PEARSON EDEXCEL GCSE PHYSICS (HIGHER) · 1PH0

PHYSICS



EXAM QUESTION PACK

TOPIC 3: CONSERVATION OF ENERGY (PACK 1)

SCORE	PERCENTAGE
/80	%

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Q1.

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.

Calculate the amount of gravitational potential energy gained by the shot.

(2)

gravitational potential energy gained = ... J

(Total for question = 2 marks)

Q2.

Figure 13 shows two ice skaters during a performance.



Figure 13

(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)

Q3.

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)

Q4.

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

The mass of the aircraft is 3.6 × 105 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)

Q5.

(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)

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(Total for question = 3 marks)

Q6.

In a science fiction story, lightning is used as an energy source for accelerating a car.

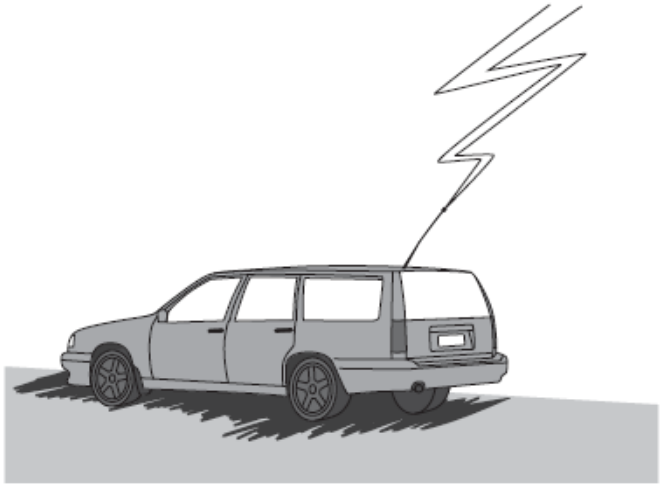


Figure 6

In the story, the car has a kinetic energy of 960 kJ at a speed of 40 m/s.

(i) Calculate the mass of the car.

(4)

mass = ... kg

(ii) Only 5% of the energy of the lightning bolt is transferred to the kinetic energy of the car.

Calculate the total energy of the lightning bolt in MJ.

(2)

energy = ... MJ

(Total for question = 6 marks)

Q7.

A kettle is used to heat water.

Figure 11 shows a graph of temperature against time for the water in the kettle.

