PEARSON EDEXCEL GCSE PHYSICS (HIGHER) · 1PH0

PHYSICS



EXAM QUESTION PACK

TOPIC 8: ENERGY – FORCES DOING WORK (PACK 2)

SCORE	PERCENTAGE
/64	%

STEMUP

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Q1.

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.

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

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

(2)

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(Total for question = 2 marks)

Q2.

The International Space Station (ISS) has several solar panels called wings.



(a) The wings convert energy from the Sun into a form useful in the ISS.

(1)

☒ **A** transverse and electromagnetic

☒ **B** electromagnetic but not transverse

☒ **C** transverse but not electromagnetic

☒ **D** neither transverse nor electromagnetic

(b) In one second, the useful energy available from one wing is 34.3 kJ.
The energy incident on the wing from the Sun is five times this amount.

What is the percentage efficiency of the wing?

(3)

efficiency = ... %

(c) A wing is in direct sunlight.
The ISS is not receiving energy from the wing.
The temperature of the wing remains constant.

Explain why the temperature of the wing remains constant in these conditions.

(2)

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Q3.

The International Space Station (ISS) has several solar panels called wings.



(a) The wings convert energy from the Sun into a form useful in the ISS.

(1)

☒ **A** transverse and electromagnetic

☒ **B** electromagnetic but not transverse

☒ **C** transverse but not electromagnetic

☒ **D** neither transverse nor electromagnetic

(b) In one second, the useful energy available from one wing is 34.3 kJ.
The energy incident on the wing from the Sun is five times this amount.

What is the percentage efficiency of the wing?

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efficiency = ... %

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The ISS is not receiving energy from the wing.
The temperature of the wing remains constant.

Explain why the temperature of the wing remains constant in these conditions.

(2)

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Q4.

Figure 14 shows a demolition ball of mass 400 kg.

The ball is used to demolish a wall.

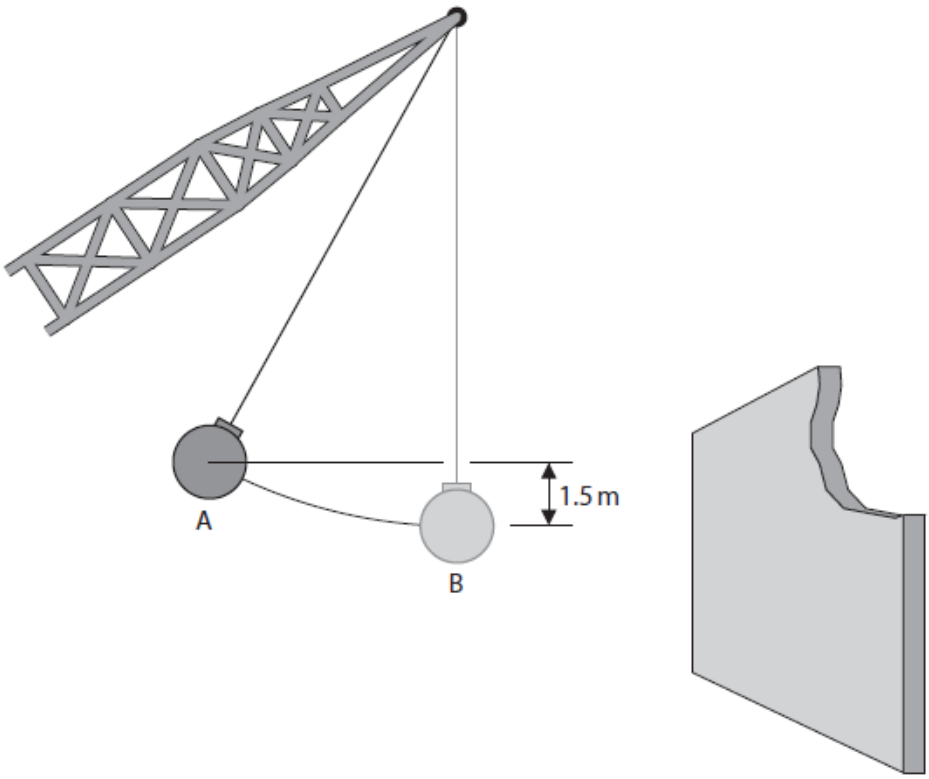


Figure 14

* After knocking down the wall, the ball will swing **freely**.

The graph in Figure 15 shows how the height of the ball above ground varies with time during three swings.

