PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

PHYSICS



EXAM QUESTION PACK

TOPIC 3: CONSERVATION OF ENERGY (PAPER 1)

SCORE	PERCENTAGE
/127	%

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Q1.

Figure 11 shows a wind turbine.

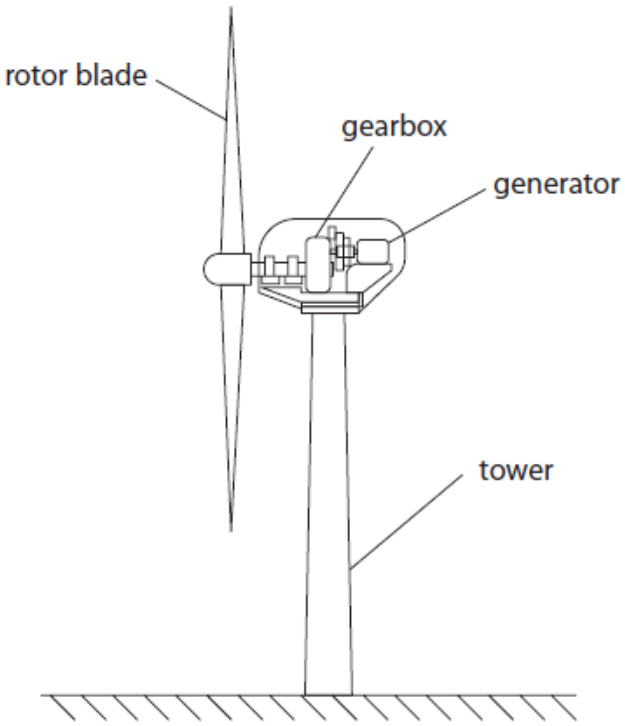


Figure 11

Explain how unwanted energy transfers could be reduced in the gear box.

(2)

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(Total for question = 2 marks)

(Q14 1SC0/1PF, June 2018)

Q2.

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 (☒).

Carbon-14 is a radioactive substance that emits beta minus (β^-) particles.

(i) Which of these is the unit for the activity of a sample of carbon-14?

(1)

☒ **A** Pa

☒ **B** Nm

☒ **C** Gs

☒ **D** Bq

(ii) Which row of the table gives a correct comparison of the penetrating abilities of alpha, beta and gamma radiation?

(1)

		least penetrating ⟶ most penetrating
☒	**A**	alpha, beta, gamma
☒	**B**	alpha, gamma, beta
☒	**C**	gamma, beta, alpha
☒	**D**	gamma, alpha, beta

(iii) The mass of a beta minus particle is 9.1×10^{-31} kg.

Calculate the kinetic energy of a beta minus particle moving with a speed of 3.8×10^6m/s.

(2)

kinetic energy = ... J

(Total for question = 4 marks)

(**QU06a 1SC0/1PH, June 2025**)

Q3.

Figure 6 shows apparatus set up to investigate the speed of a falling object.

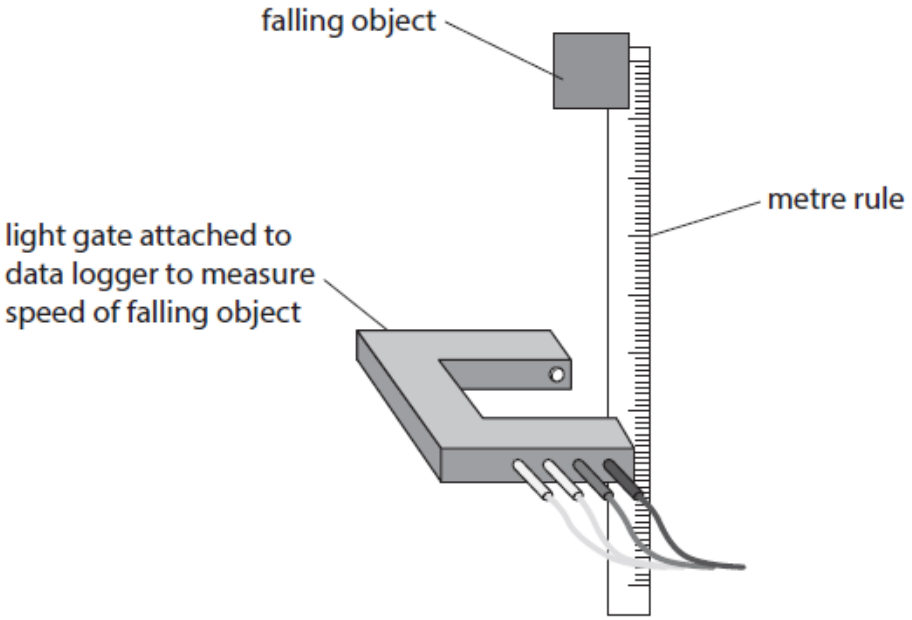


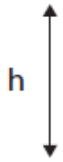
Figure 6

The object is dropped from rest at the position shown.
The object falls through the light gate.

(i) The speed of the object, after it has fallen through a height, h, is measured by the light gate.

Label Figure 6 to show the height, h.
Your label should look like this

(1)



(ii) The speed is measured at least four times for each drop height.

Give **one** reason for repeating the measurements.

(1)

.....

.....

(iii) The metre rule shown in Figure 6 is used to measure the height, h.

Suggest **two** ways to make the measurement of h as accurate as possible.

(2)

1 .....

.....

2 .....

.....