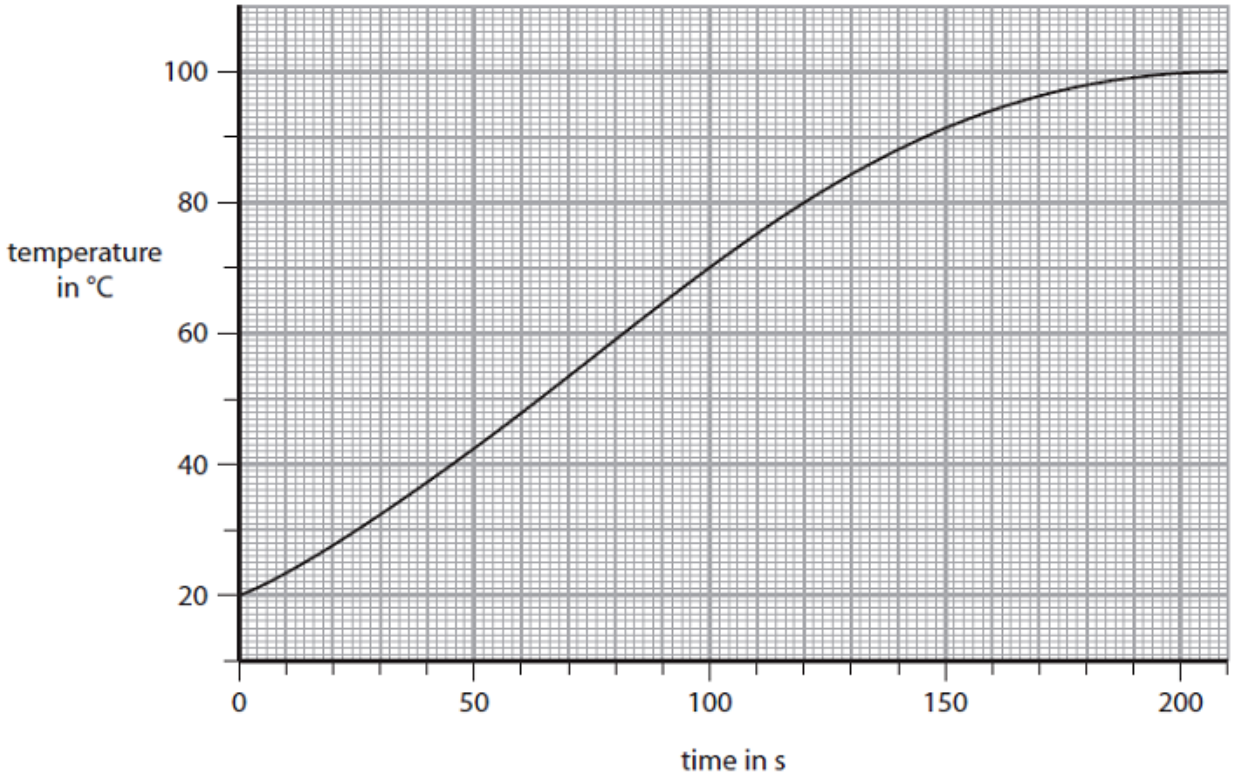


Figure 11

Calculate the rate of increase in temperature at a time of 150 s, by drawing a tangent to the curve in Figure 11 at a time of 150 s.

(3)

..... °C / s

(Total for question = 3 marks)

Q8.

A kettle is used to heat water.

The kettle has an efficiency of 91% in supplying energy to the water.
The thermal energy of the water increases by 3.3×10^5 J in 200 s.

Calculate the total amount of energy supplied to the kettle in the 200 s.

Use the equation

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

(2)

total amount of energy supplied = ... J

(Total for question = 2 marks)

Q9.

This question is about waves in the electromagnetic (e.m.) spectrum.

(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)

Q10.

(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)

Q11.

Some questions must be answered with a cross in a box (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

Which statement describes conservation of energy in a closed system?

(1)

☒ **A** when there are energy transfers, the total energy reduces

☒ **B** when there are energy transfers, the total energy does not change

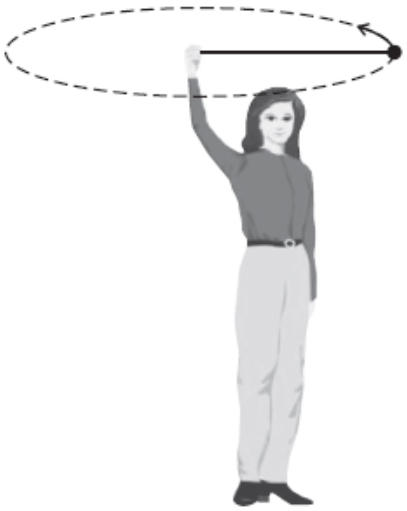
☒ **C** when there are no energy transfers, the total energy reduces

☒ **D** when there are no energy transfers, the total energy increases

(Total for question = 1 mark)

Q12.

(a) The diagram shows a girl swinging a rubber ball in a horizontal circle above her head.



(i) In which direction does the resultant force act on the ball?

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

(1)

☒ **A** away from the centre of the circle

☒ **B** in the direction of the arrow on the diagram

☒ **C** in the opposite direction to the arrow on the diagram

☒ **D** towards the centre of the circle

(ii) State the name of the resultant force acting on the ball.

(1)

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(iii) Suggest what would happen to the ball as the girl gets tired.

(2)

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(iv) The girl lets go of the string and the ball hits a wall.

The collision is not elastic.

Explain what happens to both momentum and kinetic energy when the ball hits the wall.

(2)

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*(b) Describe a cyclotron and how charged particles move inside it.

You may draw a labelled diagram to help with your answer.

(6)

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(Total for Question = 12 marks)

Q13.

* Nuclear fission and nuclear fusion are two non-renewable sources of energy.

Compare nuclear fission and nuclear fusion as possible sources of energy for generating electricity using a nuclear reactor.

Your comparison should refer to

- the differences between nuclear fission and nuclear fusion
- the relative advantages and difficulties involved in using these sources.

