3.1 Energy: Test Pack

AQA 8463 · Calculator allowed · about 40 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Give the name for each of these energy stores: chemical store in a battery, energy stored by a stretched rubber band.

(a) Energy store in a battery (chemical store). **(1)**

(Total for Question 1 is 1 mark)

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2 Give one example of a renewable energy source and one example of a non-renewable energy source.

(a) Name one renewable source. **(1)**

(b) Name one non-renewable source. **(1)**

(Total for Question 2 is 2 marks)

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3 Complete the sentences. Fill in the missing words.

1. When an object is raised above the ground its energy store increases and we call this the gravitational potential energy store.

2. When a moving object slows down its energy in the kinetic store decreases.

(a) Complete sentence 1: name the store. **(1)**

(b) Complete sentence 2: name the store. **(1)**

(Total for Question 3 is 2 marks)

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4 A small mass of 1.5 kg is lifted 2.0 m. Calculate the change in gravitational potential energy using g = 10 N/kg. Show working.

(a) Use E = mgh. **(2)**

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(Total for Question 4 is 2 marks)

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5 This question is about energy stores.

(a) A car is moving along a road. Which energy store is associated with the car's motion? **(1)**

- ☐ A) Kinetic
- ☐ B) Elastic potential
- ☐ C) Chemical
- ☐ D) Nuclear

(b) Name the energy store that increases when an object is lifted higher above the ground. **(1)**

(c) Name the energy store of a stretched spring. **(1)**

(Total for Question 5 is 3 marks)

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6 Machines and buildings can be designed to reduce unwanted energy transfers.

(a) Explain how lubricating the moving parts of a machine reduces the amount of energy that is wasted. **(2)**

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(b) A house loses energy through its outer walls. Explain how filling the wall cavity with insulating material reduces this energy transfer. **(2)**

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(Total for Question 6 is 4 marks)

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7 Two outer walls of a building have the same thickness and area, with the same temperature difference across them, but are made from different materials. Wall X has a high thermal conductivity and wall Y has a low thermal conductivity.

(a) State which wall, X or Y, has the lower rate of energy transfer through it. **(1)**

(b) State two other factors, apart from thermal conductivity, that affect the rate of energy transfer through a wall. **(2)**

(Total for Question 7 is 3 marks)

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8 When energy is transferred by a device, some energy is dissipated.

(a) What is meant by energy being dissipated? **(1)**

(b) A phone battery transfers 3000 J of energy while charging a phone. Of this, 2400 J is transferred usefully. Calculate the energy dissipated and the efficiency of the charging process. **(3)**

(Total for Question 8 is 4 marks)

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9 A student investigates the specific heat capacity of a metal block. The 0.5 kg block is heated by an electric heater. The heater transfers 12000 J of energy to the block and the temperature of the block rises by 30°C. specific heat capacity = energy transferred / (mass x temperature change)

(a) Calculate the specific heat capacity of the metal from the student's results. Give the unit with your answer. **(2)**

.....

(b) The value the student calculates is higher than the true value for the metal. Suggest why not all of the 12000 J was transferred to the block. **(1)**

.....

(c) Give one change the student could make to reduce this energy loss. **(1)**

(Total for Question 9 is 4 marks)

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10 A student investigates how the extension of a spring depends on the force applied, as a required practical. State two control variables the student should keep constant to make this a fair test, and explain why the spring should not be stretched beyond its limit of proportionality.

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(Total for Question 10 is 2 marks)

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11 The UK is increasing the proportion of its electricity generated from renewable resources, such as wind and solar power, and reducing its use of non-renewable resources, such as coal and natural gas.

Evaluate one advantage and one disadvantage of relying more heavily on wind power for UK electricity generation.

(Total for Question 11 is 2 marks)

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Mark scheme · 3.1 Energy: Test Pack

Question 1

(a) chemical store cao **B1**

(a) Answer: Chemical store

Question 2

(a) any renewable such as solar, wind, hydro, biomass, geothermal cao **B1**

(a) Answer: For example: solar

(b) any non-renewable such as coal, oil, natural gas, nuclear cao **B1**

(b) Answer: For example: coal

Question 3

(a) gravitational potential energy store or gravitational store cao **B1**

(a) Answer: Gravitational potential energy store

(b) kinetic store or kinetic energy store cao **B1**

(b) Answer: Kinetic store

Question 4

(a) substitutes: E = 1.5 x 10 x 2.0 **M1**

(a) 30 J cao **A1**

(a) Answer: 30 J

Question 5

(a) A (kinetic) **B1**

(b) gravitational potential (energy store) **B1**

(b) Answer: Gravitational potential

(c) elastic potential (energy store) **B1**

(c) Answer: Elastic potential

Question 6

(a) lubrication reduces the friction between the moving surfaces **B1**

(a) so less energy is dissipated / transferred to the thermal store of the surroundings **B1**

(a) Answer: Reduces friction, so less energy is dissipated as heat

(b) the insulating material has a low thermal conductivity **B1**

(b) so the rate of energy transfer (by conduction) through the wall is reduced **B1**

(b) Answer: Insulation has low thermal conductivity, reducing the rate of conduction through the wall

Question 7

(a) wall Y (the low thermal conductivity wall) **B1**

(a) Answer: Wall Y

(b) one valid factor, e.g. the thickness of the wall; the temperature difference across the wall; the area of the wall, oe **B1**

(b) a second, different valid factor, oe **B1**

(b) Answer: Any two of: thickness of the wall; temperature difference across it; area of the wall

Question 8

(a) energy is transferred to the surroundings in less useful ways / spread out (usually as thermal energy) **B1**

(a) Answer: Energy is transferred to the surroundings in a less useful (spread out) way

(b) energy dissipated = 3000 - 2400 = 600 J **B1**

(b) efficiency = 2400 / 3000 **M1**

(b) 0.8, so 80% **A1**

(b) Answer: Energy dissipated = 600 J; efficiency = 80%

Question 9

(a) 12000 / (0.5 x 30) (correct substitution) **M1**

(a) 800 J/kg °C (value and unit) **A1**

(a) Answer: 800 J/kg °C

(b) some energy is transferred to the surroundings / air (heat loss from the block/heater) **B1**

(b) Answer: Some energy is transferred (lost) to the surroundings

(c) insulate / lag the block (allow: put a lid on / use a smaller temperature difference) **B1**

(c) Answer: Insulate (lag) the block

Question 10

control variables: use the same spring throughout (same original length, material and thickness), and keep temperature constant, oe (any two) **B1**

beyond the limit of proportionality, extension is no longer directly proportional to force, so the straight-line (linear) relationship used to calculate the spring constant no longer applies, and the spring may also be permanently deformed and not return to its original length, oe **B1**

Answer: Keep the same spring (same length/material) and constant temperature throughout. Beyond the limit of proportionality extension is no longer proportional to force, so the linear relationship (and spring constant) no longer applies, and the spring may be permanently stretched.

Question 11

advantage: wind power produces no carbon dioxide (or other greenhouse gas/pollutant) emissions while generating electricity, and the energy resource (wind) will not run out, oe **B1**

disadvantage: wind power is unreliable/intermittent, as it depends on wind speed and cannot supply electricity on demand (or cannot be easily stored, and requires backup generation), oe **B1**

Answer: Advantage: wind power produces no emissions during generation and the resource will never run out. Disadvantage: it is unreliable, as output depends on wind speed and cannot be guaranteed on demand.

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