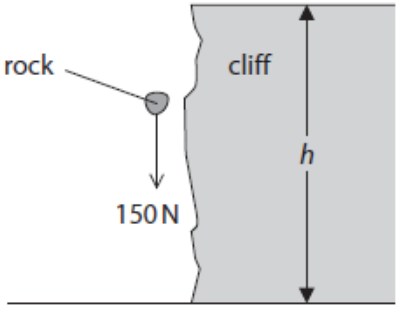


Figure 3

The work done by this force when the rock falls from the top to the bottom of the cliff is 2700 J.

(i) Calculate the height, *h*, of the cliff.

(2)

h = ... m

(ii) State the value of the kinetic energy of the rock just before it hits the ground.

(1)

kinetic energy = ... J

(iii) The mass of the rock in Figure 3 is 15 kg.

Calculate the velocity of the rock just before it reaches the bottom of the cliff.

(2)

velocity = ... m/s

(Total for question = 5 marks)

Q6.

A rock falls off the top of a cliff of height *h*.

Figure 1 shows the rock falling.

The Earth exerts a force of 150 N on the rock.

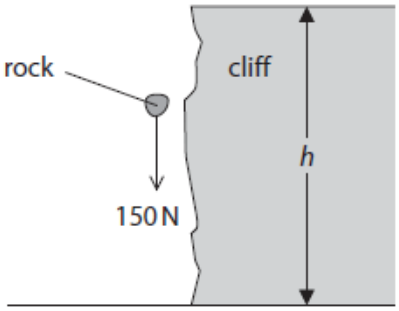


Figure 1

The work done by this force when the rock falls from the top to the bottom of the cliff is 2700 J.

(i) Calculate the height, *h*, of the cliff.

(2)

h = ... m

(ii) State the value of the kinetic energy of the rock just before it hits the ground.

(1)

kinetic energy = ... J

(iii) The mass of the rock in Figure 1 is 15 kg.

Calculate the velocity of the rock just before it reaches the bottom of the cliff.

(2)

velocity = ... m/s

(Total for question = 5 marks)

Q7.

A ball has a mass of 0.046 kg.

(i) Calculate the change in gravitational potential energy when the ball is lifted through a vertical height of 2.05 m.

Use the equation

$$\Delta GPE = m \times g \times \Delta h$$

(2)

change in gravitational potential energy = ... J

(ii) The ball is released.

Calculate the kinetic energy of the ball when the speed of the ball is 3.5 m/s.

(3)

kinetic energy of the ball = ... J

(iii) The ball bounces several times.

Figure 4 shows how the height of the ball above the floor changes with time.

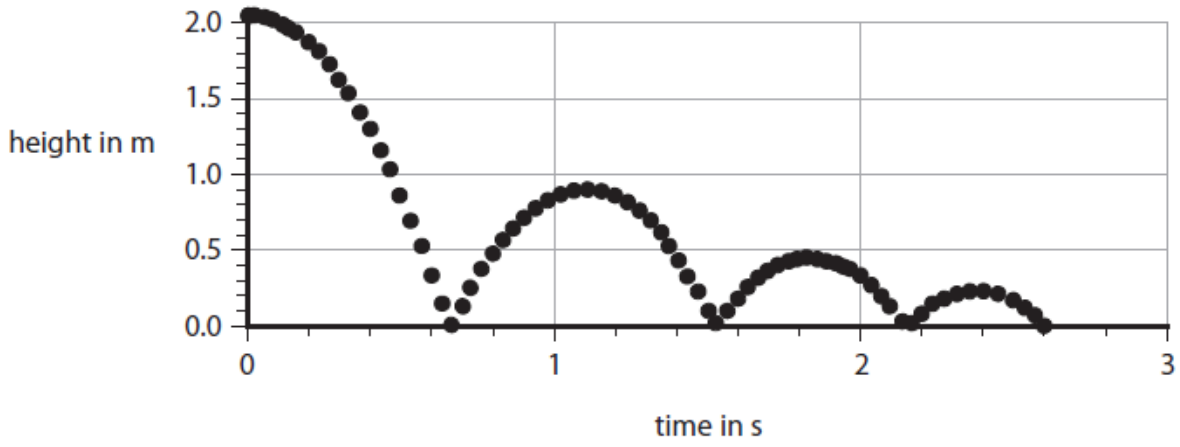


Figure 4

Use Figure 4 to estimate the maximum height that the ball reaches after the first bounce.

(1)

height after first bounce = ... m

(iv) Explain why the ball does not bounce back to its starting height of 2.05 m.

(2)

.....

.....

.....

.....

(Total for question = 8 marks)

Q8.

A ball has a mass of 0.046 kg.

(i) Calculate the change in gravitational potential energy when the ball is lifted through a vertical height of 2.05 m.

Use the equation

$$\Delta GPE = m \times g \times \Delta h$$

(2)

change in gravitational potential energy = ... J

(ii) The ball is released.

Calculate the kinetic energy of the ball when the speed of the ball is 3.5 m/s.

(3)

kinetic energy of the ball = ... J

(iii) The ball bounces several times.