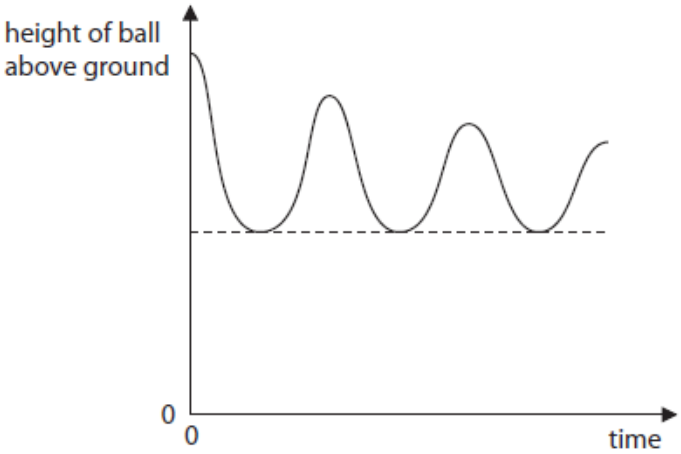


Figure 15

Explain how the energy within the system changes during this time.

The system consists of the swinging ball and its surroundings.

(6)

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(Total for question = 6 marks)

Q5.

Figure 8 shows a demolition ball of mass 400 kg.

The ball is used to demolish a wall.

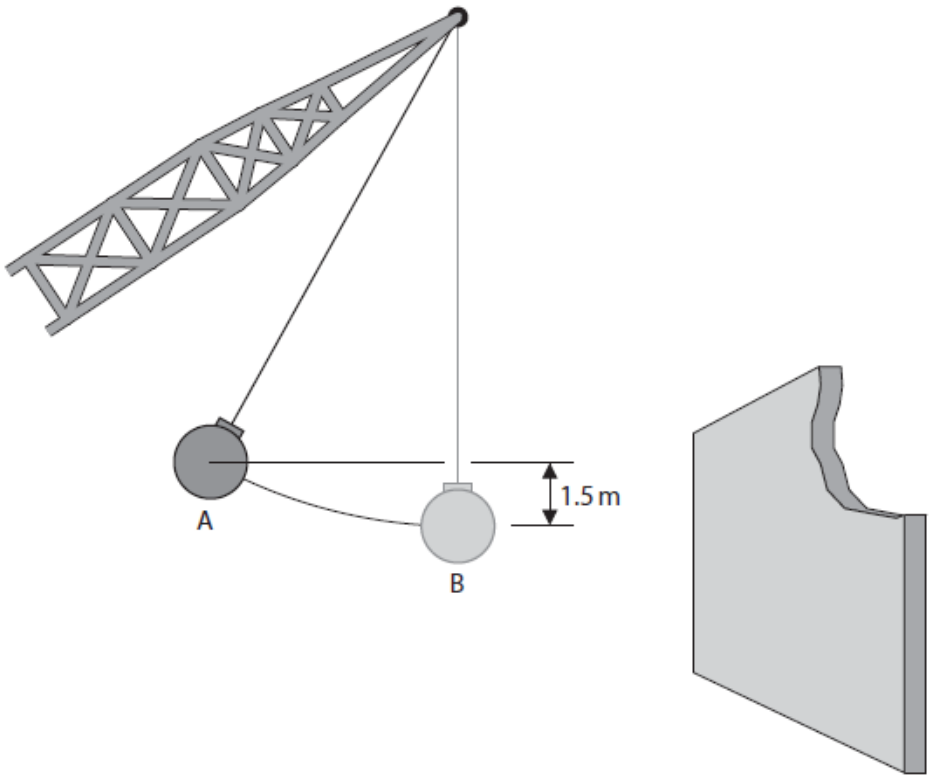


Figure 8

* After knocking down the wall, the ball will swing **freely**.

The graph in Figure 9 shows how the height of the ball above ground varies with time during three swings.

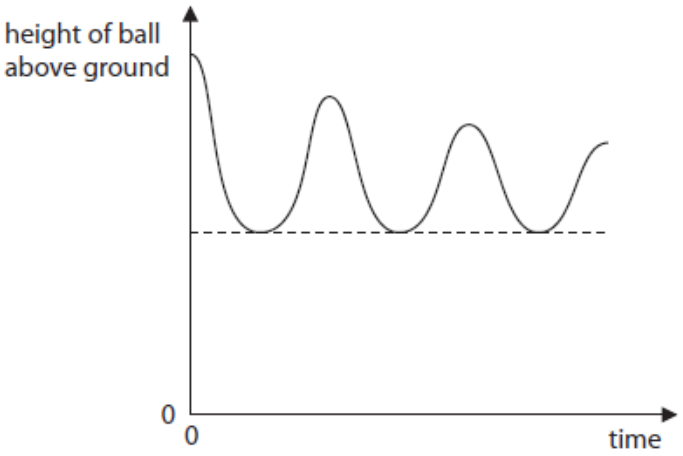


Figure 9

Explain how the energy within the system changes during this time.

