Name: _____

Energy

Questions

Date:

Time:

Total marks available:

Total marks achieved: _____

Questions

Q1.

Before a car brakes it has kinetic energy.
The kinetic energy decreases as it brakes.

State what happens to the kinetic energy during braking.

(1)

.....

.....

(Total for question = 1 mark)

Q2.

Which of these is a non-renewable source of energy?

(1)

- ☒ **A** geothermal
- ☒ **B** natural gas
- ☒ **C** tidal
- ☒ **D** solar

(Total for question = 1 mark)

Q3.

Explain why renewable sources provide an increasing fraction of the electricity supply for many countries.

(2)

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.....

(Total for question = 2 marks)

Q4.

Moving air can be used to generate electricity using a wind turbine.

Figure 8 is a graph of kinetic energy against wind speed for a mass of moving air.

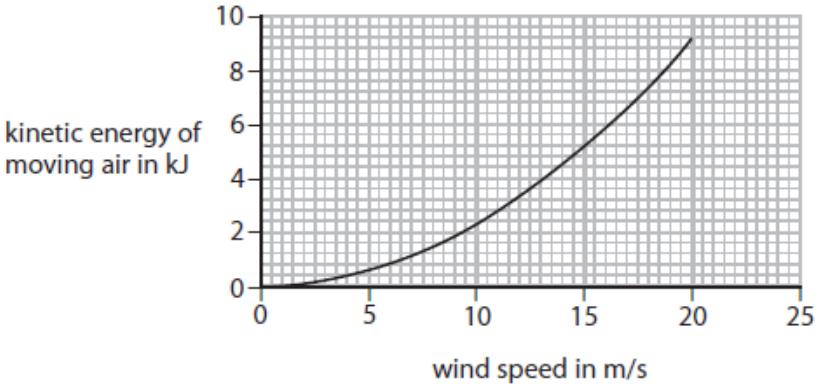

Figure 8

Just before the air reaches a wind turbine it has a wind speed of 15 m/s.

When the air has gone through the turbine it has a wind speed of 13 m/s.

As the air moves through the turbine some of its kinetic energy is transferred to the turbine.

Use the graph to determine the percentage of the kinetic energy transferred to the turbine from the air.

(3)

percentage of kinetic energy transferred from the air = ... %

(Total for question = 3 marks)

Q5.

Figure 6 is a graph of the student's results.

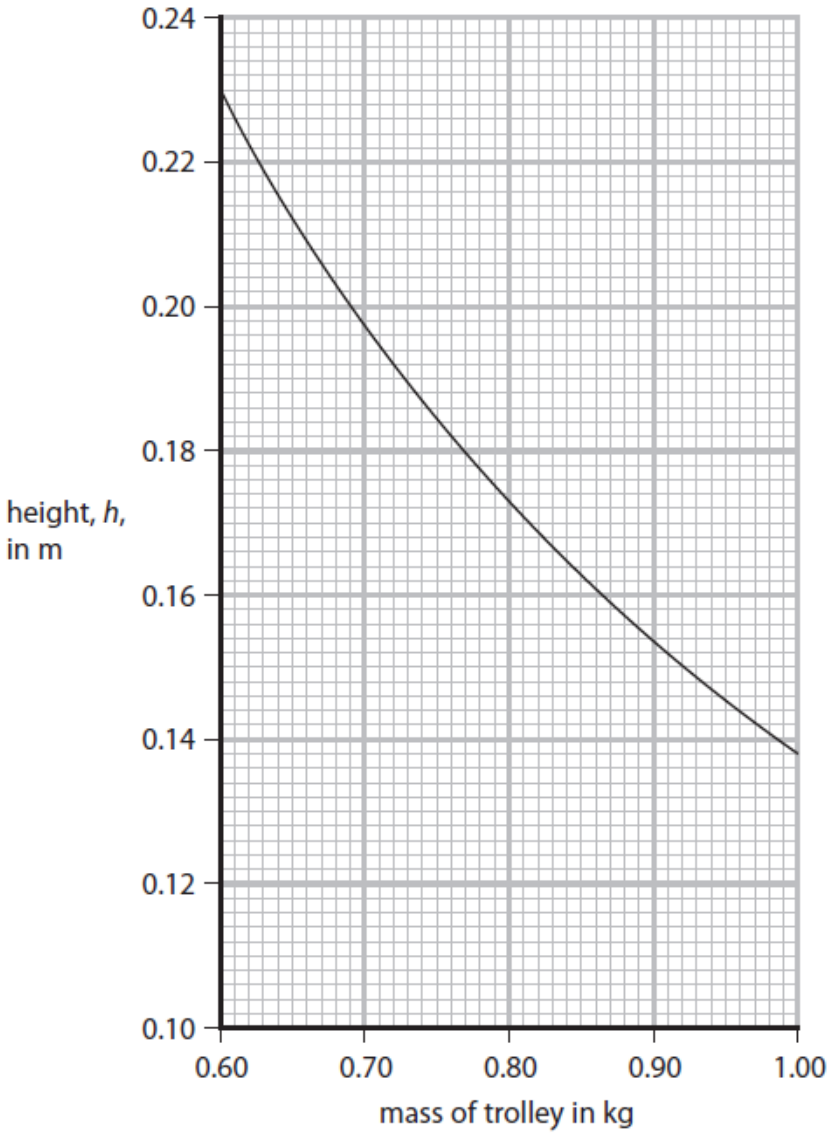

Figure 6

The student states that the energy transferred by the spring is the same each time it is used.