Figure 1 shows how the height of the ball above the floor changes with time.

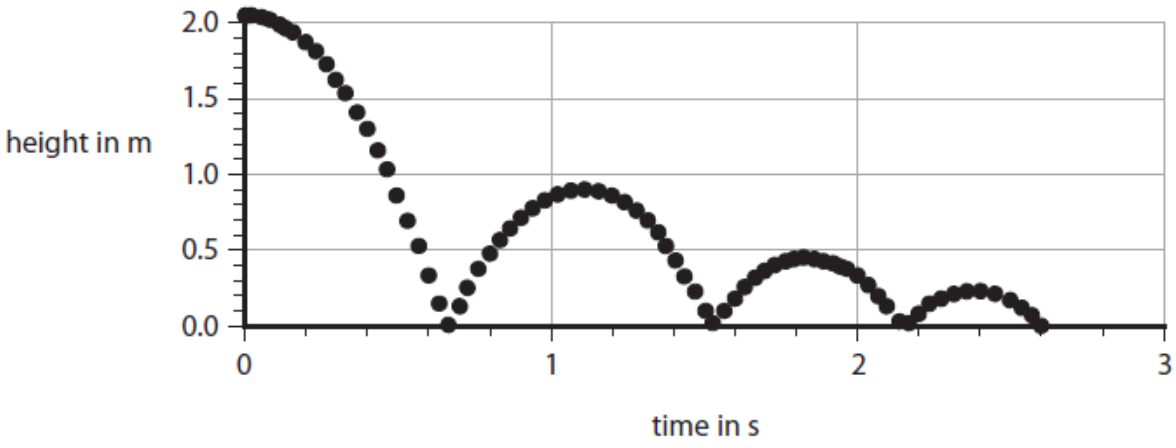


Figure 1

Use Figure 1 to estimate the maximum height that the ball reaches after the first bounce.

(1)

height after first bounce = ... m

(iv) Explain why the ball does not bounce back to its starting height of 2.05 m.

(2)

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.....

(Total for question = 8 marks)

Q9.

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

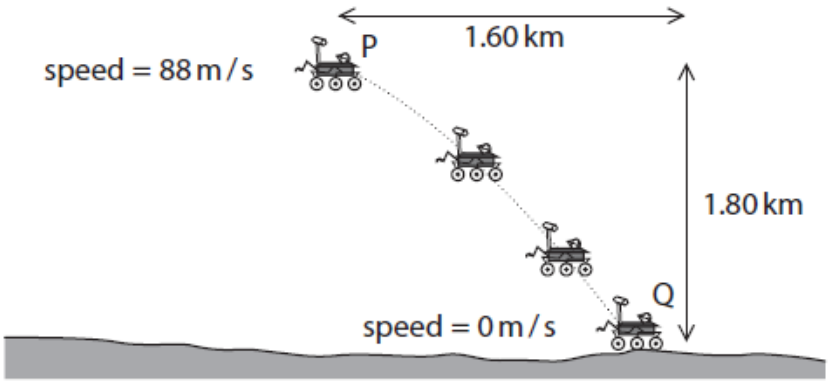


Figure 6

(i) Calculate the change in gravitational potential energy of the rover as it descends from position P to position Q.

Mass of rover = 1100 kg

Gravitational field strength on Mars = 3.7 N / kg

Give your answer to 2 significant figures.

(3)

change in gravitational potential energy = ... J

(ii) Use data from Figure 6 to calculate the change in kinetic energy of the rover as it descends from position P to position Q.

(2)

change in kinetic energy = ... J

(iii) The rover is slowed down safely using thrusters and a parachute (not shown in Figure 6).

The thrusters use jets of gas to control movements and the parachute is designed to be used in the atmosphere of Mars.

Describe the energy changes involved in terms of the work done by various forces as the rover descends.

(3)

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.....

(Total for question = 8 marks)

Q10.

A drone has a mass of 4.5 kg.

This drone rises from the ground to a height of 20 m.

(i) Calculate the change in gravitational potential energy when the drone rises through a height of 20 m.

The gravitational field strength g = 10N/kg.

(2)

change in gravitational potential energy = ... J

(ii) State the amount of useful work done by the blades as the drone rises through 20 m.

(1)

useful work done = ... J

(iii) It takes 4 s for the drone to rise through 20 m.

Calculate the useful power developed by the blades in this time of 4 s.

(2)

useful power developed = ... W

(Total for question = 5 marks)

Q11.

Figure 4 shows a drone.



© Liubov Kotliar/123RF

Figure 4

A different drone has a mass of 4.5 kg.

This drone rises from the ground to a height of 20 m.

(i) Calculate the change in gravitational potential energy when the drone rises through a height of 20 m.

The gravitational field strength g = 10 N/kg.

(2)

change in gravitational potential energy = ... J

(ii) State the amount of useful work done by the blades as the drone rises through 20 m.

(1)

useful work done = ... J

(iii) It takes 4 s for the drone to rise through 20 m.

Calculate the useful power developed by the blades in this time of 4 s.

(2)

useful power developed = ... W

(Total for question = 5 marks)

Q12.