The system consists of the swinging ball and its surroundings.

(6)

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(Total for question = 6 marks)

Q6.

(i) Figure 14 shows the vertical forces on an aeroplane.

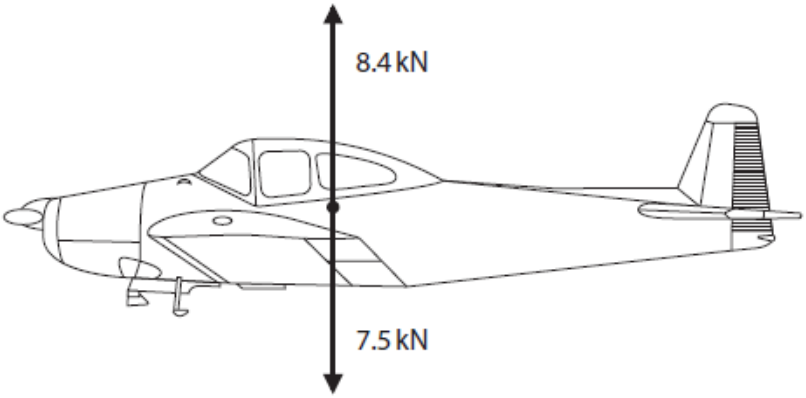


Figure 14

Use information from the diagram to determine the size and direction of the resultant vertical force on the aeroplane.

(2)

size = ... kN, direction is .....

(ii) The aeroplane is descending.

Figure 15 shows a diagram of the resultant vertical and horizontal forces on the aeroplane as it is descending.

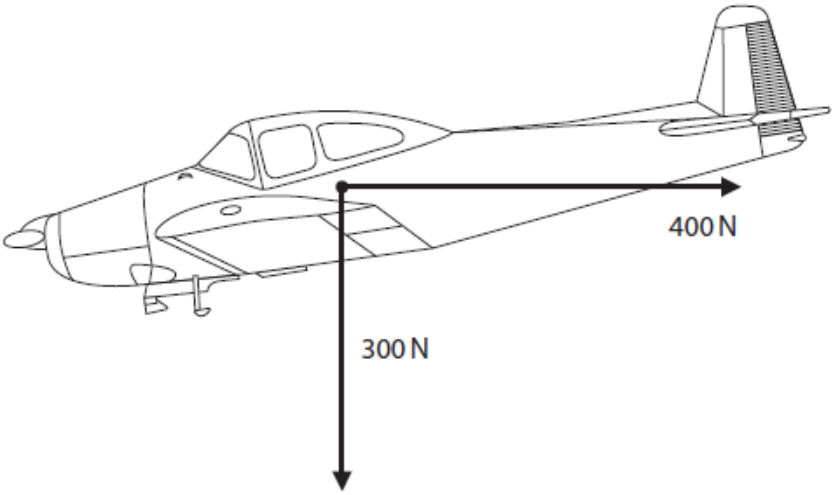


Figure 15

Complete the diagram to show the resultant of these two forces.

(1)

(iii) The mass of the aeroplane is 750 kg.

Calculate the change in gravitational potential energy of the aeroplane as it descends from 1300 m to the ground.

Gravitational field strength (g) = 10 N/kg

(2)

energy = ... J

(Total for question = 5 marks)

Q7.

(i) Figure 14 shows the vertical forces on an aeroplane.

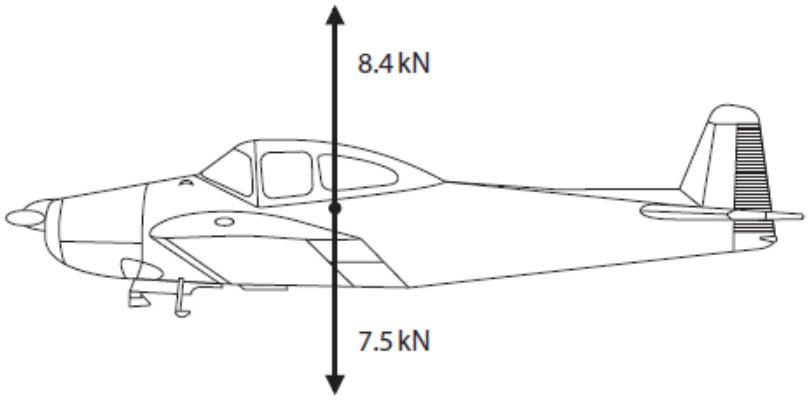


Figure 14

Use information from the diagram to determine the size and direction of the resultant vertical force on the aeroplane.