(6)

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(Total for question = 6 marks)

Q14.

A student lifts a toy car from a bench and places the toy car at the top of a slope as shown in Figure 2.

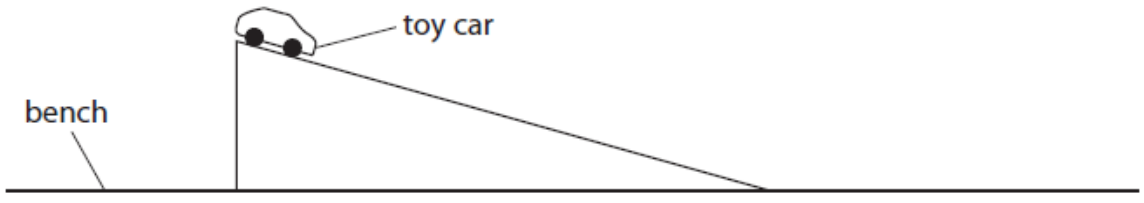


Figure 2

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)

Q15.

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.

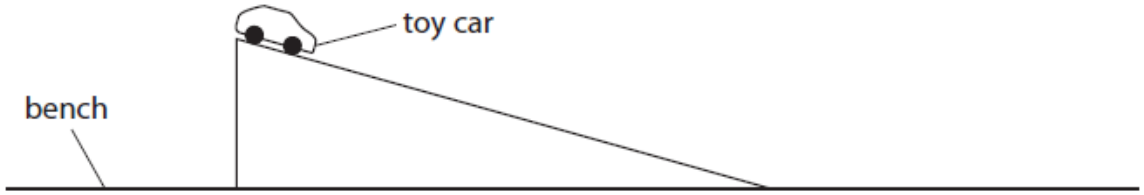


Figure 1

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)

.....

.....

.....

.....

(Total for question = 2 marks)

Q16.

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.

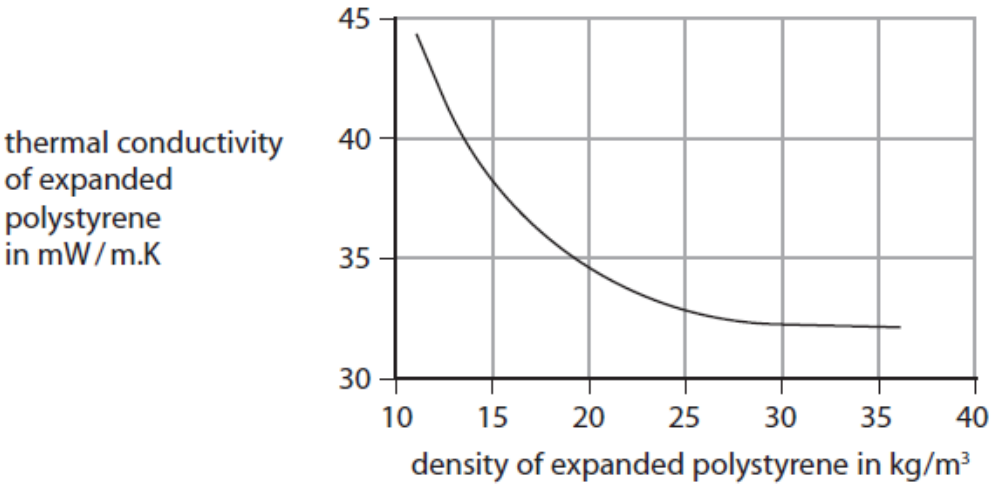


Figure 2

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)

Q17.

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

Figure 4 shows how the thermal conductivity of expanded polystyrene changes with the density of expanded polystyrene.

