Blast-off : Energy Mark Scheme

Page 5

1. **Wind turbine**
    - Input energy: Kinetic (from the wind)
    - Outputs: Electrical energy (useful), sound energy (wasted), heat energy (wasted)
2. **Light bulb**
    - Input energy: Electrical energy
    - Outputs: Light energy (useful), heat energy (wasted)
3. **Speaker**
    - Input energy: Electrical energy
    - Outputs: Sound energy (useful), heat energy (wasted)

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1. **Microphone**
    - Input energy: Sound energy
    - Outputs: Electrical energy (useful), heat energy (wasted)
2. **Parachute**
    - Input energy: Gravitational potential energy
    - Outputs: Kinetic energy (useful), heat energy (due to air resistance, wasted)
3. **Kettle**
    - Input energy: Electrical energy
    - Outputs: Thermal energy (useful), sound energy (wasted)

Page 9

1. **Useful energy output of the car**: 150 J (kinetic energy)
2. **Wasted energy**: 30 J (heat and light energy)
3. **Efficiency of the car**:
   Efficiency = (Useful energy output / Total energy input) × 100
   Efficiency = (150 / 180) × 100 = 83.3%
4. **What does efficiency mean?**
   Efficiency is the percentage of input energy that is converted into useful output energy.

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1. **Petrol engine**
    - Wasted energy: 1000 J - 300 J = 700 J
    - Efficiency = (300 / 1000) × 100 = 30%
    - Wasted forms of energy: Heat energy, sound energy
2. **Solar cell**
    - Wasted energy: 300 J - 45 J = 255 J
    - Efficiency = (45 / 300) × 100 = 15%

Page 12

1. **Conversion table**
    - 5000 J = 5 kJ
    - 4310 J = 4.31 kJ
    - 23 J = 0.023 kJ
    - 54,300 J = 54.3 kJ

Page 13

1. **Breakfast cereal (484 kJ to J)**: 484 × 1000 = 484,000 J
2. **White bread (443,100 J to kJ)**: 443,100 ÷ 1000 = 443.1 kJ

Page 16

1. **Biscuit with most energy**: Biscuit 1 (15°C temperature rise)
    - Reason: A higher temperature rise indicates more energy transferred to the water.
2. **Equipment to measure water temperature**: Thermometer
3. **Factors to keep constant for a fair test**:
    - Volume of water
    - Mass of the biscuit
    - Starting temperature of the water
4. **Energy change**: Chemical energy in food is converted to heat energy

Page 22

Fill-in-the-blanks (4 marks)

1. Light and **heat** from the Sun pass through the Earth's atmosphere.
2. Most heat is **reflected** back into space but some is trapped in the Earth's atmosphere by **carbon dioxide**.
3. Carbon dioxide is known as a **greenhouse** gas.
4. The more **fossil** fuels we burn, the more carbon dioxide there is in the atmosphere. **Global warming** is a result of this. This increases the temperature of the Earth and will cause the **polar ice caps** to melt and sea levels to rise.

[Marking Guidance]

- 1 mark for each correct blank. Spelling must be correct.

Page 23

Short Answer Questions (6 marks)

1. Name 3 fossil fuels:
    - Coal, oil, natural gas (1 mark).
2. What does non-renewable mean?
    - A resource that cannot be replaced once used up (1 mark).
3. What gas is produced when fossil fuels are burned?
    - Carbon dioxide (1 mark).
4. How is using wind energy better for the environment?
    - It does not release greenhouse gases or air pollution (1 mark).
5. Describe the energy changes that take place in a wind turbine:
    - Kinetic energy of wind → mechanical energy → electrical energy (1 mark).
6. Describe the energy transfers that happen in solar panels:

- Light energy from the sun → electrical energy (1 mark).

