T3 Conservation of Energy

Section A

1) What is the unit that energy is measured in?
- ☐ **A:** Joules (J)
- ☐ **B:** Newtons (N)
- ☐ **C:** Watts (W)
- ☐ **D:** Volts (V)

2) What form of energy is stored in batteries and fuel?
- ☐ **A:** Electrical
- ☐ **B:** Kinetic Energy
- ☐ **C:** Chemical
- ☐ **D:** Gravitational Potential Energy

3) All of the energy supplied to another device is transferred into other forms. This is an example of
- ☐ **A:** renewable energy
- ☐ **B:** non-renewable energy
- ☐ **C:** conservation of energy
- ☐ **D:** catalysis

4) what is 55 kJ written in standard units?
- ☐ **A:** 0.055 J
- ☐ **B:** 0.55 J
- ☐ **C:** 5500 J
- ☐ **D:** 55 000 J

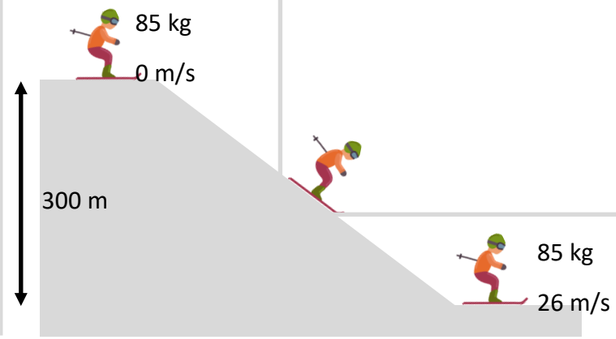
5) Which of these does ***not*** affect how quickly energy transfers through the walls of a house?
- ☐ **A:** thickness of walls
- ☐ **B:** thermal conductivity of the material
- ☐ **C:** height of walls
- ☐ **D:** temperature difference between sides of wall

6) How could unwanted energy transfers be reduced in devices with lots of moving parts?
- ☐ **A:** decrease the mass
- ☐ **B:** use lubrication
- ☐ **C:** increase the speed
- ☐ **D:** heat the device

change in gravitational potential energy = mass × gravitational field strength × change in vertical height	$\Delta GPE = m \times g \times \Delta h$
kinetic energy = 1/2 × mass × (speed)^2	$KE = \frac{1}{2} \times m \times v^2$

gravitational field strength, g
is roughly 10 N/kg on Earth

Show that the skier gained more than 250 kJ of gravitational potential energy when they climbed to the top of the slope



Show that the kinetic energy of the skier at the bottom of the slope is roughly 29 kJ.

State how much gravitational potential energy the skier has when they are halfway down the slope.

Suggest why the kinetic energy stored in the skier at the bottom of the slope is not equal to the gravitational potential energy stored in the skier at the top of the slope.
(hint: their skis are rubbing against the snow on the way down)

Section B

Use the energies from the box to complete energy transfers for each situation

the number of times you should use each energy is shown by the check boxes

thermal ☐☐
gravitational potential ☐☐
chemical ☐☐
electrical ☐☐
kinetic ☐☐☐☐☐
elastic potential☐

Top tip
Any potential energies are always transferred to and from kinetic energy.

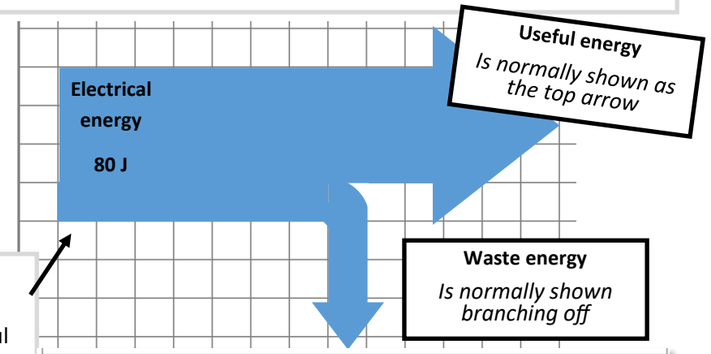
Situation	Input energy		Output energy
A fan is plugged into a mains electricity socket and turned on.		→	
A skydiver falls towards the Earth.		→	
A charcoal barbeque cooks meat.		→	
A battery is connected to a complete circuit.		→	
The bouquet of flowers is thrown high into the air at a wedding.		→	
An elastic band is pinged off of a student's finger.		→	
Brakes press onto a car wheel to slow it down.		→	

The diagram below shows how the total electrical energy supplied to a lightbulb is transferred.

