Cambridge Assessment International Education

Cambridge IGCSE™

3: Energy – Topic questions

Paper 4

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
3	2015	June	33
3	2016	June	42
4	2016	March	42

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at www.cambridgeinternational.org/support

3 **(a)** The boxes on the left contain the names of some sources of energy. The boxes on the right contain properties of some sources of energy.

Draw **two** straight lines **from each box** on the left to the two boxes on the right which describe that source of energy.

	renewable
solar energy	
	not renewable
	polluting
natural gas	
	not polluting

[2]

(b) Coal-fired power stations are polluting.

State an advantage of using coal as a source of energy.

.....

.....[1]

(c) A coal-fired power station generates electricity at night when it is not needed.

Some of this energy is stored by pumping water up to a mountain lake. When there is high demand for electricity, the water is allowed to flow back through turbines to generate electricity.

On one occasion, 2.05×10^8 kg of water is pumped up through a vertical height of 500 m.

(i) Calculate the weight of the water.

weight = ...[1]

(ii) Calculate the gravitational potential energy gained by the water.

energy gained = ...[2]

(iii) The electrical energy used to pump the water up to the mountain lake is 1.2×10^{12} J. Only 6.2×10^{11} J of electrical energy is generated when the water is released.

Calculate the efficiency of this energy storage scheme.

efficiency = ...[2]

[Total: 8]

3 Fig. 3.1 shows a cabin used to transport passengers up a hillside.

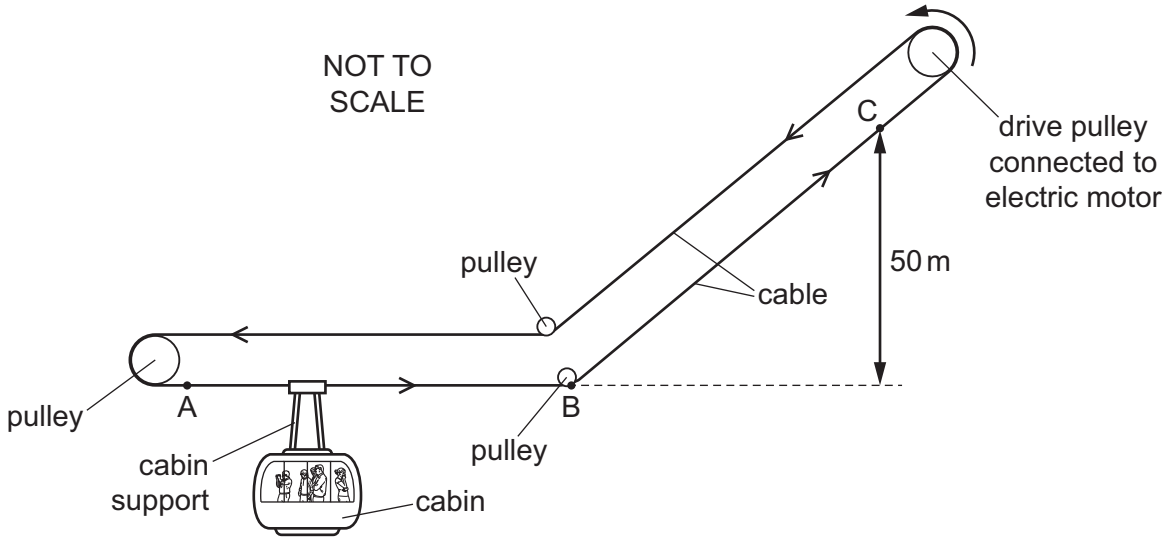

Fig. 3.1

The cabin is attached to a cable which moves horizontally from A to B, then up the hill from B to C.

(a) There is an electrical input of energy to the motor which moves the cable.

Place **two** ticks against types of energy that increase as the cabin moves **horizontally** at **constant speed** from A to B.

- ☐ kinetic energy of the cabin
- ☐ gravitational potential energy of the cabin
- ☐ gravitational potential energy of the cable
- ☐ internal energy of the surroundings
- ☐ internal energy of the wires of the motor

[2]

(b) The cabin and passengers have a total mass of 800 kg. The vertical distance between B and C is 50 m.