(Total for question = 4 marks)

(**QU04a 1SC0/1PF, June 2025**)

Q4.

A cyclist has a mass of 64 kg.

(i) The cyclist rides from a flat road to the top of a hill.

The top of the hill is 24 m above the flat road.

Calculate the gain in gravitational potential energy, ΔGPE, of the cyclist.

Use g = 10 N/kg

Use the equation

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

(2)

gain in gravitational potential energy = ... J

(ii) The cyclist returns to the flat road.

The mass of the cyclist is 64 kg.

Calculate the kinetic energy of the cyclist when the cyclist is travelling at 6.0 m/s.

Use the equation

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

(3)

kinetic energy = ... J

(iii) The cyclist then uses the brakes on the bicycle to stop.

Explain what happens to the kinetic energy of the cyclist.

(2)

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(Total for question = 7 marks)

(**Q02a 1SC0/1PF, Nov 2021**)

Q5.

Figure 2 shows an energy transfer diagram for a steam engine.

The diagram shows the amounts of energy transferred each second by the steam engine.

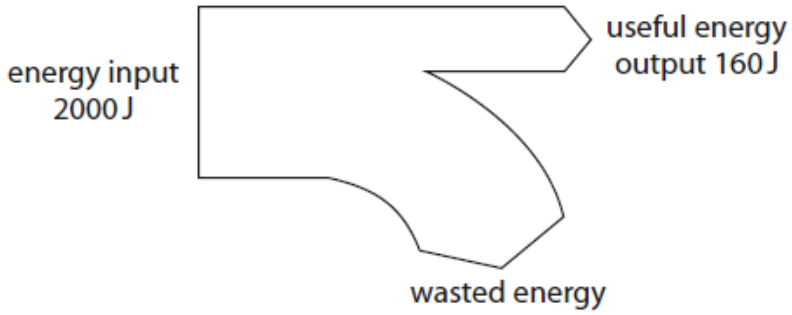


Figure 2

(i) Calculate the amount of wasted energy.

(1)

wasted energy = ... J

(ii) Calculate the efficiency of the steam engine.

Use the equation

$$\text{efficiency} = \frac{\text{(useful energy transferred by the steam engine)}}{\text{(total energy supplied to the steam engine)}}$$

(2)

efficiency = ...

(iii) State what happens to the wasted energy.

(1)

.....

.....

(iv) Coal is a fossil fuel that is burnt in some steam engines.

State **two** ways that the use of coal might be harmful to the environment.

(2)

1 .....

.....

2 .....

.....

(Total for question = 6 marks)

(**Q02a 1SC0/1PF, June 2019**)

Q6.

Shot-put is an Olympic event.
The shot is a heavy ball.
An athlete throws the shot as far as possible.

A sports scientist analyses an athlete's throw to help improve performance.

In one throw, the shot continues to rise by another 1.3 m after it leaves the athlete's hand.
The mass of the shot is 7.26 kg.

(i) Calculate the amount of gravitational potential energy gained by the shot.

(2)

gravitational potential energy gained = ... J

(ii) Explain how the total energy stored in the shot changes between leaving the athlete's hand and hitting the ground.

(2)

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.....

(Total for question = 4 marks)

(**Q05c 1SC0/1PF, SAM**)

Q7.

A different cyclist uses a motorised bicycle.

The motorised bicycle is powered by an electric motor.

Figure 3 is an energy diagram for the motor.

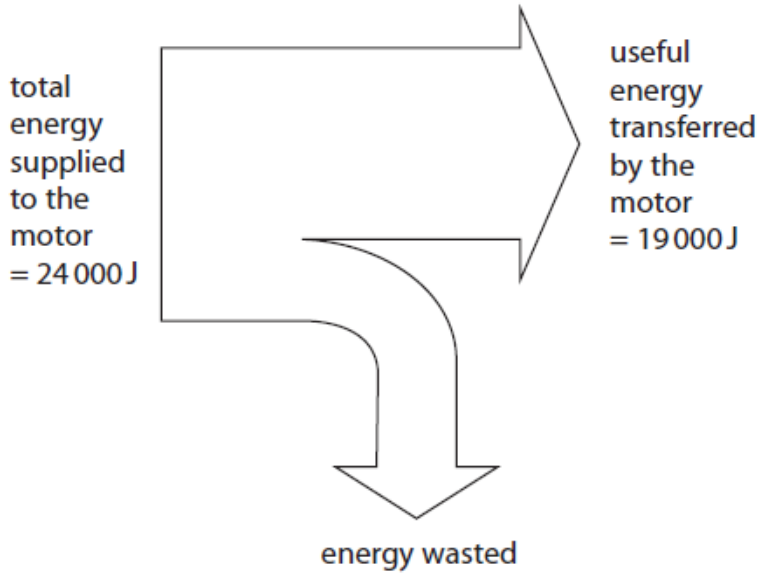


Figure 3

(i) Calculate how much energy is wasted.

(1)

energy wasted = ... J

(ii) Calculate the efficiency of the electric motor.

Use the equation:

(2)

$$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}}$$

efficiency of electric motor = ...

(Total for question = 3 marks)

(**Q02b 1SC0/1PF, Nov 2021**)

Q8.

Figure 8 shows two ice skaters during a performance.



Figure 8

(i) The two ice skaters are travelling together in a straight line at 3.50 m/s.

Their total momentum is 371 kgm/s.

The man has a mass of 64.5 kg.