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Table Completion (4 marks)

Advantages and Disadvantages of Hydroelectric Power:

Advantages	Disadvantages
1. Renewable and sustainable energy source	1. Requires large areas to be flooded
2. Does not produce greenhouse gases	2. Can disrupt aquatic ecosystems

[Marking Guidance]

- 1 mark for each correct entry in the table.

Page 25

Diagram Labelling (9 marks)

1. Label the resources:
   - Wind energy (wind turbines)
   - Solar power (solar panels)
   - Hydroelectricity (dam)
   - Coal mine
   - Natural gas (storage tank)
   - Oil platform
   - Electricity pylons
   - Biomass energy (trees)
   - Geothermal energy (underground pipe system).

[Marking Guidance]

- 1 mark per correctly labeled resource.

Sorting Table (6 marks)

Renewable	Non-Renewable
Wind energy	Coal
Solar power	Natural gas
Biomass energy	Oil platform
Hydroelectricity	

[Marking Guidance]

- 1 mark per correct placement.

Page 26

Definition and Short Answers (4 marks)

1. What is a renewable energy resource?
   - A resource that can be replaced naturally and will not run out, such as wind or solar energy (2 marks).
2. Name a gas released when fossil fuels are burned. Describe the harm this gas causes to the environment.
   - Gas: Carbon dioxide (1 mark).
   - Harm: Contributes to global warming and climate change (1 mark).

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Matching Statements Table (6 marks)

Energy Source	Advantage	Disadvantage
Biomass	Supplies can be replaced easily	Releases emissions when used
Solar Power	Produces no pollution	Can only be used in certain conditions
Coal	Releases a lot of heat energy	Will eventually run out and cannot be replaced

[Marking Guidance]

- 1 mark for each correct placement.

Page 27

Short Answers and Energy Calculation (7 marks)

6. How many joules (J) are there in one kilojoule (kJ)?
    - 1,000 J (1 mark).
7. Name the energy store associated with food, fuels, and batteries:
    - Chemical energy (1 mark).
8. Which of the drinks has the largest store of energy?
    - Semi-skimmed milk (1 mark).
9. Why are energy values given per 100ml instead of per serving?
    - To allow fair comparison between different products (1 mark).

Page 28

Temperature and Energy Calculations (6 marks)

12. Calculate the temperature change for food C:
- Change = Final temp - Starting temp = 38.6°C - 17.9°C = 20.7°C (1 mark).

13. Which food had the largest energy store?
- Food A (1 mark).

14. Calculate the number of minutes you would need to cycle to transfer 1,000 kJ of energy:
- Energy per minute = 25 kJ.
- Minutes = 1,000 ÷ 25 = 40 minutes (1 mark).

15. Total energy transferred during 24 hours:
- Sleep: 10 × 5 = 50 kJ
- Running: 30 × 60 = 1,800 kJ
- Dressing: 30 × 7 = 210 kJ
- Walking: 120 × 13 = 1,560 kJ
- Sitting: 600 × 6 = 360 kJ
- Standing: 60 × 7 = 420 kJ
- **Total = 4,400 kJ** (1 mark).

16. How much energy should the person take in from food and drink during the day?
- **4,400 kJ** (matches energy expenditure) (1 mark).

Page 29

Efficiency Calculation (6 marks)

Appliance	Efficiency (%)
Kettle	(90 ÷ 100) × 100 = 90%
Television	(70 ÷ 150) × 100 = 46.7%
Light bulb	(20 ÷ 100) × 100 = 20%
Drill	(550 ÷ 1,500) × 100 = 36.7%
Radio	(50 ÷ 700) × 100 = 7.1%
Electric fan	(147 ÷ 700) × 100 = 21%

[Marking Guidance]

- 1 mark per correctly calculated efficiency.

