1. **Energy changes and energy stores part 1 – Energy systems and energy changes**

1. Describe the energy store changes when a rocket firework is lit, goes up in the air and then falls back

to the ground. (4)

**Chemical thermal kinetic gravitational kinetic thermal**

**(1 mark for each correct energy store change, maximum 4 marks)**

2. A cyclist is braking hard to avoid a collision.

Describe the energy store changes as the bicycle and rider decelerate to a stop. (3)

* **Rider and bicycle have a store of kinetic energy (1)**
* **The energy store shifts to heat energy in the brakes and wheel rims due to friction (1)**
* **When the bicycle stops the heat store is dissipated into the environment (1)**

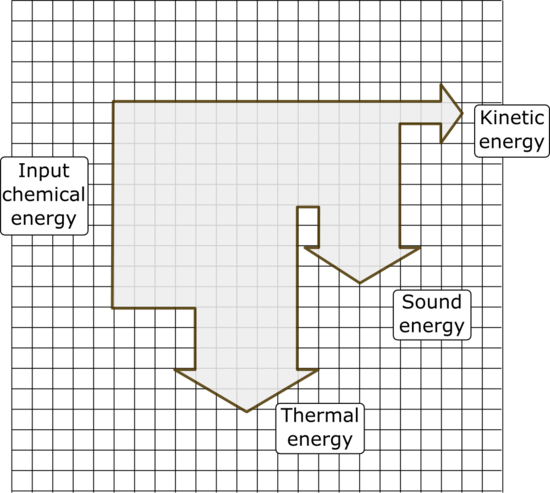
3. When a battery stops working people often say the energy has been used up. Explain why this statement is not

correct. (2)

**Energy cannot be used up as it cannot be created or destroyed (1)**

**The energy has been transferred into a less useful energy store (1)**

4. The Sankey diagram shows the simple energy store transfers for a car.



Chemical energy from the petrol = 20 000 J

1. Calculate the amount of useful energy

transferred by the engine. (1)

**4000 J (1) (each small square equates to 2000 J)**

1. What is the total amount of “wasted” energy

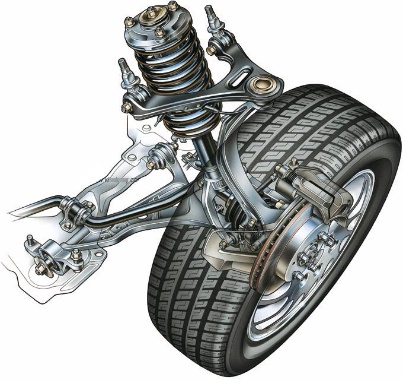
in the system? (1)

**18 000 J (1) (thermal and sound)**

5. An eagle has a mass of 4 kg and is flying at a velocity of 35 m/s. Calculate the kinetic energy of the bird. (3)

**Ek = ½ m v2 (1) Ek = ½ (4 x 352) (1) Ek = 2450 J (1)**

6. The spring on a car wheel extends by 0.05 m when the wheel goes down a pothole in the road.



spring

**Ee = ½ k e2**

If the spring constant is 20 kN/m, calculate the elastic potential energy in the spring when it is extended. (2)

**Ee = ½ x 20 000 x 0.052 (1) Ee = 25 J (1)**

7. A 48 kg person diving off a cliff has 3500 J of stored gravitational potential energy. Calculate the height of the cliff (3)

**Ep = m g h h = \_ Ep\_ (1) h = \_3500\_ (1) Height of cliff = 7.3m (1)**

**m g 48 x 10**

**B. Energy changes and energy store part 2 – energy changes in systems and power**

8. A swimming pool contains 30 000 kg of water at 8 oC.

Specific heat capacity of water = 4181 J/kg oC

**ΔE = m x c x Δθ**

1. How much thermal energy is needed to raise the temperature of the water to 15oC? (3) **Temperature rise = 15 – 8 = 7oC (1) E = 30 000 x 4181 x 7 (1)**

**thermal energy required = 878 010 000 J (1) or 878.01MJ**

1. On a sunny day, the concrete at the side of the pool feels much hotter than the water even though both have received the same thermal energy from the sun. Explain fully why the concrete is hotter. (2)

**Concrete has a lower specific heat capacity ( *c* ) than water (1)**

**So, the temperature of the concrete will rise more than the water for the same thermal energy input. (1)**

9.The lift in the world’s tallest building takes 64 s to reach a height of 828 m.