Calculate the mass of the woman.

(4)

mass = ... kg

(ii) Calculate the kinetic energy of the man.

(2)

kinetic energy = ... J

(Total for question = 6 marks)

(**Q06a 1SC0/1PH, SAM**)

Q9.

Figure 4 shows a truck lifting a box.

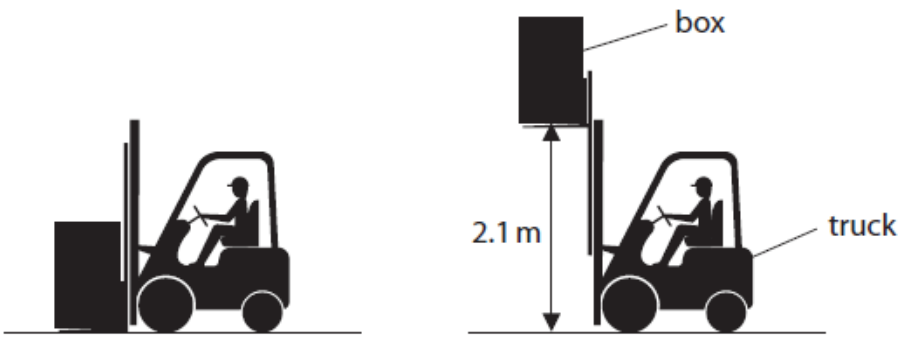


Figure 4

The box has a mass of 57 kg.

The truck lifts the box through a vertical height of 2.1 m.

The gravitational field strength, g = 10 N/kg

Calculate the change in the gravitational potential energy of the box.

Use the equation

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

(2)

change in gravitational potential energy = ... J

(Total for question = 2 marks)

(**QU03a 1SC0/1PF, June 2022**)

Q10.

A stone is held at rest above the ground.

The stone is released and falls until its velocity is 17 m / s.

Calculate the distance the stone has fallen when its velocity has reached 17 m / s.

(2)

distance = ... m

(Total for question = 2 marks)

(**QU02b 1SC0/1PH, June 2023**)

Q11.

Figure 11 is an energy diagram for an electric kettle, used to heat water.

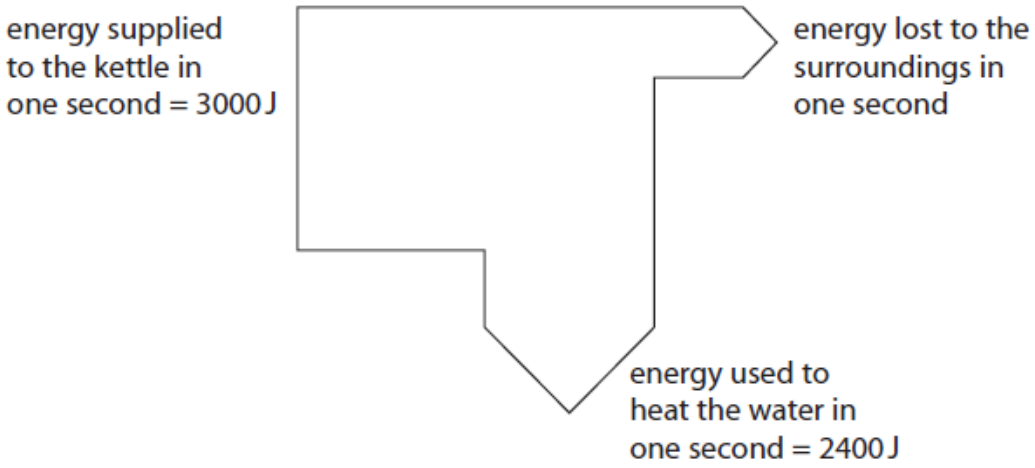


Figure 11

(i) Calculate the amount of energy lost to the surroundings in one second.

(1)

energy lost to the surroundings in one second = ... J

(ii) Calculate the efficiency of the kettle.

Use the equation

$$\text{efficiency} = \frac{\text{useful energy transferred by the kettle in one second}}{\text{total energy supplied to the kettle in one second}}$$

(2)

efficiency = ...

(Total for question = 3 marks)

(**QU05d 1SC0/1PF, June 2022**)

Q12.

Figure 9 shows a person on a skateboard at the top of a ramp.

At P, the person is not moving.

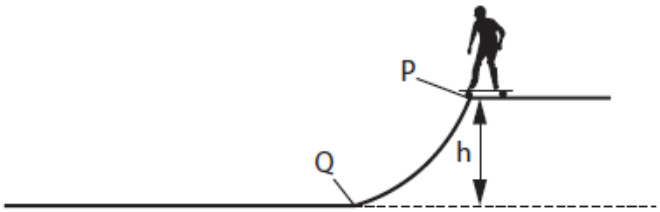


Figure 9

The person rides the skateboard down the ramp from P to Q.

The gravitational potential energy of the person decreases by 980 J.

The mass of the person is 35 kg.

Calculate h, the height of the ramp.

Use g = 10 N/kg.

Use the equation

change in gravitational potential energy = $m \times g \times h$

(2)

h = ... m

(Total for question = 2 marks)

(**QU05a 1SC0/1PF, June 2024**)

Q13.

Figure 1 shows a person on a skateboard at the top of a ramp.

At P, the person is not moving.