(2)

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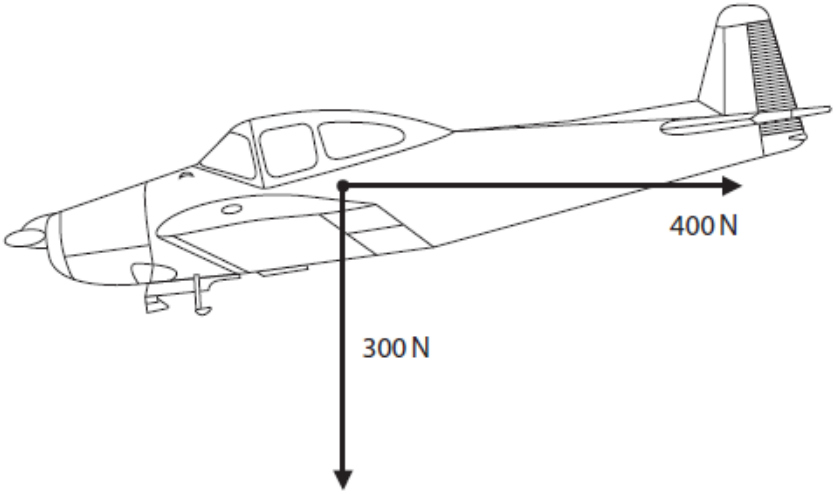


Figure 15

Complete the diagram to show the resultant of these two forces.

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(iii) The mass of the aeroplane is 750 kg.

Calculate the change in gravitational potential energy of the aeroplane as it descends from 1300 m to the ground.

Gravitational field strength (g) = 10 N/kg

(2)

energy = ... J

(Total for question = 5 marks)

Q8.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

Two cyclists ride on a hilly road and go through points P, Q, R and S.

The diagram in Figure 16 shows how the vertical height of the road changes during the journey from P to S.

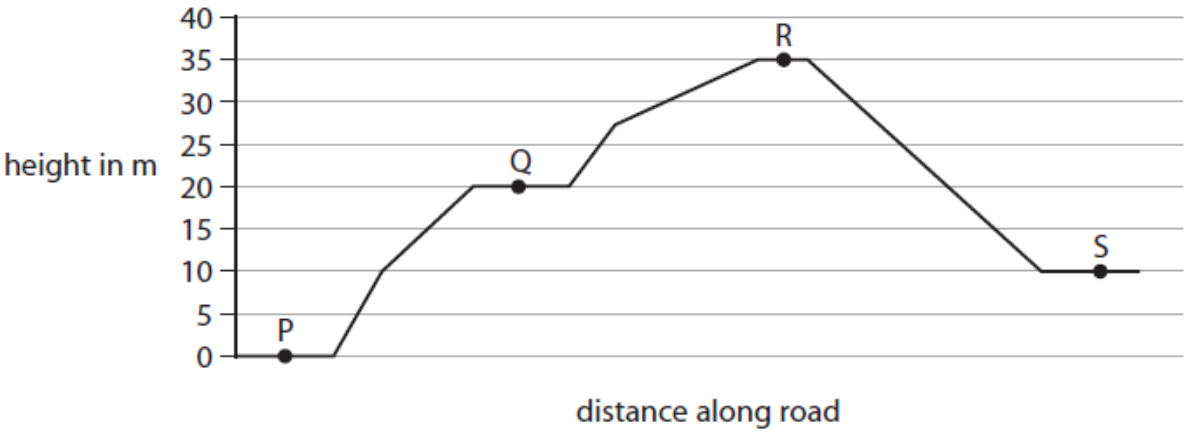


Figure 16

(i) The greatest overall change in gravitational potential energy for each cyclist is between which two points on the journey?

(1)

☒ **A** P and Q

☒ **B** Q and R

☒ **C** P and S

☒ **D** R and S

(ii) The total weight of one cyclist and bicycle is 700 N.

Calculate the total amount of work done against gravity when the cyclist travels from point P to point Q in the journey.

(2)

work done = ... J

(iii) The gravitational potential energy of the other cyclist changes by 11 250 J when travelling from point Q to point R.

Calculate the mass of this cyclist.

Gravitational field strength = 10 N / kg

Use the equation

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

(2)

mass = ... kg

(iv) Explain why the total amount of work done by a cyclist between points Q and R is different from the change in gravitational potential energy of the cyclist between points Q and R.