Figure 15 shows a 'Mars rover' descending to the surface of the planet Mars.

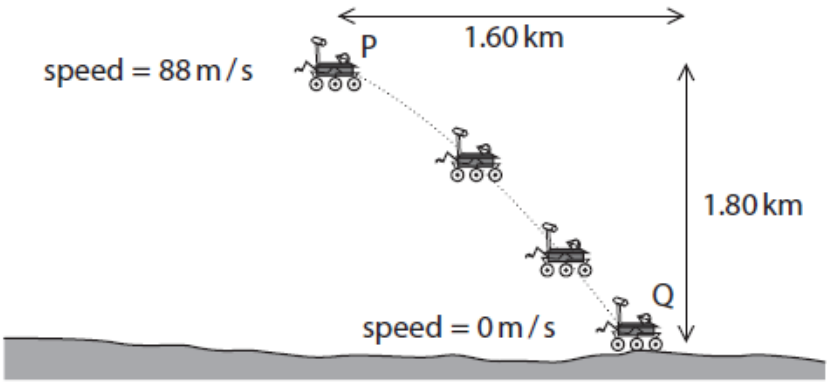


Figure 15

(i) Calculate the change in gravitational potential energy of the rover as it descends from position P to position Q.

Mass of rover = 1100 kg

Gravitational field strength on Mars = 3.7 N / kg

Give your answer to 2 significant figures.

(3)

change in gravitational potential energy = ... J

(ii) Use data from Figure 15 to calculate the change in kinetic energy of the rover as it descends from position P to position Q.

(2)

change in kinetic energy = ... J

(iii) The rover is slowed down safely using thrusters and a parachute (not shown in Figure 15).

The thrusters use jets of gas to control movements and the parachute is designed to be used in the atmosphere of Mars.

Describe the energy changes involved in terms of the work done by various forces as the rover descends.

(3)

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.....

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(Total for question = 8 marks)

Q13.

Figure 8 shows a bicycle.

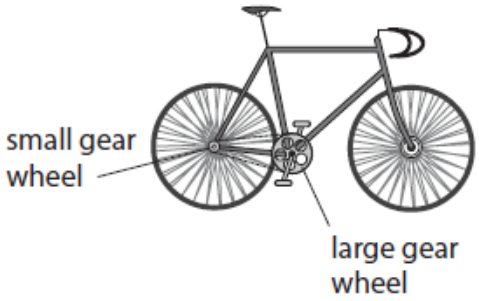


Figure 8

(i) The rider uses the pedals to make the large gear wheel turn.

The large gear wheel moves the chain.
The chain turns the small gear wheel.

The large gear wheel has 48 teeth.

The small gear wheel has 12 teeth.

The large gear wheel turns 2 times each second.

Calculate the number of times that the small gear wheel turns each second.

(2)

..... turns each second

(ii) Oil is applied to the wheel of a bicycle at the point shown in Figure 9.

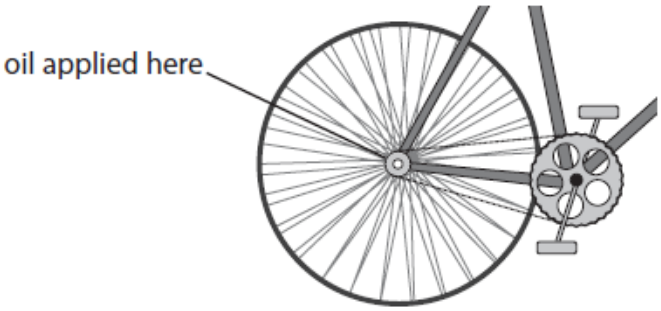


Figure 9

Explain how the oil improves the efficiency of the bicycle.

(3)

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(Total for question = 5 marks)

Q14.

Figure 14 shows an athlete using a fitness device.

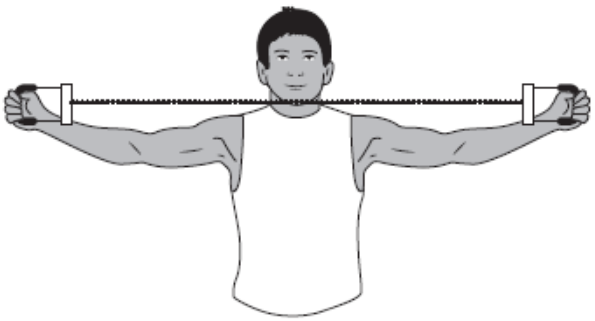


Figure 14

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)

Q15.

Figure 7 shows an athlete using a fitness device.

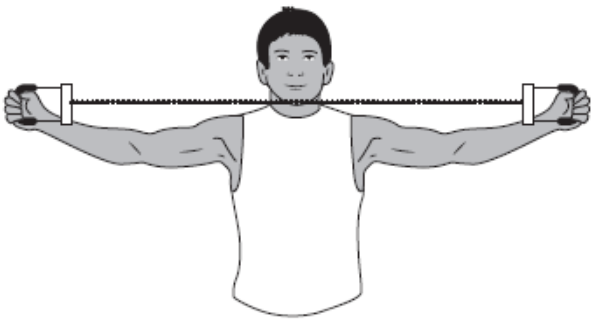


Figure 7

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 from the relevant equation sheet.