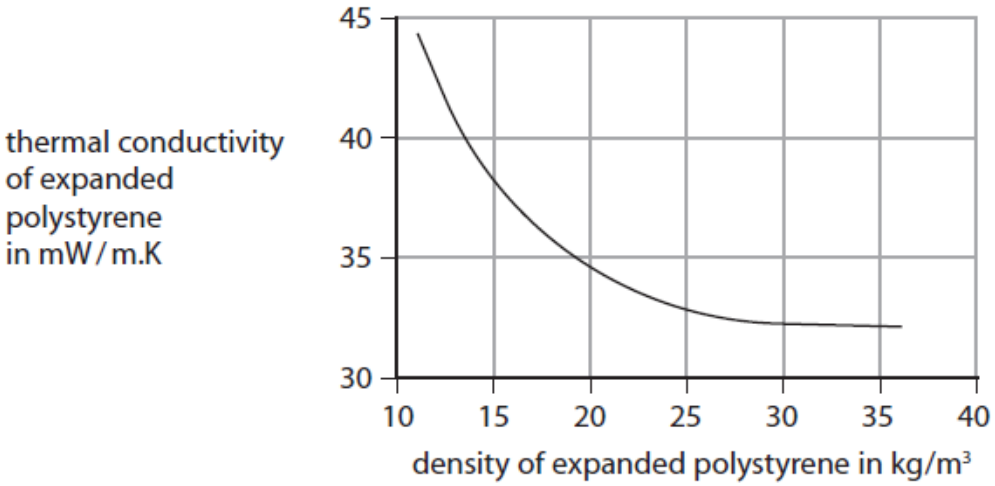


Figure 4

Using the graph in Figure 4, 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)

Q18.

A student uses the apparatus in Figure 3 to find out which of two materials, sand or sawdust, is the better insulator.



Figure 3

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)

Q19.

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 .....

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2 .....

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3 .....

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(Total for question = 6 marks)

Q20.

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)

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(Total for Question = 12 marks)

Q21.

(a) Here are some forms of energy:

chemical	elastic potential	electrical
heat (thermal)	kinetic	light
nuclear	sound	

(i) Use words from the box to complete the table.
Each word may be used once, more than once, or not at all.

The first one has been done for you.

(3)

device	energy transferred from...	energy is mostly transferred into...
electric motor	electrical	kinetic
bow and arrow	elastic potential	
electric kettle	electrical	
microphone		electrical

(ii) In the electric motor only some of the electrical energy is transferred into kinetic energy.

State what happens to the remaining electrical energy.

(1)

.....

(b) 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 electrical energy = 20 J light energy = 2 J	energy transfer in one second electrical energy = 20 J light energy = 8 J

(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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(c) The photograph shows an electric heater used to warm garages.



When the heater is switched on, it quickly warms up and then stays at a constant temperature.

Explain why the heater stays at a constant temperature.

(2)

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(Total for Question is 9 marks)

Q22.

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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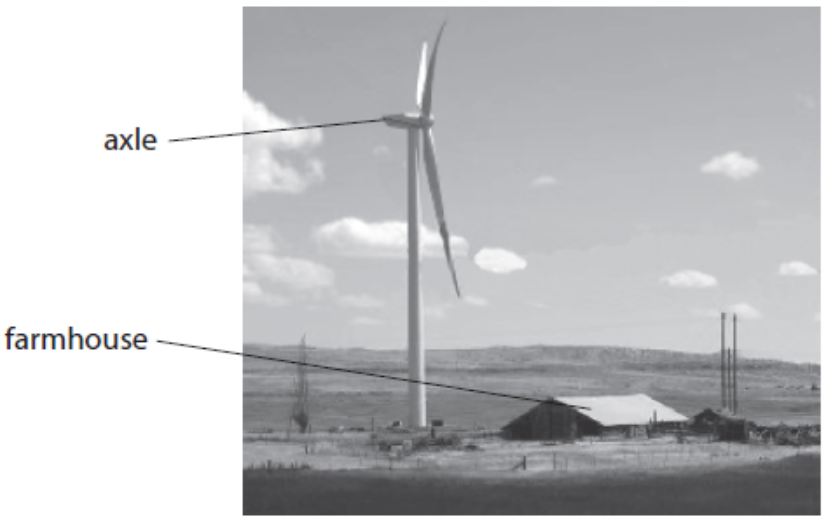
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Q23.

(a) A wind generator is used as the source of energy for a remote farmhouse.