The maximum mass of the lift and passengers is 900 kg.

1. Calculate the power of the lift. (3)

**Power = work done (1) work = f x d = 9000 x 828 = 7 452 000 J (1)**

**time**

**Power = 7 452 000 = 116 438 W or 116.438 kW**

**64**

1. A service lift in this building is used to move furniture to apartments in the tower.

This lift has a 130 kW motor. If the maximum load for this lift is 2000 kg, how long will it take to reach the top of the building? (3)

**Power = work done (1) time = work done (1) time = 20 000 x 828 = 127s (1)**

**time power 130 000**

**C. Conservation and dissipation of energy – Energy transfers and efficiency**

10. The diagram represents the energy transfers for an oil-fired power station.

**Generator**

**Turbine**

**Water and steam**

**Oil**

**Energy transferred as movement**

**Useful energy out**

**X**

**Energy transferred as heat**

1. What is the useful energy out? (1)

**Electrical energy (1)**

1. In what form will energy be “wasted” in this process? (1)

**Thermal (internal) energy (1)**

1. What useful energy store is represented by the box labelled **X**? (1)

**Movement or kinetic (1)**

11. Loft insulation reduces heat loss from a home.

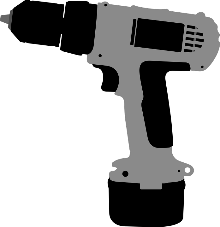
Loft insulation can be made out of many different materials.

Give two properties of the insulating material that will affect the amount of heat lost through the roof. (2)

**Thermal conductivity (1) and thickness (1) of the material**

12. A company sells two types of electric drill.

 Drill A Drill B



Drill A is a 300 W drill with an output power of 165 W.

Drill B is a 1100 W drill with an output power of 520 W.

Explain which drill is the more efficient at transferring useful energy? (3)

**Efficiency = useful power output (1)**

**Total power input**

**Drill A efficiency = 165 = 0.55 Drill B efficiency = 520 = 0.47 (1)**

**300 1100**

**Drill A is more efficient at transferring useful energy (1)**

13. Describe two ways you could increase the efficiency of a household central heating system. (2)

**Lag pipes carrying hot water to reduce thermal energy loss**

**Buy a more efficient boiler**

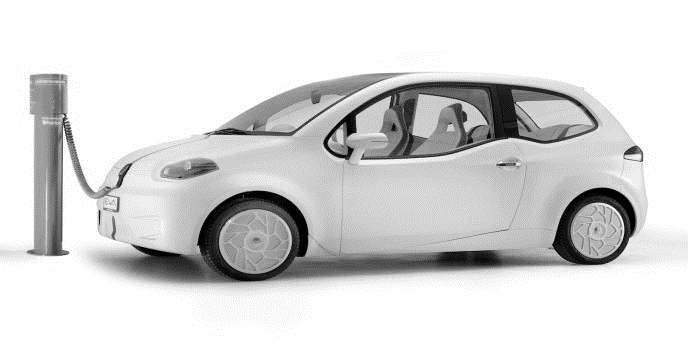
**Re-use the waste thermal energy to pre-heat water (any 2 valid answers) (2)**

**D. National and global energy resources – renewable and non-renewable energy**

**resources and patterns in energy use**

14. Name four renewable and four non-renewable energy resources. (2)

|  |  |
| --- | --- |
| Energy Resources | |
| Renewable resources | Non-renewable resources |
| **Wind, wave** | **Coal** |
| **Hydro – electric, tidal** | **Oil** |
| **Bio – fuel, solar** | **Gas** |
| **Geothermal (1)** | **Nuclear, peat (1)** |

 15. An electric car uses no fossil fuels to turn its motor.

Themanufacturer claims that this car does not contribute to carbon dioxide emissions into the atmosphere.