(2)

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(v) The cyclists lubricated the chains and the wheel bearings of their bicycles before setting off.

Lubricating the chains and wheel bearings helps to

(1)

☒ **A** decrease the amount of work done against gravity

☒ **B** decrease the efficiency of the cyclist and bicycle

☒ **C** increase the efficiency of the cyclist and bicycle

☒ **D** increase the overall amount of energy transferred by the cyclist

(Total for question = 8 marks)

Q9.

Answer the questions with a cross in the boxes you think are correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Two cyclists ride on a hilly road and go through points P, Q, R and S.

The diagram in Figure 7 shows how the vertical height of the road changes during the journey from P to S.

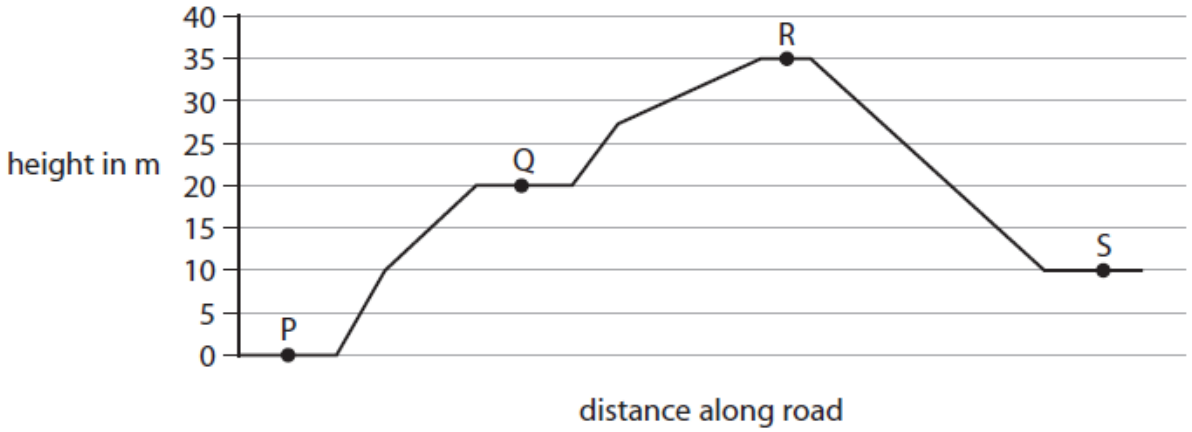


Figure 7

(i) The greatest overall change in gravitational potential energy for each cyclist is between which two points on the journey?

(1)

☒ **A** P and Q

☒ **B** Q and R

☒ **C** P and S

☒ **D** R and S

(ii) The total weight of one cyclist and bicycle is 700 N.

Calculate the total amount of work done against gravity when the cyclist travels from point P to point Q in the journey.

(2)

work done = ... J

(iii) The gravitational potential energy of the other cyclist changes by 11 250 J when travelling from point Q to point R.

Calculate the mass of this cyclist.

Gravitational field strength = 10 N / kg

Use the equation

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

(2)

mass = ... kg

(iv) Explain why the total amount of work done by a cyclist between points Q and R is different from the change in gravitational potential energy of the cyclist between points Q and R.

(2)

.....

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(v) The cyclists lubricated the chains and the wheel bearings of their bicycles before setting off.

Lubricating the chains and wheel bearings helps to

(1)

☒

A decrease the amount of work done against gravity

☒ **B** decrease the efficiency of the cyclist and bicycle

☒ **C** increase the efficiency of the cyclist and bicycle

☒ **D** increase the overall amount of energy transferred by the cyclist

(Total for question = 8 marks)

Q10.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Which of these is the equation for work done?

(1)

☒ **A** work done = force ÷ distance moved in direction of force

☒ **B** work done = force × distance moved in direction of force

☒ **C** work done = force ÷ distance moved at right angles to direction of force

☒ **D** work done = force × distance moved at right angles to direction of force

(Total for question = 1 mark)

Q11.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Which of these is the equation for work done?

(1)

☒ **A** work done = force ÷ distance moved in direction of force

☒ **B** work done = force × distance moved in direction of force

☒ **C** work done = force ÷ distance moved at right angles to direction of force

☒ **D** work done = force × distance moved at right angles to direction of force

(Total for question = 1 mark)

Q12.

(a) A father pushes his child in a cart. The cart starts to move.



Scientists can use many physical quantities to describe what is happening.

Four of these are shown in the box.

energy	momentum	power	work

(i) Which one of these can be measured in joules per second?