(3)

extension of the spring = ... m

(Total for question = 5 marks)

Q16.

The kinetic energy of another cyclist is 2800 J.

The mass of the cyclist is 85 kg.

Calculate the velocity of this cyclist.

Use the equation

$$KE = \frac{1}{2} \times m \times v^2$$

(3)

velocity = ... m / s

(Total for question = 3 marks)

Q17.

The kinetic energy of another cyclist is 2800 J.

The mass of the cyclist is 85 kg.

Calculate the velocity of this cyclist.

Use the equation

$$KE = \frac{1}{2} \times m \times v^2$$

(3)

velocity = ... m/s

(Total for question = 3 marks)

Q18.

Fuel weighing 230 000 N is pumped into an aircraft.

This fuel moves upwards through a vertical height of 4.7 m.

The power developed by the pump is 1600 W.

Calculate the time needed to refuel the aircraft.

(3)

time = ... s

(Total for question = 3 marks)

Q19.

Figure 1 shows part of a roller coaster ride seen from the side.

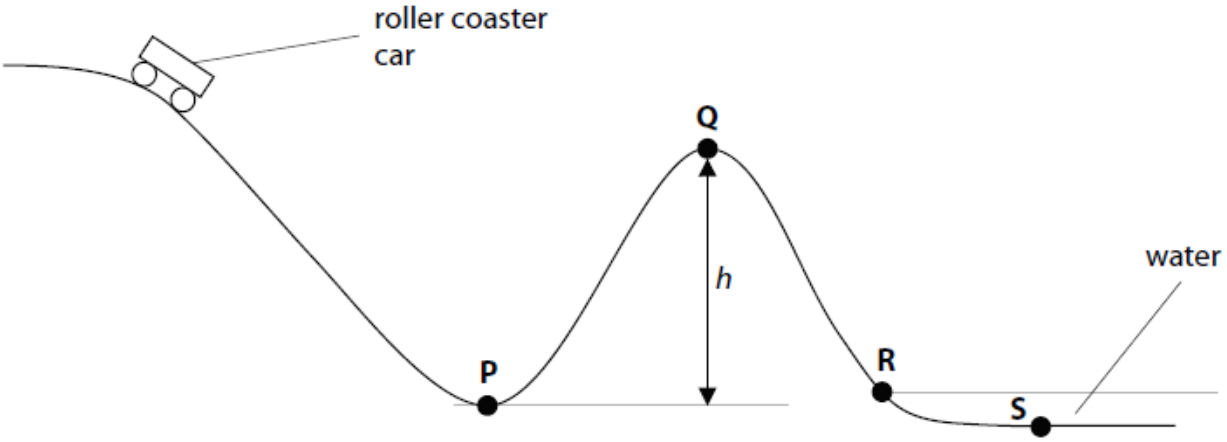


Figure 1

(a) The roller coaster car rolls down towards **P**. The car has mass, m kg and velocity v m/s.

Which of these is the correct equation for calculating the kinetic energy of the car?

(1)

☒ **A** $KE = mv$

☒ **B** $KE = mv^2$

☒ **C** $KE = ½mv^2$

☒ **D** $KE = 2mv^2$

(b) The mass of the car is 580 kg.

The car gains 39 000 J of gravitational potential energy as it climbs from **P** to **Q**.

(i) State the equation relating change in gravitational potential energy, mass, gravitational field strength and change in vertical height.

(1)

(ii) Calculate the height h, shown in Figure 1.

(gravitational field strength, g = 10 N/kg)

(3)

h = ... m

(Total for question = 5 marks)

Q20.

A cyclist is riding a bicycle at a steady velocity of 12 m/s.

The cyclist and bicycle have a total mass of 68 kg.

Calculate the kinetic energy of the cyclist and bicycle.

Use the equation

$$KE = \frac{1}{2} \times m \times v^2$$

(2)

kinetic energy = ... J

(Total for question = 2 marks)

Q21.

A cyclist is riding a bicycle at a steady velocity of 12 m/s.

The cyclist and bicycle have a total mass of 68 kg.

Calculate the kinetic energy of the cyclist and bicycle.

Use the equation

$$KE = \frac{1}{2} \times m \times v^2$$

(2)

kinetic energy = ... J

(Total for question = 2 marks)

Q22.

The espresso machine shown in Figure 27 is an electrical appliance.



(Source: © tanawaty/123RF)

Figure 27

The espresso machine has a steam pipe that can be used to heat milk in a jug, as shown in Figure 28.



(Source: © Wavebreak Media Ltd/123RF)

Figure 28

Steam from the pipe enters the milk, where steam condenses to water.

The steam and hot water heat the milk.

(i) Describe, in terms of energy, how the arrangement and movement of particles in the steam changes as the steam enters the milk, condenses and cools.

(2)

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(ii) The specific heat capacity of milk is 3840 J/kg K.

The specific heat capacity of water is 4200 J/kg K.