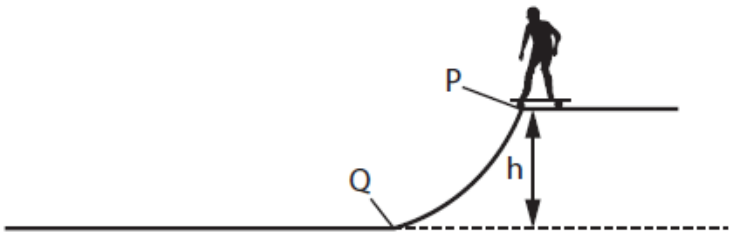


Figure 1

The person rides the skateboard down the ramp from P to Q.

The gravitational potential energy of the person decreases by 980 J.

The mass of the person is 35 kg.

Calculate h, the height of the ramp.

Use g = 10 N/kg.

Use the equation

change in gravitational potential energy = $m \times g \times h$

(2)

h = ... m

(Total for question = 2 marks)

(**QU01a 1SC0/1PH, June 2024**)

Q14.

Figure 7 shows a skier sliding down a slope.

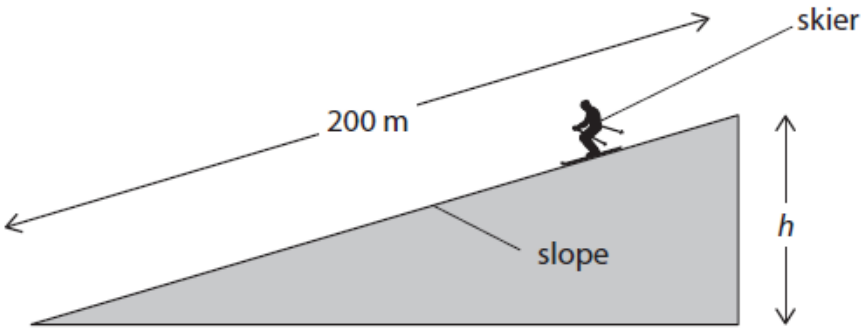


Figure 7

(i) The gravitational potential energy of the skier decreases by 39 000 J between the top and the bottom of the slope.

The mass of the skier is 70 kg.

Calculate the height, *h*, of the slope.

The value of g is 10 N / kg.

Use the equation

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

(2)

h = ... m

(ii) The skier starts from rest at the top of the slope.

The velocity of the skier at the bottom of the slope is 27 m/s.

Using information from Figure 7, calculate the acceleration of the skier along the slope.

(3)

acceleration = ... m/s^2

(iii) When the skier slides from the top to the bottom of the slope, some energy is dissipated.

Explain how to determine the amount of energy dissipated.

(2)

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(Total for question = 7 marks)

(**QU04a 1SC0/1PH, June 2025**)

Q15.

Figure 10 shows a football kicked against a wall.

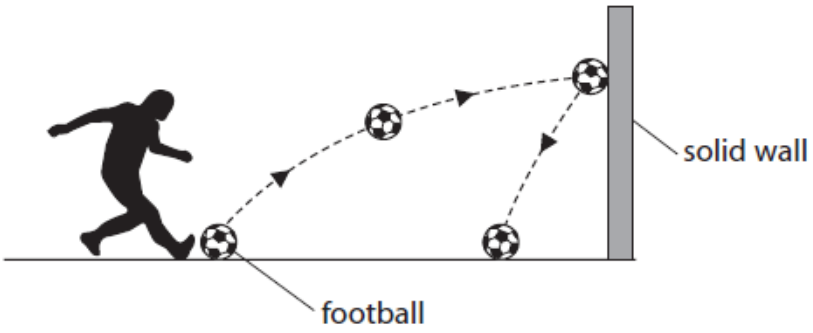


Figure 10

The football has a mass of 0.42 kg.

(i) The football gains 11 J of gravitational potential energy as it moves from the ground to the wall.

Calculate the height at which the ball hits the wall.

(3)

Gravitational field strength = 10 N / kg

Use the equation

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

height = ... m

(ii) Calculate the kinetic energy of the football when it is moving at a velocity of 12 m / s.

(2)

Use the equation

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

kinetic energy = ... J

(iii) Describe the energy transfers that happen when the ball hits the wall.

(2)

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(Total for question = 7 marks)

(**QU06a 1SC0/1PF, June 2023**)

Q16.

Figure 4 shows a football kicked against a wall.

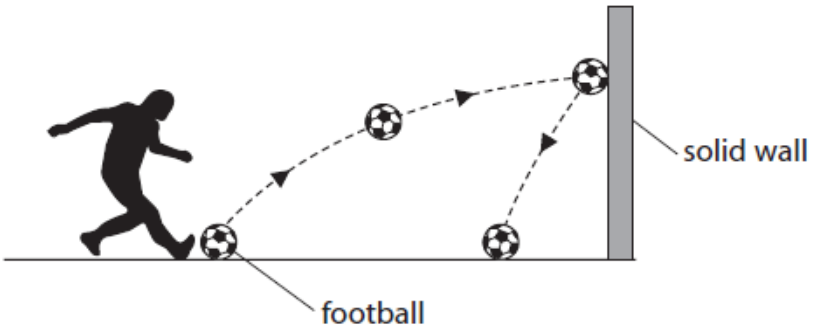


Figure 4

The football has a mass of 0.42 kg.

(i) The football gains 11 J of gravitational potential energy as it moves from the ground to the wall.

Calculate the height at which the ball hits the wall.

(3)

Gravitational field strength = 10 N / kg

Use the equation

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

height = ... m

(ii) Calculate the kinetic energy of the football when it is moving at a velocity of 12 m / s.