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

(1)

☒ **A** energy

☒ **B** momentum

☒ **C** power

☒ **D** work

(ii) Complete the sentence using words from the box.

(1)

The ..... transferred to the cart is equal to the ..... done on the cart.

(iii) The child and cart have a total mass of 50 kg. They travel at a velocity of 4 m/s.

Calculate the momentum of the child and cart.

(2)

momentum = ... kg m/s

(iv) The father applies a steady force for a time of 1.5 s. The momentum of the child and cart increases by 450 kg m/s.

Calculate the force which the father applies.

(2)

force = ... N

(v) Momentum is a vector quantity.

State what is meant by a vector quantity.

(1)

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(b) The photograph shows a mother and her daughter stationary on an ice rink.



The mother and daughter push each other away.
They move in opposite directions with different speeds.

Explain why they have different speeds.

(3)

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(Total for Question = 10 marks)

Q13.

Figure 14 shows the vertical forces on an aeroplane.

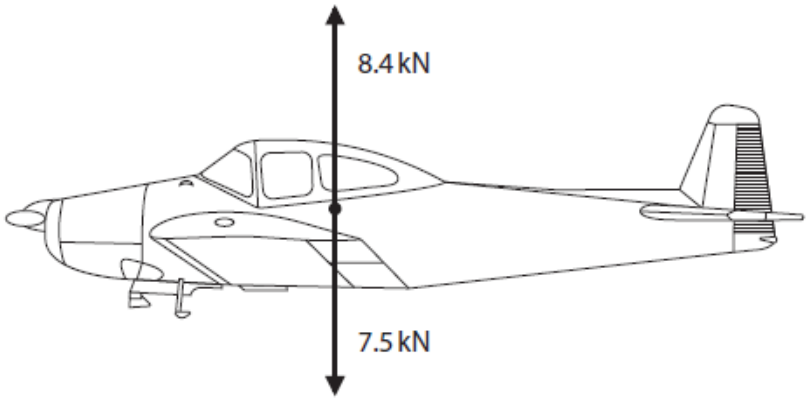


Figure 14

The 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)

Q14.

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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)

Q15.

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

They drop balls into a tray filled with sand.

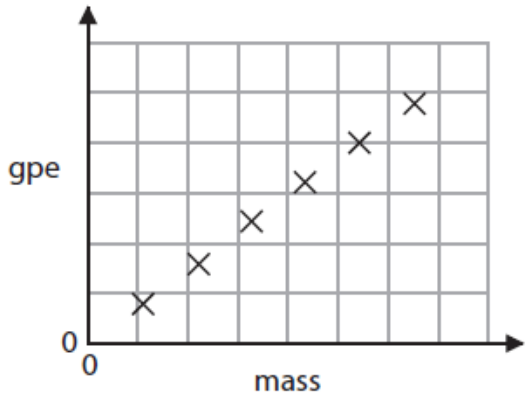
They use six balls with different masses.

They drop each ball from the same height.

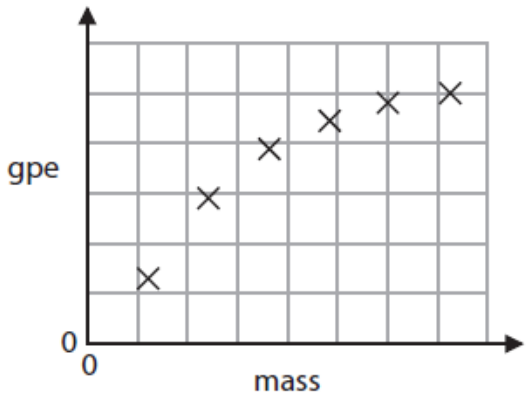
(a) (i) Which one of these graphs shows the relationship between the gravitational potential energy (gpe) of the balls and their mass when they are all at the same height?

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

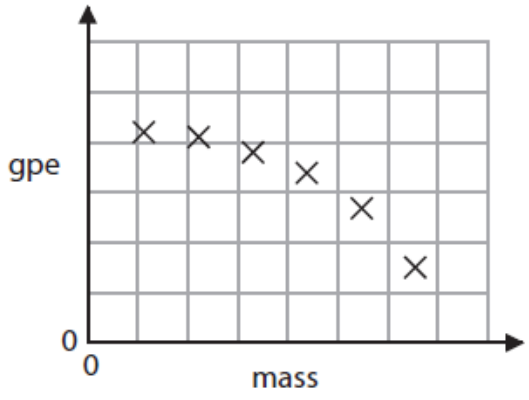
(1)