The specific latent heat of condensation of steam is 2260 kJ/kg.

The temperature of the steam is 100°C

The mass of steam that condenses is 25 g.

The temperature of the milk rises from 5°C to 65°C.

By considering the transfer of energy from the steam to the milk, calculate the mass of milk that is heated by the steam and hot water.

Use equations from the formula sheet.

(4)

mass of milk = ... kg

(iii) Give **two** reasons why the actual mass of steam needed to heat the milk from 5°C to 65°C is greater than 25 g.

(2)

1 .....

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2 .....

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(Total for question = 8 marks)

Q23.

Figure 14 shows a demolition ball of mass 400 kg.

The ball is used to demolish a wall.

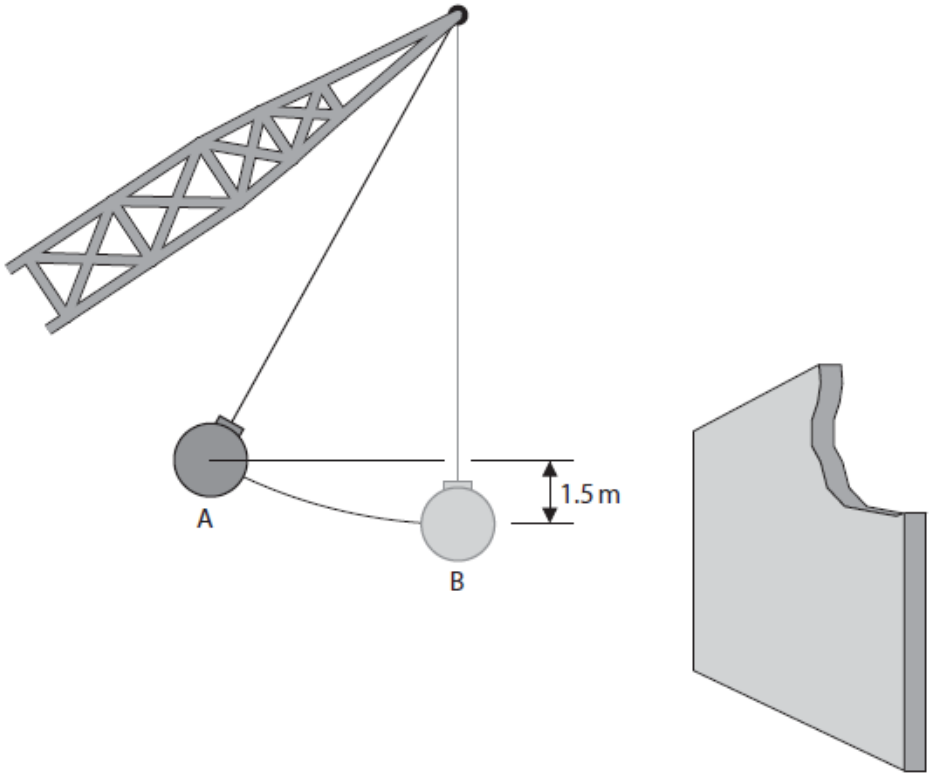


Figure 14

As the ball swings from A to B, it moves through a vertical height of 1.5 m.

(i) Calculate the change in gravitational potential energy.

Take gravitational field strength, g, to be 10 N/kg.

(3)

(ii) The heavy ball comes to rest soon after smashing into the wall. In doing this, the temperatures of the ball, wall and surroundings all increase slightly.

Explain this observation.

(2)

.....

.....

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.....

(iii) Which of these quantities of the ball changes in **both** magnitude and direction while the ball is swinging?

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

(1)

☒ **A** gravitational potential energy

☒ **B** velocity

☒ **C** the gravitational force acting

☒ **D** kinetic energy

(Total for question = 6 marks)

Q24.

Figure 8 shows a demolition ball of mass 400 kg.

The ball is used to demolish a wall.