What is the useful output energy for a lightbulb? ↓

Thickness of arrows
Represent amount of energy

Start of the arrow
Represents input energy supplied



How much of the 80 J input energy is transferred to useful energy?

$$\text{efficiency} = \frac{(\text{useful energy transferred by the device})}{(\text{total energy supplied to the device})}$$

Top tip
Any time it seems like energy has disappeared it has most likely been transferred to waste thermal energy which is dissipated to the surroundings.
Reducing friction makes this happen less.

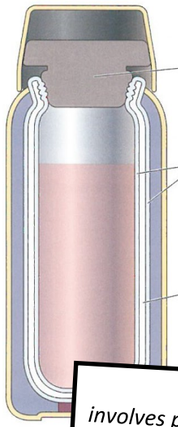
What is the efficiency of the lightbulb?

What form is the waste energy in and what happens to it?

combined sciences text book pages 315-328

Link to BBC Bitesize

Section C



draw one line from each feature to match it to its effect

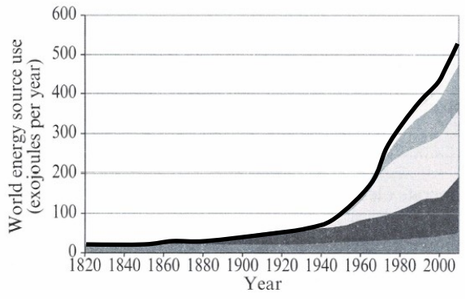
Briefly explain how each feature works.

Feature	Heat transfer it minimises	Explanation
Tight-fitting lid	conduction	
Glass walls with silver coating facing inside	convection	
Vacuum-filled gap between walls	radiation	

Conduction
involves particles colliding with their neighbours and transferring movement energy

Convection
involves warmer pockets of gases or liquids being less dense and floating up, taking their energy with them

Radiation
involves the transfer of energy by waves of infra-red light



← Describe and explain the overall trend shown in the graph.

Use the energy names in the box below to complete the table (you can use energy names more than once)

Coal nuclear wind bio-fuel natural gas solar oil geothermal hydroelectricity tidal

Key Word: ***non-renewable***
Energy resources that are being used up more quickly than they can be made

Feature of Energy Resource	Name of Energy Resource(s)
Renewable	
Non-renewable	
Produces hazardous waste products	
Power stations are only possible in some geographic locations	
Does not produce air pollution	
Reliability depends on the weather conditions	

Section D - give all answers in standard units

How much energy is required to lift a 2.0 kg bag of flour from a worktop to a shelf 0.8 m higher up?	How much kinetic energy is stored in a 2.0 kg bag of flour falling at a speed of 4.2 m/s?	A diesel generator transfers 420 J of chemical energy in its fuel into 140 J of electrical energy and 280 J of thermal energy. What is the efficiency of the generator?
What is the efficiency of a lightbulb that emits 8 J of light energy for every 100 J of electrical energy that it is supplied with? Give your answer as a decimal.	If a rock lifted from the surface of the moon gained 1200 J of gravitational potential energy, how much kinetic energy would you expect it to have when it lands back on the surface after being dropped?	A backpack weighs 3520 g. How much energy is required to lift it 160 cm above the ground to put it on?
A football has a mass of 410 g. When the ball hits the back of the net it is travelling at 32 m/s. How much kinetic energy is stored in the football?	A motor is 80 % efficient. If it is supplied with 160 kJ of energy, how much kinetic energy does it output?	A cricket ball is bowled at 22 m/s. The ball has 1.76 J of kinetic energy. What is the mass of the cricket ball?
An object gains 80 J of energy when it is lifted 0.5 m upwards. what is the mass of the object?	A diesel generator is 30 % efficient. It is supplied with 50 kJ of energy. How much energy is wasted as heat?	State the velocity of a 30 g bullet that possesses 25 kJ of kinetic energy.

Answers						
	0.33	408	128 000	35 000	16	210
	56.3	17.6	16	1200	0.0073	0.08