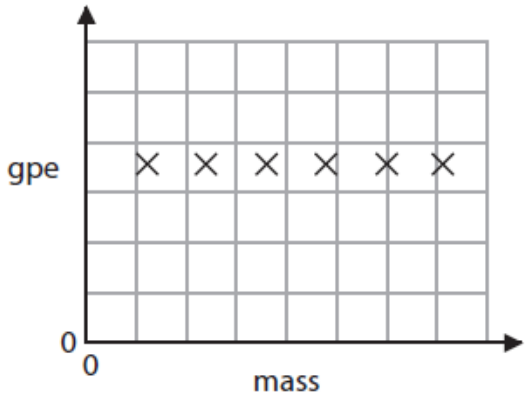
☐ **A**



☐ **B**



☐ **C**



☐ **D**

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

(2)

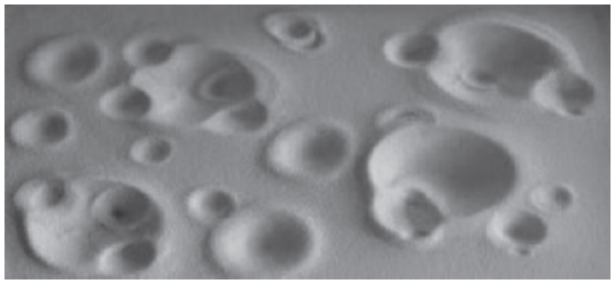
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(b) This photograph shows the sand after several balls have hit it.



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

Q16.

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

They drop balls into a tray filled with sand.

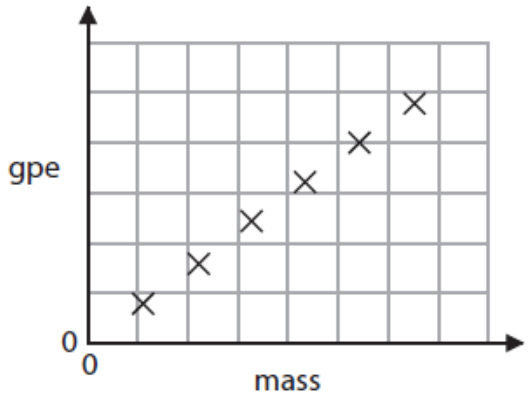
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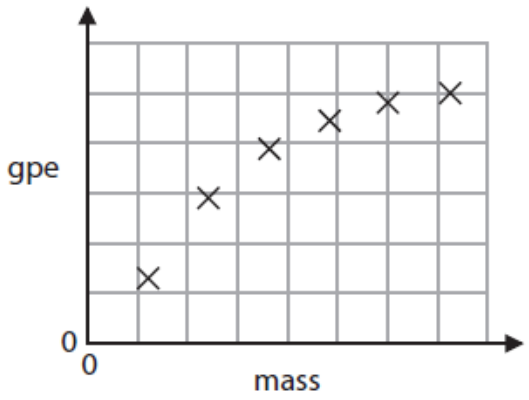
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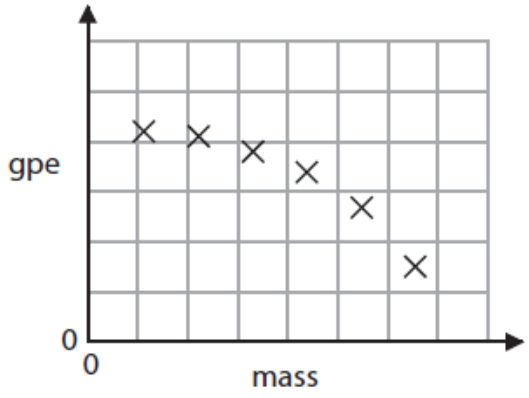
(1)



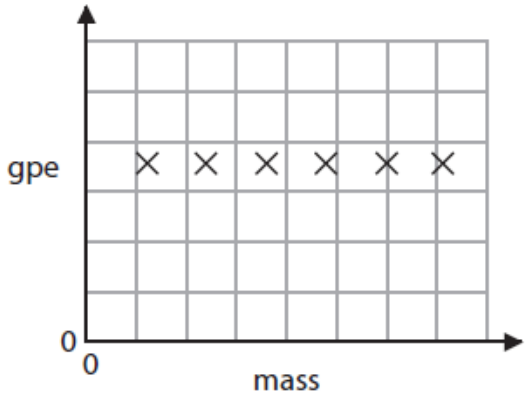
☐ **A**



☐ **B**



☐ **C**



☐ **D**

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

(2)

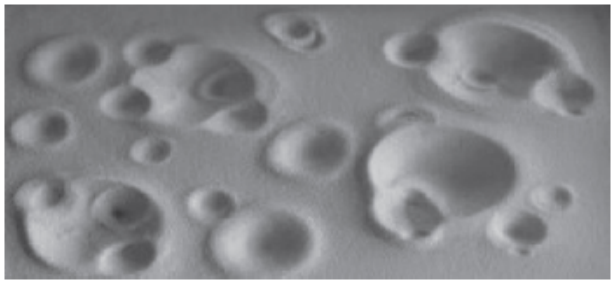
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(b) This photograph shows the sand after several balls have hit it.



