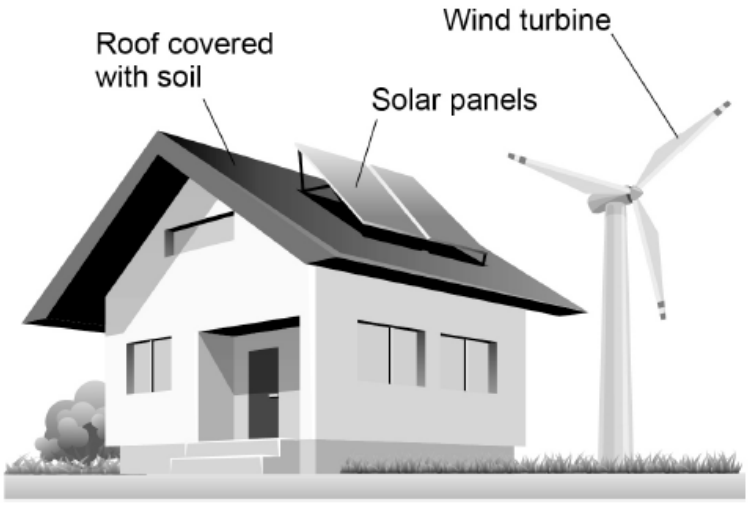
AQA - Energy and Power – GCSE Combined Science Physics

1. May/2020/Paper_1F/No.3

0 3 An eco-house is designed to be environmentally friendly.

Figure 4 shows a picture of an eco-house.

Figure 4



0 3 . 1 The solar panels and a wind turbine are used to generate electricity for the eco-house.

Solar and wind are both renewable energy resources.

What does renewable energy resource mean?

[1 mark]

Tick (✓) **one** box.

It can be replenished as it is used. ☐

It is unreliable. ☐

It has no fuel costs. ☐

It produces no greenhouse gases. ☐

0 3 . 2 Biomass, nuclear and natural gas are three other energy resources.

Complete the table to show whether each energy resource is renewable or non-renewable.

[2 marks]

Tick (✓) **one** box for **each** energy resource.

Energy resource	Renewable	Non-renewable
Biomass		
Nuclear		
Natural gas		

0 3 . 3 Moving air makes the wind turbine spin.

The wind turbine generates electricity which is used to charge a battery.

Complete the sentences.

Choose answers from the box.

[2 marks]

chemical	electrical	gravitational	kinetic

When the wind turbine spins faster there is an increase in its _____ energy.

Charging the battery increases the _____ store of energy of the battery.

0 3 . 4 The roof of the eco-house is covered with soil.

Covering the roof with soil decreases the thermal conductivity of the roof.

What are the advantages of having a roof with a lower thermal conductivity?

[2 marks]

Tick (✓) **two** boxes.

Less energy is needed to heat the house. ☐

The rate of energy transfer by conduction is greater. ☐

The roof is a better insulator. ☐

The roof is less likely to leak. ☐

Weather will have a greater effect on the temperature of the house. ☐

0 3 . 5 The average power transferred to the solar panels by sunlight is 26 000 W

Calculate the average energy transferred to the solar panels in 30 seconds.

Use the equation:

energy transferred = power × time

[2 marks]

Average energy transferred to solar panels = _____ J

0 3 . 6 Write down the equation that links efficiency, total power input and useful power output.

[1 mark]

0 3 . 7 The solar panels on the roof of the eco-house have an efficiency of 0.15

The average power input to the solar panels is 26 000 W

Calculate the average useful power output from the solar panels.

[3 marks]

Average useful power output = _____ W

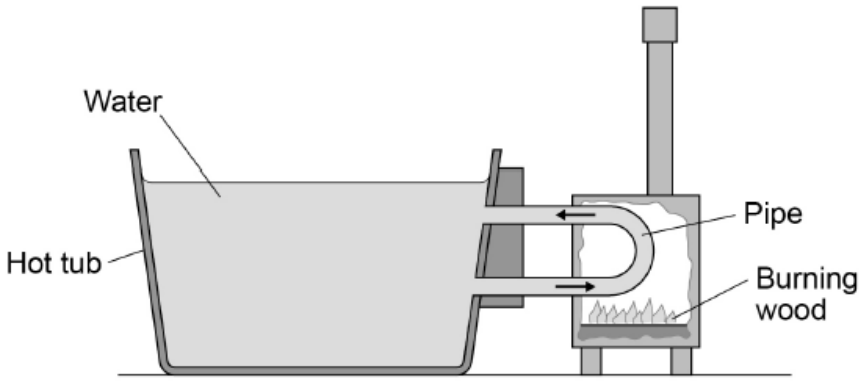
0 3 . 8 Explain why it is a good idea for the eco-house to have both a wind turbine and solar panels.

[2 marks]

2. May/2020/Paper_1H/No.4

0 4 **Figure 5** shows a wood-fired hot tub.

Figure 5



0 4 . 1 What type of fuel is wood?

[1 mark]

Tick (✓) **one** box.

A non-renewable biofuel ☐

A non-renewable fossil fuel ☐

A renewable biofuel ☐

A renewable fossil fuel ☐

0 4 . 2 Give **two** environmental effects of using wood as an energy resource.

[2 marks]

1 _____

_____

2 _____

_____

0 4 . 3 Describe the change to the stores of energy of the wood, pipe and water as the water is heated.

[3 marks]

Wood _____

_____

Pipe _____

_____

Water _____

_____

0 4 . 4 The temperature of the water reaches 42 °C

The temperature then stays constant even though the fire continues to burn.