Use data from any two points on the graph in Figure 6 to support this statement.

(3)

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.....

(Total for question = 3 marks)

Q6.

Figure 5 shows a way of projecting a small trolley up a sloping track.

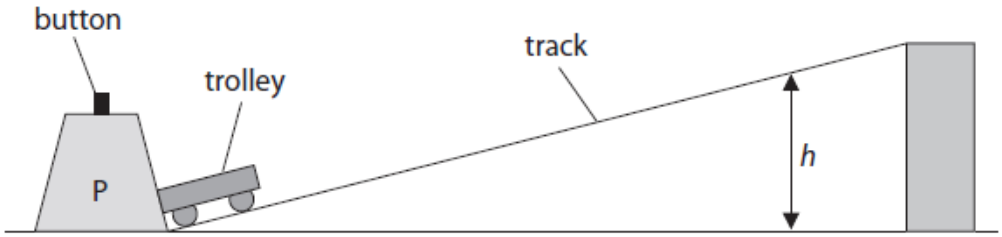

Figure 5

When the button is pressed, a spring is released in P that projects the trolley up the track.

The trolley travels up the track, stops and then rolls back down.

The spring in P always exerts the same force when projecting the trolley.

A student investigates how the mass of the trolley affects the maximum vertical height, *h*, reached by the trolley.

State the measurements the student should make to complete the investigation.

You should make use of the equipment shown in Figure 5 and any other equipment that is needed.

(4)

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(Total for question = 4 marks)

Q7.

Electricity can be generated using a water turbine.

(i) Water gains kinetic energy by falling from the top of a dam.

Calculate the minimum height that 7.0 kg of water must fall to gain 1300 J of kinetic energy.

(3)

minimum height = ... m

(ii) As water enters the turbine at the bottom of the dam, the kinetic energy of 8.0 kg of moving water is 1100 J.

Calculate the speed of the moving water as it enters the turbine.

(3)

speed = ... m/s

(Total for question = 6 marks)

Q8.

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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.....

Q9.

(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)

Q10.

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)

Q11.

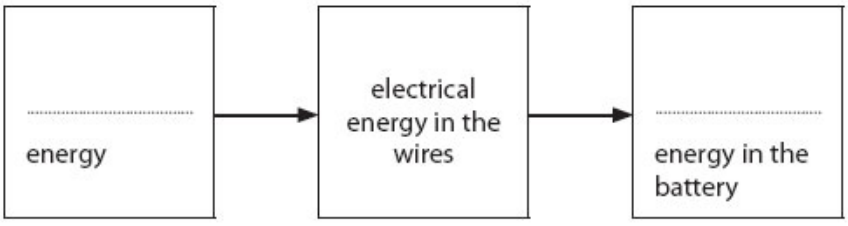
A student uses a solar powered battery charger to charge some batteries.

(a) The diagram is an energy transfer diagram for a battery being charged.

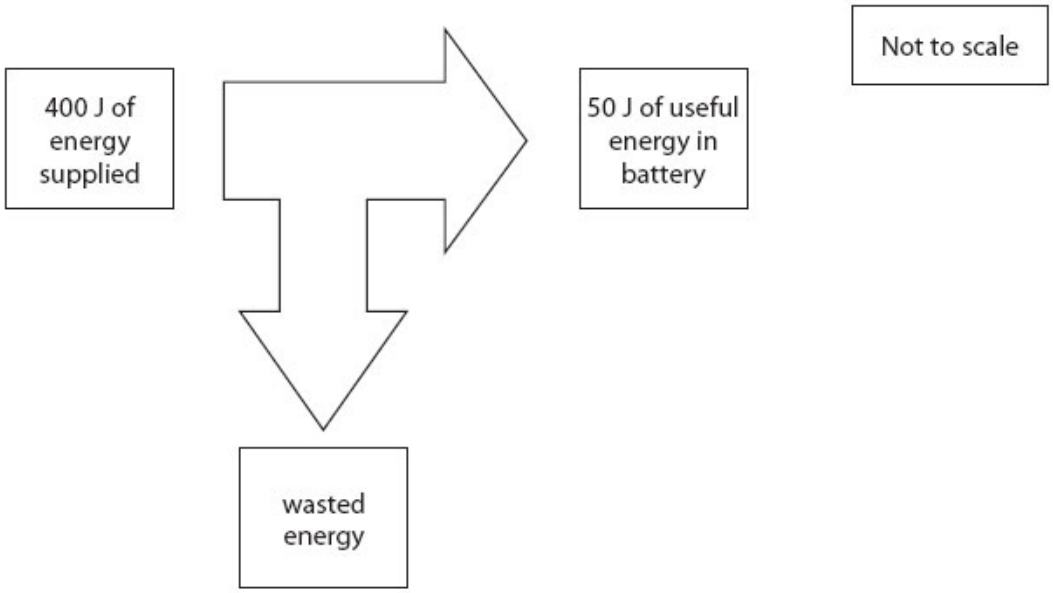
Use words from the box to complete the energy transfer diagram.