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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

Q17.

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)

Q18.

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

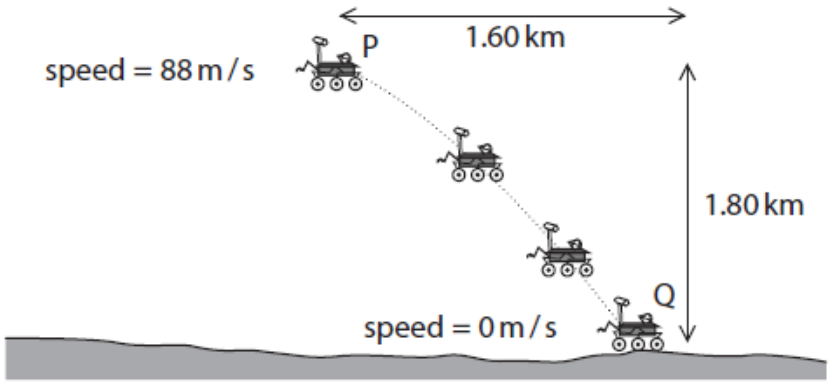


Figure 6

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(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)

Q19.

The area between the curve and the extension axis of a force/extension graph corresponds to work done or energy transferred.

Suggest what the shaded area of the graph in Figure 16 represents.

(2)

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(Total for question = 2 marks)

Q20.

The area between the curve and the extension axis of a force/extension graph corresponds to work done or energy transferred.

Suggest what the shaded area of the graph in Figure 9 represents.

(2)

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(Total for question = 2 marks)

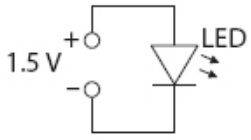
Q21.

(a) What is the name of the device used to change the size of an alternating voltage?

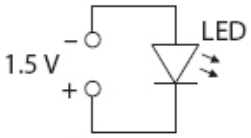
(1)

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(b) A light emitting diode (LED) can only emit light when connected correctly to a potential difference.

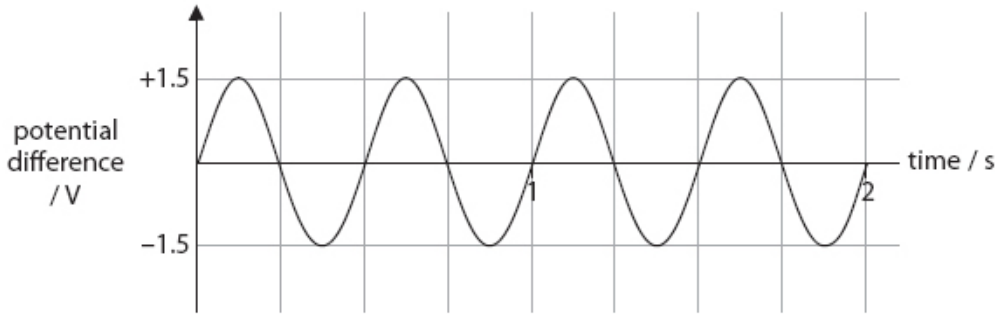


LED emits light



LED does **not** emit light

Use this information to suggest what happens when this alternating voltage is connected across the LED.



.....

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.....

.....

(c) A LED lamp has a power rating of 3 W.
The voltage across the lamp is 12 V.
Calculate the current in the lamp.

(3)

current in the lamp =.....A

*(d) Some research has been carried out into replacing fluorescent lamp fittings with LED fittings.



photo of stairwell
with fluorescent fitting



photo of stairwell
with LED fitting

The data in the table is taken from the report of a trial using LEDs to light stairwells and corridors in a large building.

total energy saved each year by using LEDs	3 000 kW h
LED fitting cost	£2 000
CO_2 saving each year by using LEDs	1.6 tonnes
change in lighting levels by using LEDs	200%
average price of electrical energy	14 p / kW h
average lifetime of LED fittings	50 000 hours
average lifetime of fluorescent fittings	10 000 hours

Use the information to discuss the benefits of replacing fluorescent fittings with LED fittings.

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(Total for Question = 12 marks)