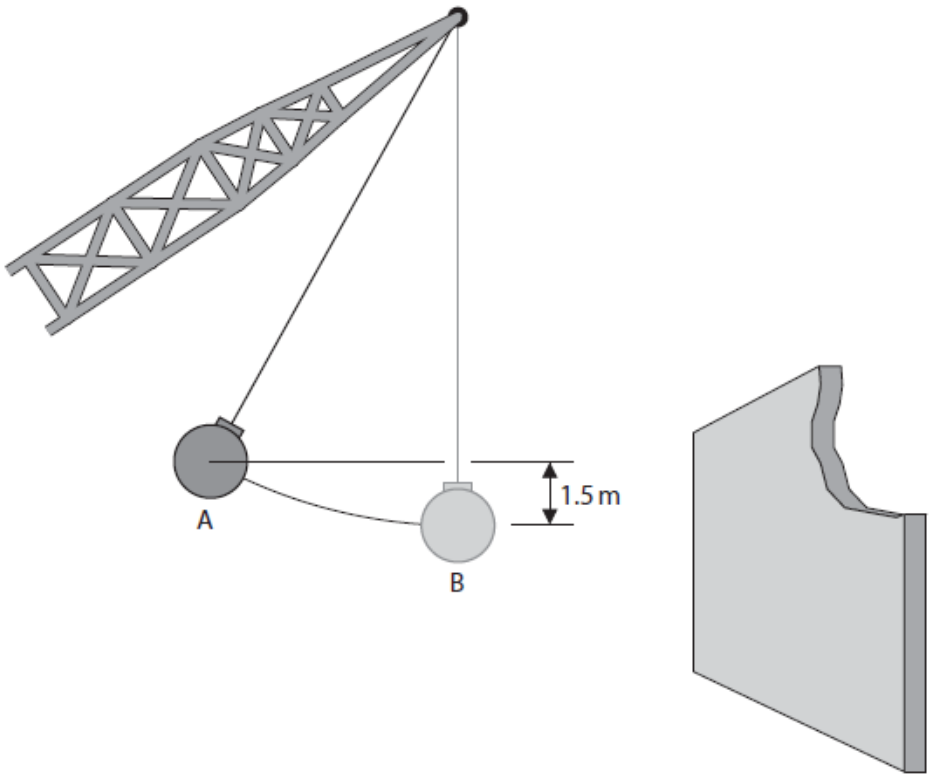


Figure 8

As the ball swings from A to B, it moves through a vertical height of 1.5 m.

(i) Calculate the change in gravitational potential energy.

Take gravitational field strength, g, to be 10 N/kg.

(3)

(ii) The heavy ball comes to rest soon after smashing into the wall. In doing this, the temperatures of the ball, wall and surroundings all increase slightly.

Explain this observation.

(2)

.....

.....

.....

.....

(iii) Which of these quantities of the ball changes in **both** magnitude and direction while the ball is swinging?

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

(1)

☒ **A** gravitational potential energy

☒ **B** velocity

☒ **C** the gravitational force acting

☒ **D** kinetic energy

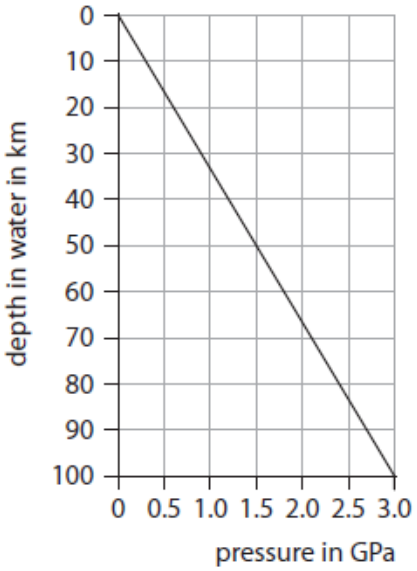
(Total for question = 6 marks)

Q25.

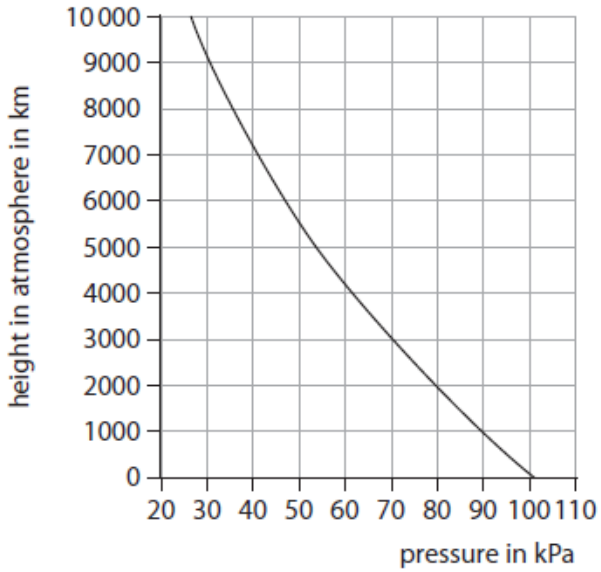
Figure 17 shows information about the pressures in the ocean and in the atmosphere of a distant planet.

Graph A shows the variation of pressure as the depth in the ocean increases.

Graph B shows the variation of pressure as the height in the atmosphere increases.



Graph A



Graph B

Figure 17

(i) Use information from Graph A to obtain a value for the density of the ocean water.

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

(4)

density = ... kg/m^3

* (ii) Explain the similarities and differences in the pressure variations shown in graphs A and B.

Your answer should refer to both the particle model (kinetic theory) and to density.

(6)