Explain why the manufacturer's claim is not true. (3)

**Electrical energy store to run the car may have been produced by burning fossil fuels (1)**

**Burning fossil fuels releases carbon dioxide into the atmosphere (1)**

**Carbon dioxide emissions from the manufacture and transport of the electric car (1)**

16. Explain why fossil fuels are considered to be a more reliable energy resource for electricity production than the

use of wind turbines. (3)

**Fossil fuels deliver a consistent electricity supply from a power station (1)**

**Wind turbines do not produce electricity when the wind is not blowing so they are less reliable (1)**

**Wind turbines do not produce electricity when it is too windy (1)**

17. Name an appropriate energy source for each of the following uses and briefly describe how it is used for

|  |  |  |
| --- | --- | --- |
| **Use** | **Energy source** | **How it is used** |
| **Producing electricity** | **Coal, oil, gas, bio-fuel,**  **Nuclear**  **Wind, wave, hydro – electric**  **Geothermal** | **Burning fuel used in the production of electricity**  **Nuclear reaction provides heat for the production of electricity**  **Movement of air or water turns a turbine to produce electricity**  **Steam from hot rocks used to produce electricity**  **(any one source and simple description 1)** |
| **Transport** | **Oil (petrol, diesel, fuel oil, LPG)**  **Renewable resources may supply electricity** | **Burning fuel drives an engine**  **Electricity to drive a motor**  **(any one source and simple description 1)** |
| **Heating a hospital** | **Coal, oil, gas, bio-fuel,**  **Renewable resources may supply electricity** | **Burnt to heat water**  **Electricity to run electric heating**  **(any one source and simple description 1)** |

this purpose. (3)

18. Worldwide agreements to reduce CO2 emissions are intended to slow down climate change. Describe how CO2 emissions contribute to climate change. (4)

**CO2 is released from burning fossil fuels**

**This CO2 builds up in the atmosphere**

**Increased CO2 in the atmosphere causes the atmosphere to heat up (retain heat)**

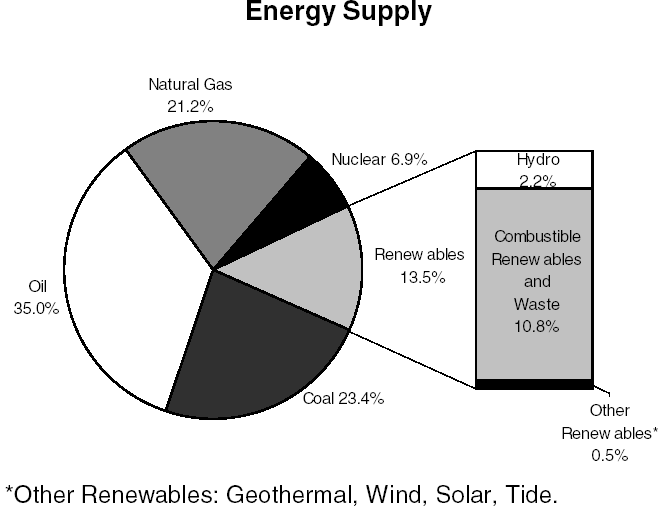
**This occurs because longer wavelength IR heat re-radiated from the Earth's surface cannot easily penetrate the CO2 rich atmosphere / greenhouse gases can absorb this longer wavelength IR.**

**Higher global temperatures result**

**This can lead to reduced ice, changing weather patterns and expanding oceans.**

**(any four valid points) (4)**

19. The chart shows the world’s energy resources usage for 2015.



Discuss the likely changes to the worlds energy supplies over the next 50 years. (6)

**Fossil fuels will become more difficult to find and extract**

**Use of fossil fuels is likely to reduce**

**Fossil fuels release carbon dioxide into the atmosphere**

**Governments likely to put policies in place to reduce fossil fuel usage**

**Nuclear fuel power stations are becoming safer, so more are being built which will increase energy from**

**this resource**

**Combustible renewables (wood, bio-fuel) and burning waste also increases CO2 so is likely to reduce**

**Other renewables are likely to increase to replace some fossil fuel usage**

**However, energy production from renewables is limited as they often provide only small quantities of**

**energy**

**(Credit any reasonable responses) (6)**