Explain why the temperature of the water stays constant.

[2 marks]

_____

_____

_____

_____

_____

3. May/2020/Paper_1H/No.7

0 7 Kangaroos are large animals that travel by jumping.

Figure 8 shows a kangaroo.

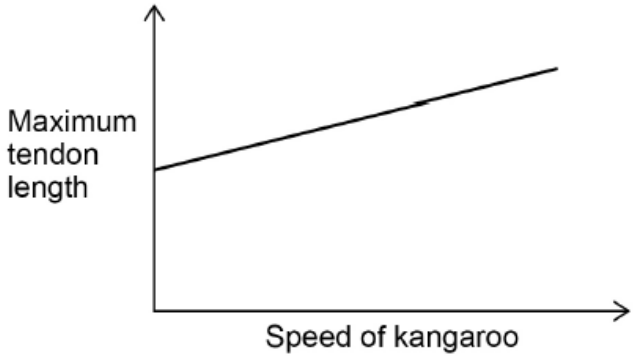
Figure 8

Each leg of a kangaroo has a tendon connected to a muscle. Each tendon can be modelled as a spring.

When a jumping kangaroo lands on the ground, the tendons stretch.

0 7 . 1 **Figure 9** shows a sketch graph of how the maximum tendon length during a jump changes with the speed of the kangaroo.

Figure 9



Explain why a kangaroo can jump higher as its speed increases.

[3 marks]

0 7 . 2 A kangaroo has a maximum gravitational potential energy during one jump of 770 J

When the kangaroo lands on the ground 14% of the maximum gravitational potential energy is transferred to elastic potential energy in one tendon.

The tendon has an unstretched length of 35.0 cm

When the kangaroo lands on the ground the tendon stretches to a length of 42.0 cm

Calculate the spring constant of the tendon.

[5 marks]

Spring constant = _____ N/m

4. May/2019/Paper_1F/No.2

0 2 A student investigated how the area of a solar panel affected the output potential difference of the solar panel.

The student placed different sized solar panels under a lamp.

Figure 3 shows a solar panel under a lamp.

Figure 3

0 2 . 1 Which variable should be controlled?

[1 mark]

Tick (✓) **one** box.

The area of the solar panels ☐

The brightness of the lamp ☐

The output potential difference of the solar panels ☐

0 2 . 2 The student measured the output potential difference using a voltmeter.

When the voltmeter was **not** connected, the reading on the voltmeter was 0.7 V

What name is given to this type of error?

[1 mark]

Tick (✓) **one** box.

Zero error ☐

Random error ☐

Measurement error ☐

Table 1 shows the results of the investigation.

Table 1

Solar panel	Area of solar panel in cm^2	Output potential difference in volts			
		Test 1	Test 2	Test 3	Mean
A	10	2.5	2.4	2.6	2.5
B	20	5.0	5.0	4.9	5.0
C	30	7.5	11.9	7.5	7.5
D	50	12.4	12.6	12.5	12.5

0 2 . 3 The readings for which solar panel show an anomalous result?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 2 . 4 The student did **not** have a solar panel with an area of 40 cm^2

Determine the most likely value for the mean output potential difference of a 40 cm^2 solar cell.

[1 mark]

Mean output potential difference = _____ V

0 2 . 5 The total input energy transfer to one of the solar panels was 8.0 joules.

The useful output energy transfer was 0.96 joules.

Calculate the efficiency of the solar panel.

Use the equation:

$$\text{efficiency} = \frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$$

[2 marks]

Efficiency = _____

0 2 . 6 Solar power is a renewable energy resource.

Complete the sentence.

Choose the answer from the box.

[1 mark]

burned	**replenished**	**consumed**

A renewable energy resource is one that is _____ as it is used.

0 2 . 7 Some homes have solar panels which generate electricity.

On a sunny day the potential difference across a solar panel is 31 volts.

A charge of 490 coulombs flows through the solar panel.

Calculate the energy transferred by the solar panel.

Use the equation:

energy transferred = charge flow × potential difference

Give your answer to 2 significant figures.

[3 marks]

Energy transferred = _____ J

0 2 . 8 Why do solar panels on homes help reduce the environmental impact of using electrical devices?

[1 mark]

Tick (✓) **one** box.

- Less electricity is used in the home. ☐
- Less fossil fuel is burned. ☐
- The electricity from the solar panels is cheaper. ☐

5. May/2019/Paper_1F/No.5(5.3_5.6)

0 5 . 3 The toaster is switched on for 120 seconds.

The power of the toaster is 850 watts.

Calculate the energy transferred by the toaster.

Use the equation:

energy transferred = power × time

[2 marks]

Energy transferred = _____ J

0 5 . 4 Complete the sentences.

Choose answers from the box.

[2 marks]

chemical	**elastic potential**	**kinetic**	**thermal**

When bread is lowered into the toaster, a spring is stretched. The stretched spring stores _____ energy.

After the bread is toasted, the spring makes the toast move upwards. As the speed of the toast increases, the _____ energy of the toast increases.

0 5 . 5 Write the equation which links gravitational field strength, gravitational potential energy, height and mass.

[1 mark]

0 5 . 6 The toast was moved upwards by the spring.

The change in gravitational potential energy of the toast was 0.049 J

The mass of the toast was 0.050 kg

gravitational field strength = 9.8 N/kg

Calculate the change in height of the toast.

[3 marks]

Change in height = _____ m