(2)

Use the equation

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

kinetic energy = ... J

(iii) Describe the energy transfers that happen when the ball hits the wall.

(2)

.....

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.....

(Total for question = 7 marks)

(**QU02a 1SC0/1PH, June 2023**)

Q17.

(i) An aircraft lands with a velocity of 71 m/s.

The mass of the aircraft is 3.6×10^5 kg.

Calculate the kinetic energy of the aircraft as it lands.

(2)

kinetic energy of aircraft = ... J

(ii) When the aircraft has come to a stop, all the kinetic energy has been transferred to the surroundings.

Give **one** way that the energy has been transferred to the surroundings.

(1)

.....

.....

(Total for question = 3 marks)

(**QU03b 1SC0/1PH, June 2022**)

Q18.

A cyclist of mass 70 kg travels at a constant velocity of 8 m/s.

Calculate the kinetic energy of the cyclist.

(3)

kinetic energy of the cyclist = ... J

(Total for question = 3 marks)

(**QU03b 1SC0/1PF, June 2022**)

Q19.

A model train has a mass of 8.0 kg.
It travels at a speed of 1.5 m/s.

Calculate the kinetic energy of the model train.

Use the equation

$$\text{kinetic energy} = \tfrac{1}{2} \times \text{mass} \times (\text{speed})^2$$

(3)

kinetic energy = ... J

(Total for question = 3 marks)

(**Q02b 1SC0/1PF, June 2019**)

Q20.

Figure 9 shows a person on a skateboard at the top of a ramp.

At P, the person is not moving.

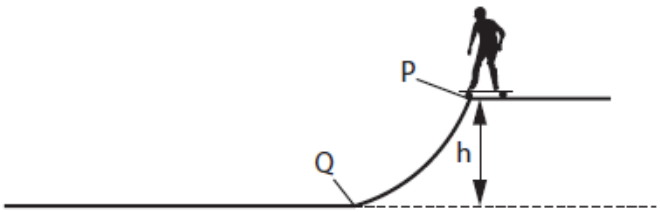


Figure 9

The kinetic energy, KE, of the person at Q is 950 J.

The mass of the person is 35 kg.

Calculate the velocity of the person at Q.

Use the equation

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

(3)

velocity = ... m/s

(Total for question = 3 marks)

(**QU05b 1SC0/1PF, June 2024**)

Q21.

Figure 1 shows a person on a skateboard at the top of a ramp.

At P, the person is not moving.

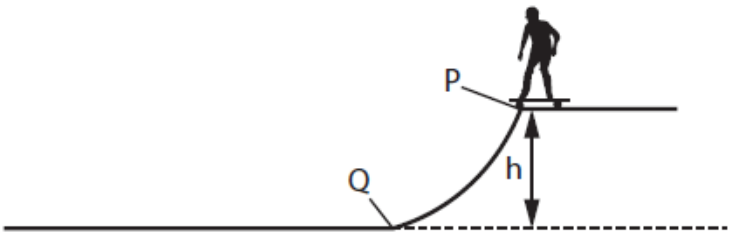


Figure 1

The kinetic energy, KE, of the person at Q is 950 J.

The mass of the person is 35 kg.

Calculate the velocity of the person at Q.

Use the equation

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

(3)

velocity = ... m/s

(Total for question = 3 marks)

(**QU01b 1SC0/1PH, June 2024**)

Q22.

(i) A microwave oven uses waves of frequency 2.45 GHz.

Calculate the wavelength of the microwaves.

The velocity of light is 3.00×10^8 m/s.

(3)

wavelength = ... m

(ii) The microwave oven is 55% efficient and transfers 42 000 J of energy to some food when it is heated.

Calculate the total amount of energy that must be supplied to the oven.

(3)

energy supplied to oven = ... J

(Total for question = 6 marks)

(**QU06b 1SC0/1PH, June 2022**)

Q23.

(i) A car is moving at 90 km/h when the driver has to stop.

Calculate the thinking time of the driver.

Using the equation:

time = distance ÷ average speed

(2)

thinking time = ... s

(ii) A car has a mass of 1300 kg.

Calculate the kinetic energy of the car when it is travelling at 20 m/s.

(2)

kinetic energy ..... J

(Total for question = 4 marks)

(**Q01c 1SC0/1PF, SAM**)

Q24.

Figure 1 shows a solar-powered charger for a mobile phone.

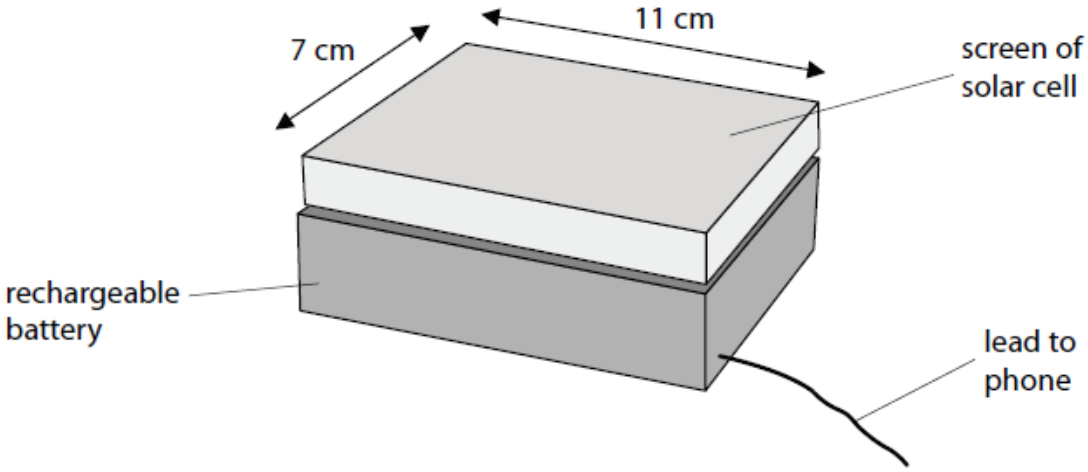


Figure 1

The screen of the solar cell takes in energy from the Sun.