Calculate the increase of gravitational potential energy of the cabin and passengers when they move from B to C.

energy = ... [2]

(c) The cabin then descends back from C to B.

The weight of the cabin pulls the cable, which rotates the motor. The electric motor acts as a generator when rotated in this way.

Explain the environmental and economic benefits of this arrangement.

.....

.....

.....

.....

.....

..... [3]

[Total: 7]

4 **(a)** The source of solar energy is the Sun.

Tick the box next to those resources for which the Sun is also the source of energy.

- ☐ coal
- ☐ geothermal
- ☐ hydroelectric
- ☐ nuclear
- ☐ wind [2]

(b) Fig. 4.1 shows a solar water-heating panel on the roof of a house.

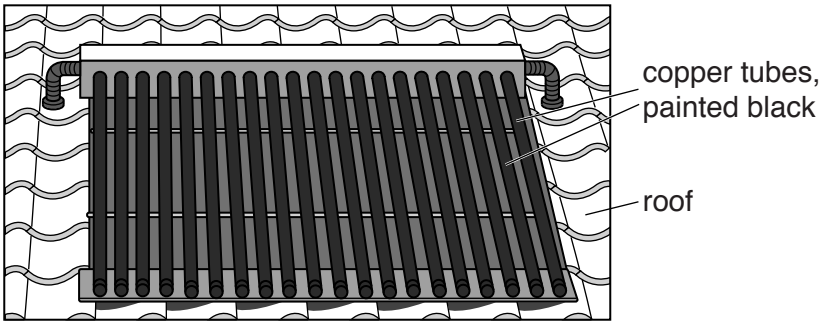

Fig. 4.1

Cold water flows into the copper tubes, which are heated by solar radiation. Hot water flows out of the tubes and is stored in a tank.

(i) Explain why the tubes are made of copper and are painted black.

.....

.....

.....[2]

(ii) In 5.0 s, 0.019 kg of water flows through the tubes. The temperature of the water increases from 20 °C to 72 °C. The specific heat capacity of water is 4200 J / (kg °C).

Calculate the thermal energy gained by the water in 5.0 s.

thermal energy = ...[3]

(iii) The efficiency of the solar panel is 70%.

Calculate the power of the solar radiation incident on the panel.

power = ...[2]

[Total: 9]

Question	Answer	Mark
3 (a)	lines from solar energy to boxes 1 AND 4 only B1 lines from natural gas to boxes 2 AND 3 only	B1 B1
3 (b)	(relatively) cheap **OR** widely available **OR** can be used on a large scale **OR** always available	B1
3 (c) (i)	2.05×10^9 N	B1
3 (c) (ii)	use of *mgh* **OR** weight × h 1.03×10^{12} J **NOT** ecf from (i)	C1 A1
3 (c) (iii)	output energy ÷ input energy **OR** $6.2 \times 10^{11} \div 1.2 \times 10^{12}$ 0.52 **OR** 52 %	C1 A1
		Total: 8
3 (a)	internal energy of surroundings Box 4 internal energy of wires of motor Box 5	B1 B1
3 (b)	(change of g.p.e. =) mgh (800 × 10 × 50 =) 400 000 J **OR** 400 kJ	C1 A1
3 (c)	any three from the following four: • electrical energy generated • sensible use of electrical energy • sensible economic comment • sensible environmental comment	B3
		Total: 7
4 (a)	Coal, hydroelectric and wind boxes ticked	B2
4 (b) (i)	Copper is a good conductor of thermal energy / heat Black surface is a good / the best absorber of radiation / infra-red	B1 B1
4 (b) (ii)	Temp rise =) 72 – 20 = 52 (°C) (Q =) mcΔθ **OR** 0.019 × 4200 × 52 4100 J	C1 C1 A1
4 (b) (iii)	Efficiency = (power) output / (power) input (× 100) **OR** 70 $\frac{\left(\frac{4100}{5}\right) \times 100}{\text{power input}}$ OR $\frac{4100 \times 100}{\text{power input}}$ **OR** rearranged Power input = 1200 W	C1 A1
		Total: 9

Notes about the mark scheme are available separately.