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

If the farmhouse is about 7 m high, the height of the axle of the generator is

(1)

☒ **A** 20 m

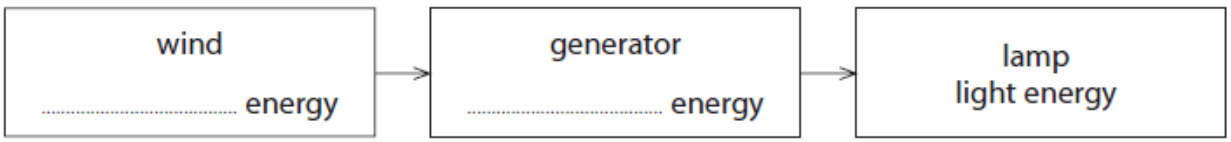
☒ **B** 50 m

☒ **C** 100 m

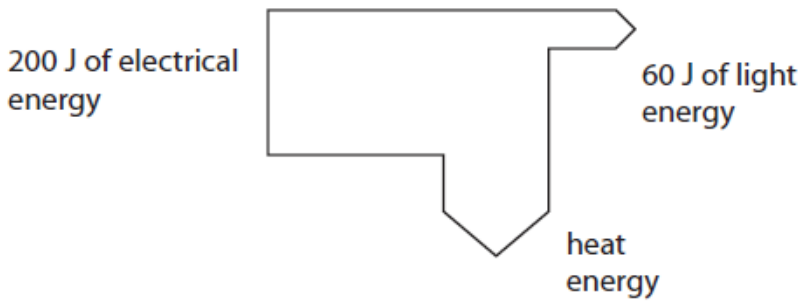
☒ **D** 150 m

(ii) Complete the flow chart to show the energy transfers that take place from the wind to light a lamp.

(2)



(b) A student produced a diagram to show energy changes in a lamp.



(i) Calculate the amount of heat energy produced by the lamp.

(1)

heat energy =.....J

(ii) Calculate the efficiency of the lamp.

(2)

efficiency =.....

(iii) When the lamp is first switched on, it heats up.
It then reaches a constant temperature.

Explain why the temperature of the lamp remains constant.

(2)

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(c) A wind power system costs £6000 to install.
It saves £250 each year.

Calculate the payback time.

(2)

payback time =.....

(Total for Question = 10 marks)

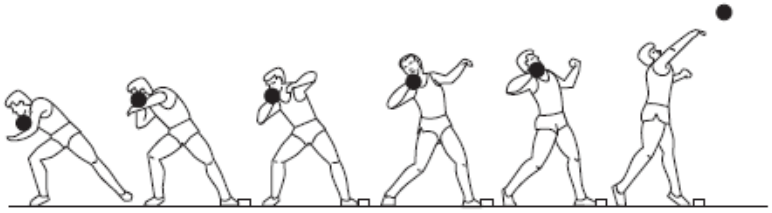
Q24.

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.

(a) The scientist takes pictures of the athlete every 0.1 s during one throw.

Figure 3 shows the pictures of one throw.



start of throw
(shot at rest)

just after the
release of the shot

Figure 3

(i) Estimate the amount of time during the throw when the shot is in the athlete's hand.

(1)

time = ... s

(ii) Explain how the scientist could improve this method of analysing the throw.

(2)

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.....

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(iii) The average acceleration of the shot while in the athlete's hand is 20.6 m/s^2.

The mass of the shot is 7.26 kg.

Calculate the average force that the athlete applies to the shot during the throw.

(2)

force = ... N

(iv) In another throw, the shot is in the athlete's hand for 0.48 s.

The average acceleration during this time is 23 m/s^2.

Calculate the velocity of the shot as it leaves the athlete's hand.

(3)

velocity = ... m/s

(b) 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.

Calculate the amount of gravitational potential energy gained by the shot.

(2)

gravitational potential energy gained = ... J

(Total for question = 10 marks)

Q25.

Andrew skis down a hill.



(a) 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)

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(b) Andrew returns to the top of the hill and starts again.

(i) His mass is 67 kg.

Show that his momentum is about 2000 kg m/s when his velocity is 31 m/s.

(2)

(ii) He falls over when his momentum is 2000 kg m/s.

After he falls over, he slows down by sliding across the snow.

It takes 2.3 s for his momentum to reduce to zero.

Calculate the average force on Andrew as he slows down.

(2)

force = ...N

(iii) Andrew is not injured by the fall even though he was moving quickly.

Use ideas about force and momentum to explain why he is not injured.

(2)

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(Total for Question is 9 marks)