Each second, 0.12 J of energy from the Sun reaches 1 cm^2 of the screen.

Calculate the total amount of energy reaching the whole screen in 1 second.

(3)

energy = ... J

(Total for question = 3 marks)

(**Q01aiii 1SC0/1PF, SAM 2016**)

Q25.

*Some students found this information about an energy saving lamp and a filament lamp that give out almost the same amount of light.

energy saving lamp



power = 15 W

cost = £1.50

lifetime = 10 000 hours

produces 20 J of light energy for each 100 J of electrical energy supplied

filament lamp



power = 60 W

cost = £0.30

lifetime = 1 000 hours

produces 5 J of light energy for each 100 J of electrical energy supplied

Describe the advantages and disadvantages of each type of lamp.

(6)

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(**Q12 1SC0/1PF, June 2013**)

Q26.

As the object in Figure 6 falls, energy is transferred.

These energy transfers are represented in Figure 7.

Complete the labels of the energy stores involved.

(3)

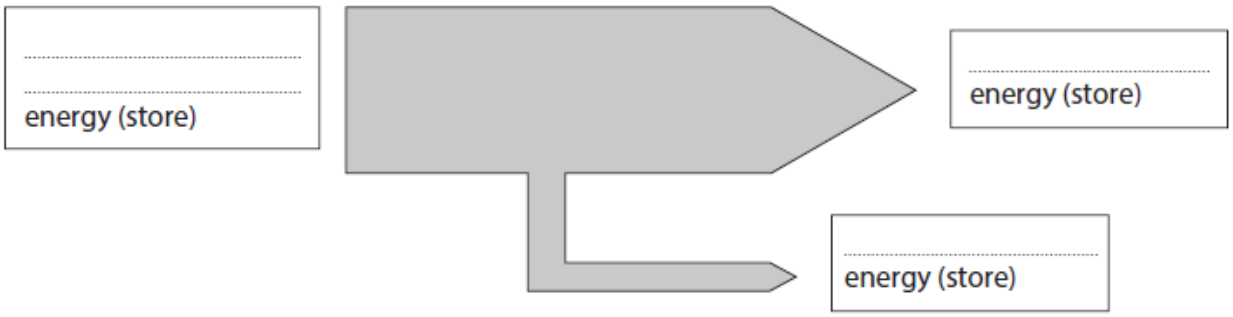


Figure 7

(Total for question = 3 marks)

(**QU04b 1SC0/1PF, June 2025**)

Q27.

A student lifts a toy car from a bench and places the toy car at the top of a slope as shown in Figure 9.

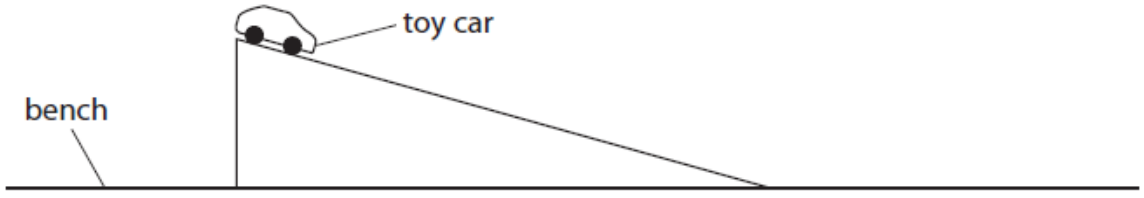


Figure 9

Describe an energy transfer that occurs when the student lifts the toy car from the bench and places the toy car at the top of the slope.

(2)

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.....

(Total for question = 2 marks)

(**Q05a 1SC0/1PF, Nov 2020**)

Q28.

A student lifts a toy car from a bench and places the toy car at the top of a slope as shown in Figure 1.

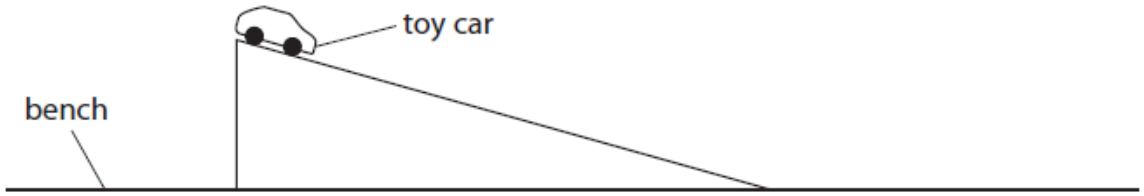


Figure 1

Describe an energy transfer that occurs when the student lifts the toy car from the bench and places the toy car at the top of the slope.

(2)

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(Total for question = 2 marks)

(**Q01a 1SC0/1PH, Nov 2020**)

Q29.

