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.

$$\text{energy efficiency} = \frac{\text{useful energy output} \times 100}{\text{energy input}}$$

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		