Page 30-31 (Question 17)

(a) (i) **Points with no kinetic energy:** A, F

(ii) **Point with the most gravitational potential energy:** A

(iii) **Point with some kinetic energy and least gravitational potential energy:** E

(b)

(i) **Force causing cars to move from B to C:** Gravity

(ii) **Force acting on the car to slow it down at E:** Water resistance or drag

(c)

Complete the sentence:

When the car hits the bumper at F, its **kinetic** energy is transferred into **sound** energy and **thermal** energy.

Page 32-33 (Question 18)

(a) **Two other fossil fuels from the list:**

- Oil
- Natural gas

(b)

(i) **Two renewable energy resources:**

- Solar
- Wind

(ii) **Order of stages to generate electricity using wave energy:**

C → E → A → B → D

Page 34 (Question 19)

(a)

(i) **Energy transfer in the battery while charging:** Electrical to chemical

(ii) **Energy transfer when the phone rings:** Chemical to electrical to sound

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Page 35-36 (Question 20)

(a) **Fuel releasing the least energy per kilogram:** Ethanol (alcohol)

(b) **Reason hydrogen produces less pollution:** It only produces water and does not emit carbon monoxide or sulfur dioxide.

(c) **Fuel compressible into a small container:** Hydrogen

(d) **Gas needed for fuels to burn:** Oxygen

(e) **Why sugar cane will not run out:** It is a renewable resource because it can be replanted and regrown.

Page 37 (Question 21)
(a)
(i) **Reason energy output varies during the day:** Solar energy output depends on sunlight intensity, which changes with the position of the Sun in the sky.
(ii) **Duration motor runs at full speed (0.7 kJ/s):** 8 hours
Page 30
Question 17
(a)
(i) A and F (2 marks)
(ii) A (1 mark)
(iii) C (1 mark)
(b)
(i) Gravity (gravitational force) (1 mark)
(ii) Water resistance (drag) (1 mark)
(c)

- Gravitational potential
- Sound
- Thermal (3 marks)

Page 32
Question 18
(a)

- Oil
- Natural gas (2 marks)

(b)
(i)

- Wind
- Solar (2 marks)

(ii) Order: C, E, A, B, D (2 marks)

Page 34
Question 19
(a)
(i) Electrical to chemical (1 mark)
(ii) Chemical to electrical to sound (1 mark)

Page 35
Question 20
(a) Ethanol (1 mark)
(b) Hydrogen does not produce carbon monoxide or sulfur dioxide. (1 mark)
(c) Hydrogen (1 mark)
(d) Oxygen (1 mark)
(e) Sugarcane is renewable because it can be replanted and grows back quickly. (1 mark)

Page 37

Question 21

(a)

(i) The energy output varies because sunlight is stronger during the middle of the day and weaker at the beginning and end of the day. (1 mark)

(ii) Approximately 6 hours (1 mark)

(b)

(i) Curve for mid-winter should be lower and peak around noon.

(ii) Solar panel turns 180° over 12 hours; 180 ÷ 12 = 15° per hour. (1 mark)

Page 39

Question 22

(a)

(i) Potential (1 mark)

(ii) Sound (1 mark)

(b) The spring unwinds faster because more energy is required to produce a louder sound. (1 mark)

(c) The solar cell reduces the energy demand on the spring. Sunlight provides additional electrical energy. (1 mark)

(d) Wind-up radios are useful in poor countries because they do not rely on electricity or batteries, making them cost-effective and accessible. (1 mark)

Page 41

Question 23

(a)

1. Coal
2. Petrol (2 marks)

(b)

(i) Sunlight (1 mark)

(ii) The solar panel cannot work at night as there is no sunlight. (1 mark)

(c) Wind makes the blades turn. (1 mark)

(d) Solar energy (1 mark)

Page 43

Question 24

(a)

(i) Electrical (1 mark)

(ii) Kinetic (1 mark)

(iii) Gravitational potential; thermal (1 mark)

(b)

Advantage: Solar cells are renewable and produce no pollution.

Disadvantage: Solar cells depend on sunlight and may not work efficiently in cloudy weather. (2 marks)