Expanded polystyrene, used to insulate buildings, has different densities.

Figure 10 shows how the thermal conductivity of expanded polystyrene changes with the density of expanded polystyrene.

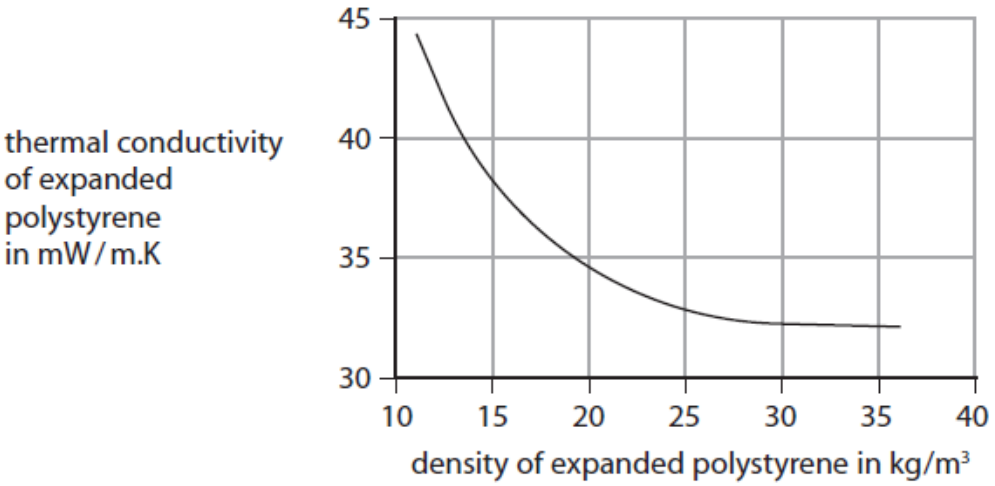


Figure 10

Using the graph in Figure 10, describe how the thermal conductivity of expanded polystyrene changes with the density of expanded polystyrene.

(2)

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(Total for question = 2 marks)

(**QU05c 1SC0/1PF, June 2022**)

Q30.

Expanded polystyrene, used to insulate buildings, has different densities.

Figure 2 shows how the thermal conductivity of expanded polystyrene changes with the density of expanded polystyrene.

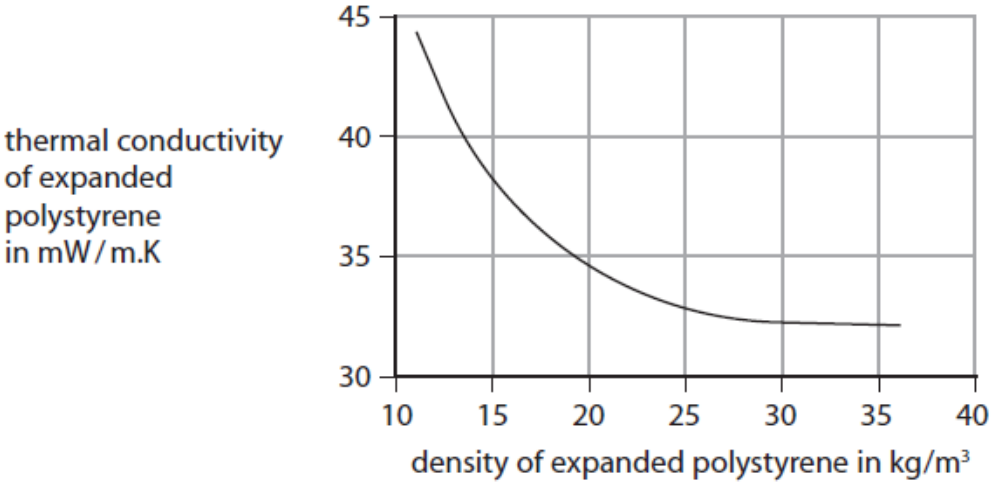


Figure 2

Using the graph in Figure 2, describe how the thermal conductivity of expanded polystyrene changes with the density of expanded polystyrene.

(2)

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(Total for question = 2 marks)

(**QU01c 1SC0/1PH, June 2022**)

Q31.

A house has a boiler to provide hot water.

One type of boiler burns natural gas.

Natural gas is a non-renewable source of energy.

* A company has developed a new material which they think could be used instead of foam around the cylinder.

Devise an investigation they could carry out to make a fair comparison of the insulating properties of their new material with those of the foam.

(6)

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(Total for question = 6 marks)

(**Q06c 1SC0/1PF, SAM**)

Q32.

Some students investigate the efficiency of electric motors.

One of the students states that all of the energy supplied to a motor is transferred into other forms.

Complete the following sentence by putting a cross (☒) in the box next to your answer.
This statement is one example of the idea of

(1)

☒ **A** renewable energy

☒ **B** conservation of energy

☒ **C** non-renewable energy

☒ **D** sustainable energy

(**Q29 1SC0/1PH, June 2013**)

Q33.

A student uses the apparatus in Figure 9 to find out which of two materials, sand or sawdust, is the better insulator.



Figure 9

The student also has a kettle to boil water, a thermometer and a stop clock.

(i) Draw a labelled diagram to show how the student should set up the equipment to investigate which material is the better insulator.

(3)

(ii) Give **three** factors that the student must control in this investigation.

(3)

1 .....

.....

2 .....

.....

3 .....

.....

(Total for question = 6 marks)

(**QU05b 1SC0/1PF, June 2022**)

Q34.