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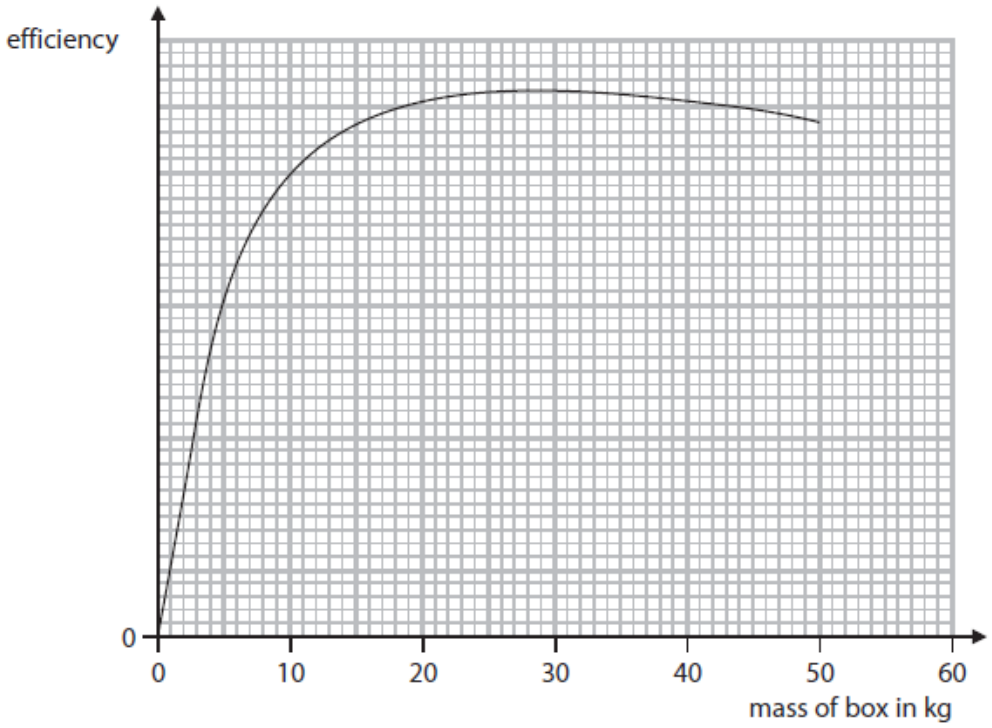
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(Total for question = 10 marks)

Q26.

An electric motor is used to lift a box.

Figure 4 shows how the efficiency of the electric motor changes as the mass of the box increases.



Describe how the efficiency of the electric motor depends on the mass of the box lifted.

(2)

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(Total for question = 2 marks)

Q27.

An electric motor is used to lift a box.

Figure 2 shows how the efficiency of the electric motor changes as the mass of the box increases.

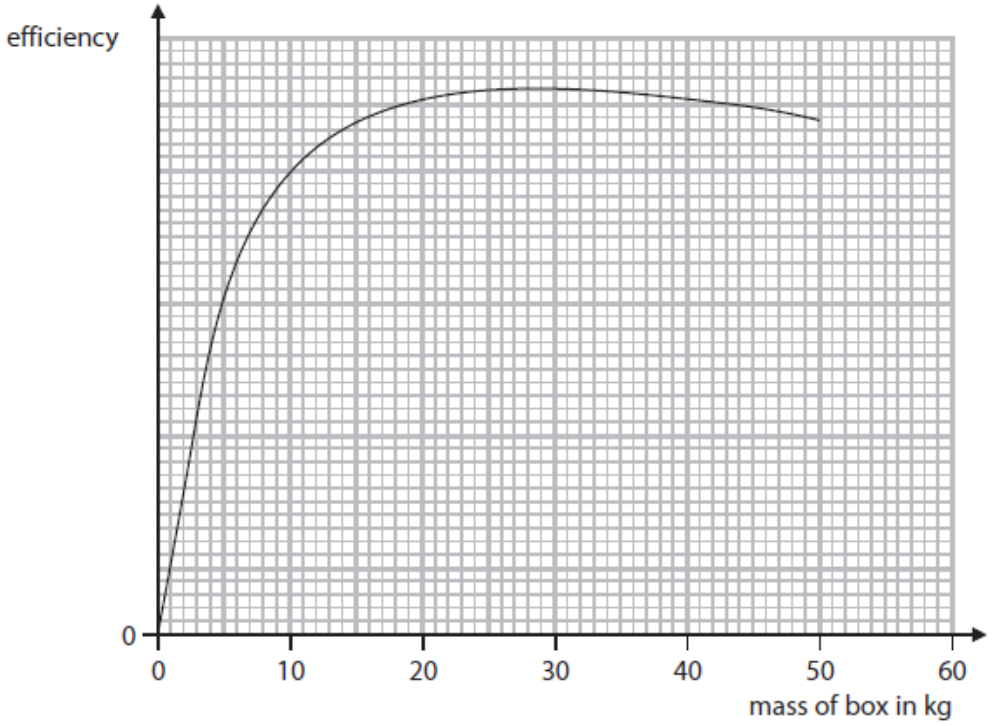


Figure 2

Describe how the efficiency of the electric motor depends on the mass of the box lifted.

(2)

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(Total for question = 2 marks)

Q28.

Figure 1 shows part of a roller coaster ride seen from the side.

