Energy costs and transfers

Task 1

Use the information in the table to calculate the amount of energy associated with each food and activity.

For each pair, choose whether the food or the activity has more energy associated with it. Circle the answer.

|  |  |  |  |
| --- | --- | --- | --- |
| **Food** | **Energy (kJ) per 100** **g** | **Activity** | **Energy (kJ) for each minute of activity** |
| apple | 200 | sitting | 6 |
| banana | 340 | standing | 7 |
| chips | 1000 | walking slowly | 13 |
| cooked beef | 1000 | running | 60 |
| chocolate | 1500 | swimming | 73 |

**1** Energy in 100 g of apple =

Energy needed for 30 minutes of sitting =

**2** Energy in 200 g of chips =

Energy needed for 180 minutes of standing =

**3** Energy in 50 g of chocolate =

Energy needed for 1 hour of walking slowly =

**4** Energy in 250 g of banana =

Energy needed for 15 minutes of swimming =

**5** Energy in 75 g of cooked beef =

Energy needed for 5 minutes of running =

**Task 2**

**1** Match each renewable and non-renewable energy resource with the appropriate advantage and disadvantage.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Advantage** | **Energy resource** | | | **Disadvantage** |
| no fuel costs and no polluting gases are released |  | wind turbines |  | if there is an accident, radioactive material may be emitted into the environment |
|  |  |  |  |  |
| no fuel costs and very reliable |  | coal power stations |  | noisy and may spoil the view |
|  |  |  |  |  |
| very reliable and can produce electricity at any time |  | solar panels |  | release carbon dioxide which contributes to global warming |
|  |  |  |  |  |
| no polluting gases are released and lots of energy is produced |  | tidal power stations |  | can destroy the habitats of wading birds |
|  |  |  |  |  |
| provides electricity in remote areas where there is no access to mains electricity |  | nuclear power stations |  | only works during the day and doesn’t work well when it is cloudy |

**2** Use the words below to complete the paragraph about how energy from a fossil fuel is transferred to a hairdryer.

**chemical current generator kinetic steam thermal**

A fuel burns, transferring energy from the store in the fuel to the thermal store of heated water. The heated water becomes . The thermal store of the steam is transferred to the energy store of the turbines as they turn. The turbine drives a . This provides the push to make the flow through the wires to the hairdryer, where it is transferred to the and kinetic stores of the air.

**Task 3**

**1** Choose the correct definition for power.

How much energy is transferred by a device per second.

The energy associated with food and fuels.

The amount of energy shifted from the battery to the moving charge.

Use the information in the table to help you with this task.

|  |  |  |  |
| --- | --- | --- | --- |
| **Appliance** | **Power (kW)** | **Appliance** | **Power (kW)** |
| kettle | 2.2 | electric heater | 3.0 |
| dishwasher | 1.4 | power shower | 7.5 |
| TV | 0.1 | oven | 2.1 |
| fridge freezer | 0.2 | washing machine | 0.5 |

Price per kWh = 12 p

**2** From the list, which of the devices would be the most expensive to use for an hour? Why?

**3** In this task, you need to calculate the cost of using the different devices in this home during a typical day. The first one has been done for you.

**a** The fridge freezer is on for 24 hours in one day.

**Known values:**

power of fridge freezer = 0.2 kW

price = 12 p per kWh

**Formula:**

cost = power (kW) × time (hours) × price (per kWh)

**Substitute known values into the formula:**

cost = 0.2 kW × 24 hours × 12 p per kWh

= 57.6 p

**b** The kettle is used for a total of 1 hour per day.

**c** The power shower is used for a total of 1.5 hours per day.

**d** The oven is used for a total of 30 minutes in one day.

**e** The washing machine is used for 1 hour 15 minutes in one day.

**f** The TV is watched for 6 hours per day.

**4** You are asked to compare two kettles. One heats water to boiling in 12 minutes (0.2 hours) and has a power of 2.8 kW. The other boils the water in 18 minutes (0.3 hours) and has a power of 2.2 kW. Which would you recommend and why?

Task 4

**1** Complete the law of conservation of energy.

Energy cannot be or destroyed, only .

**2** What are the five types of energy store?

**3** Complete the following table to show the change in the energy in different stores as a result of different activities.

|  |  |  |
| --- | --- | --- |
| **Activity** | **Energy store(s) before** | **Energy store(s) after** |
| ball rolling down a hill, starting from rest |  |  |
| hand-held fan |  |  |
| cooking soup |  |  |
| a pull back and release toy |  |  |

Task 5

**1** What does it mean if energy is dissipated? Select the correct answers from the options below.

The energy is destroyed.

The energy is transferred to a store that you do not want it to go to.

The energy becomes spread out wastefully.

**2** How can the amount of dissipated energy be calculated from the energy input (to a device) and the useful energy output (from a device)?

**3** For the following situations, explain how energy is being dissipated.

**a** a bouncing ball

**b** a current flowing down a wire

**c** a space rocket re-entering the atmosphere

**d** a bicycle being pedalled up a hill

**4** Use your answer to question 2 to calculate the energy that is dissipated for each example below.

Then calculate the efficiency of each device using the formula below. You will need to learn this formula so you can apply your understanding of energy transfer.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Device** | **Energy input (kJ)** | **Useful energy output  (kJ)** | **Energy dissipated (kJ)** | **Efficiency (%)** |
| car | 36 000 | 7200 |  |  |
| fridge | 180 | 171 |  |  |
| solar cell | 50 | 7 |  |  |
| mobile phone charger | 36 | 27 |  |  |