light	kinetic	sound
electrical	chemical	

Energy transfer diagram



(b) The diagram shows how much energy is usefully transferred by the battery charger.



(i) Calculate the amount of wasted energy.

(1)

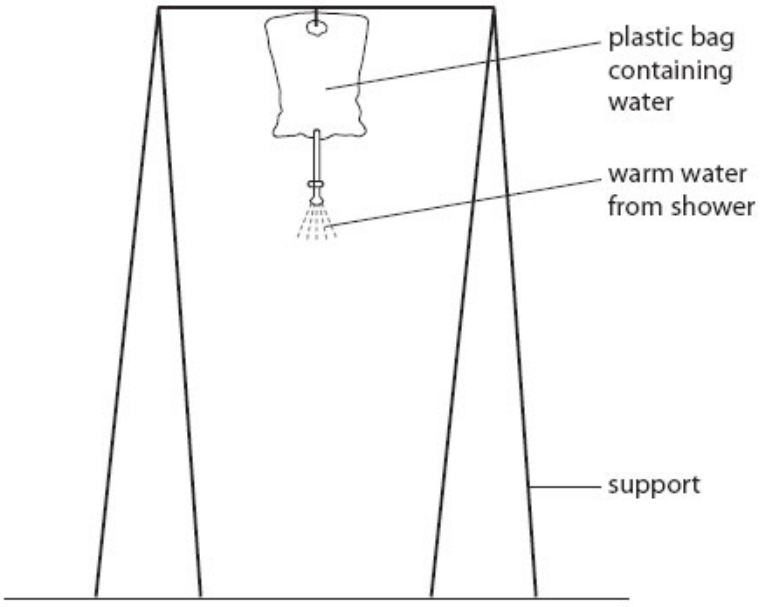
wasted energy = ...J

(ii) Calculate the efficiency of the battery charger.

(2)

efficiency of the battery charger = ...%

(c) The following arrangement is used as a solar powered shower.



The bag is left out in the sunlight during the day.

(i) Explain what colour the bag should be to heat the water to the highest temperature.

(2)

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.....

.....

.....

(ii) On a sunny day the bag is filled with cold water.
Explain why the temperature of the water increases and then stays constant.

(3)

.....

.....

.....

.....

.....

.....

(Total for Question = 10 marks)

Q12.

(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

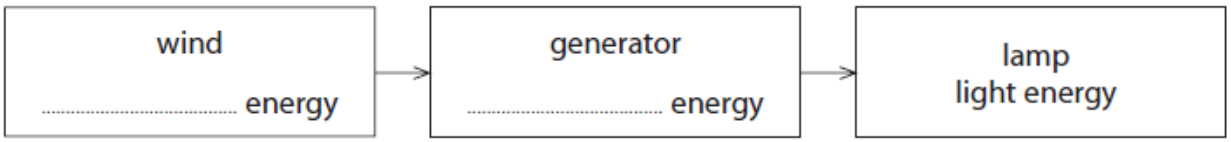
☒ **B** 50 m

☒ **C** 100 m

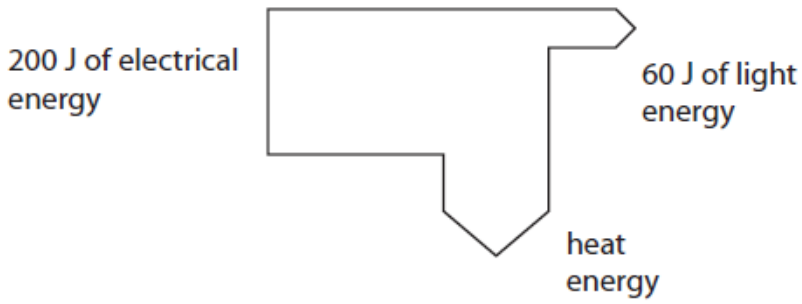
☒ **D** 150 m

(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)

.....

.....

.....

.....

(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)

Q13.

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)