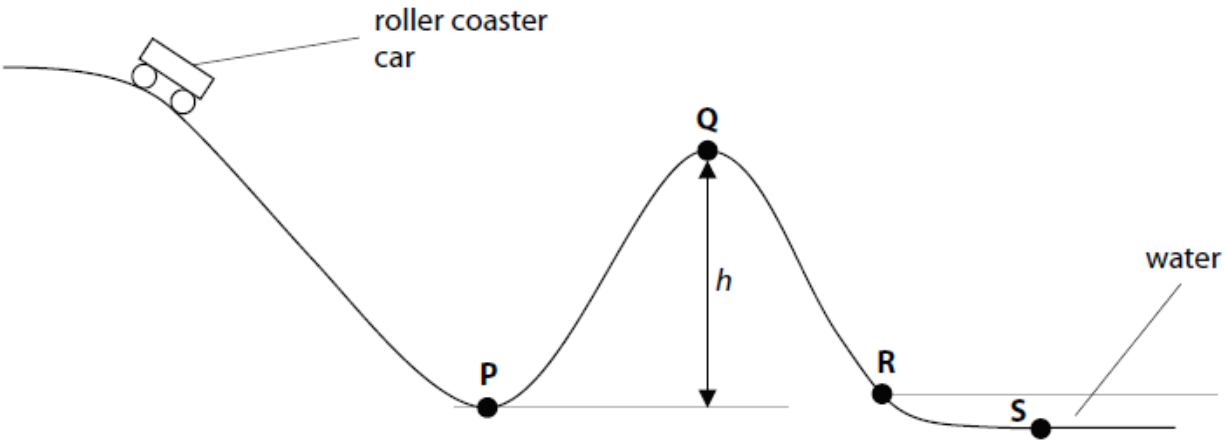


Figure 1

The car enters a pool of water at **R**. It slows down and stops at **S**.

Describe how the total energy of the system is conserved as the car travels between **R** and **S**.

(2)

.....

.....

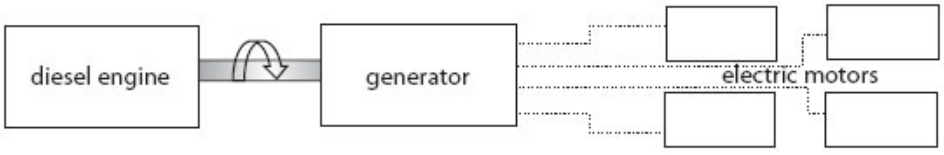
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(Total for question = 2 marks)

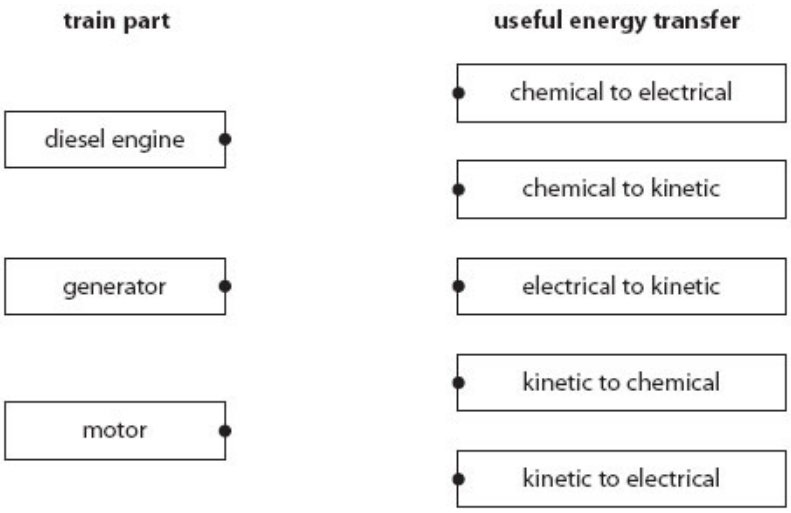
Q29.

(a) A train is powered by a diesel engine.
The diesel engine is used to turn a generator.
The generator provides electricity for electric motors which drive the wheels.



(i) Draw one straight line from each train part to its useful energy transfer.

(3)

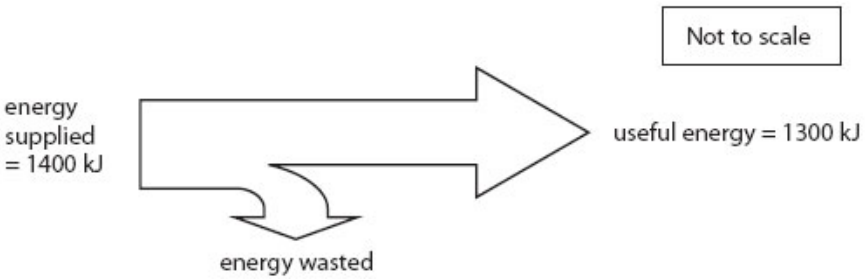


(ii) State **one**example of a non-useful energy transfer in the motor.

(1)

.....

(b) The diagram represents the energy transfer in one second in the generator.



(i) Calculate the amount of energy wasted in one second in the generator.

(1)

energy wasted = ...kJ

(ii) Calculate the efficiency of the generator.

(2)

efficiency of generator = ...

(c) The electric motors which drive the wheels are painted black.

Suggest why the motors are painted black.

(1)

.....

.....

(Total for Question is 8 marks)

Q30.

A cyclist is riding a bicycle at a steady velocity of 12 m/s.

The cyclist and bicycle have a total mass of 68 kg.

Describe the energy transfers that happen when the cyclist uses the brakes to stop.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)