A student uses the apparatus in Figure 1 to find out which of two materials, sand or sawdust, is the better insulator.

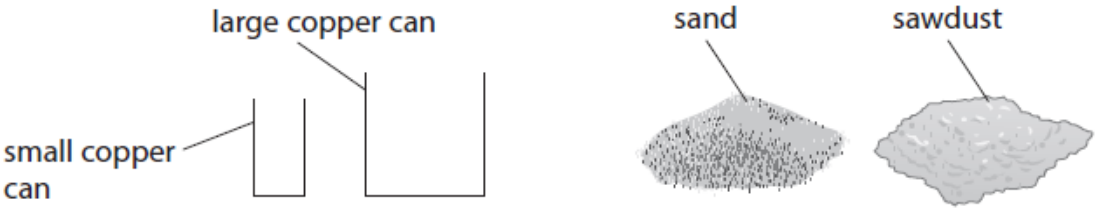


Figure 1

The student also has a kettle to boil water, a thermometer and a stop clock.

(i) Draw a labelled diagram to show how the student should set up the equipment to investigate which material is the better insulator.

(3)

(ii) Give **three** factors that the student must control in this investigation.

(3)

1 .....

.....

2 .....

.....

3 .....

.....

(Total for question = 6 marks)

(**QU01b 1SC0/1PH, June 2022**)

Q35.

The photograph shows a man dropping an egg inside a padded box from a height.



He is investigating to see if the padding stops the egg from breaking.

(a) State the type of energy which the egg gains as it falls.

(1)

.....

(b) The weight of the egg is 0.6 N.

Calculate the work done on the egg to lift it up by 20 m. State the unit.

(3)

work done on egg = ...unit ..... .

(c) The velocity of the container was 18 m/s as it hit the floor.
The mass of the container was 0.5 kg.

Calculate the momentum of the container.

(2)

momentum = ...kg m/s

.....

*(d) A student stands on the ground with an egg in his hand.
He throws the egg vertically upwards.

The egg rises to a height of 10 m.
Then the egg falls and lands on the ground.

Describe the energy changes of the egg during this sequence of events.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question = 12 marks)

(**Q07 1SC0/1PH, June 2013**)

Q36.

* A student stands on the ground with an egg in his hand.
He throws the egg vertically upwards.
The egg rises to a height of 10 m.
Then the egg falls and lands on the ground.

Describe the energy changes of the egg during this sequence of events.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

(**Q22 1SC0/1PF, June 2013**)

Q37.

Andrew skis down a hill.



Andrew starts from the top of the hill and his speed increases as he goes downhill.

He controls his speed and direction by using his skis.

He brings himself to a stop at the bottom of the hill.

Describe the energy changes that happen between starting and stopping.

(3)

.....

.....

.....

.....

.....

.....

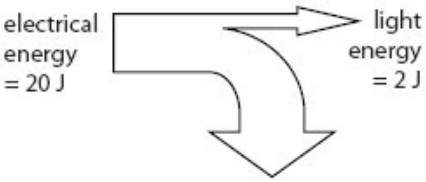
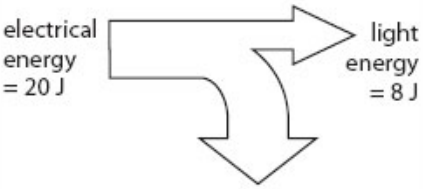
(**Q34 1SC0/1PF, Mar 2013**)

Q38.

Many appliances are sold with an energy efficiency rating.

A-rated appliances are the most energy efficient.

Here is some information about two types of electric lamp.

	halogen lamp	compact fluorescent lamp (CFL)
energy efficiency rating	**B**	**A**
energy transfer diagrams (not drawn to scale)	energy transfer in one second 	energy transfer in one second 

(i) Calculate how much energy is wasted in one second by the compact fluorescent lamp (CFL).

(1)

energy wasted = ...J

(ii) Use the energy transfer diagrams to explain why the CFL lamp has a better efficiency rating than the halogen lamp.

(2)

.....

.....

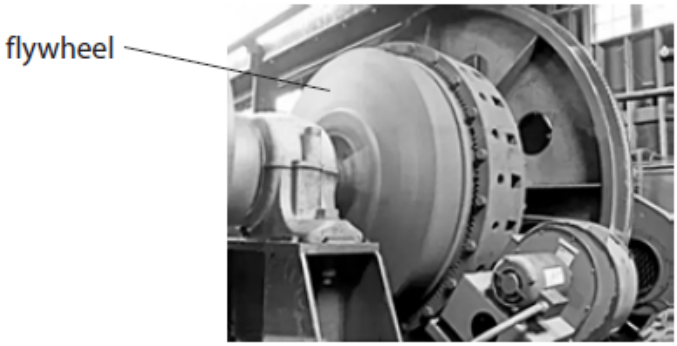
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(**Q04 1SC0/1PF, Mar 2013**)

Q39.

Figure 6 shows a spinning flywheel.



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Figure 6

(i) State how energy is stored in a spinning flywheel.

(1)

.....

(ii) State **one** way to increase the amount of energy stored in the flywheel.

(1)

.....

(Total for question = 2 marks)

(**Q08 1SC0/1PF, June 2018**)

Q40.

The photograph shows a man dropping an egg inside a padded box from a height.



He is investigating to see if the padding stops the egg from breaking.

State the type of energy which the egg gains as it falls.

(1)

.....

(**Q21 1SC0/1PF, June 2013**)