Abraham Darby Academy

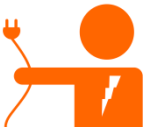
KS3 Physics | Energy and Work

Knowledge Series |Study Booklet | 2017

Key terms

- **Chemical energy**: The kind of energy stored in chemicals. Food, fuels and batteries.
- **Cells**: (Batteries) all contain chemical energy. They can provide power to a circuit.
- **Coal**: A fossil fuel made from the remains of plants.
- **Electrical energy**: The kind of energy carried by electricity.
- **Fossil**: Preserved remains or traces of any once-living thing from a past geological age. May have completely rotted away and the space filled by minerals.
- **Fossil fuels**: Coal, oil and natural gas are all fuels that were formed from the remains of dead plants and animals.
- **Fuel**: Anything that stores energy that can be converted into heat energy – including fossil fuels and nuclear fuel.
- **Generate**: Make electricity by turning a magnet inside coils of wire.
- **Heat energy**: Heat energy is the energy produced by the motion of particles within an object.
- **Kinetic energy**: The kind of energy in moving things.
- **Law of conservation of energy**: The idea that energy can never be created or destroyed, only changed from one form into another.
- **Light energy**: The kind of energy given out by light bulbs, candles, etc.
- **Natural gas**: Fossil fuel formed from the remains of dead plants and animals that lived in the sea.
- **Nuclear energy**: Energy stored inside the nucleii of atoms that everything is made from.
- **Oil**: Fossil fuel formed from the remains of dead plants/animals that lived in the sea.
- **Sound energy**: The kind of energy made by anything that is making a noise.
- **Uranium**: A fuel used in nuclear power stations.
- **Joule (J)**: The unit for measuring energy.
- **Convection current:** A flow of liquid or gas caused by part of it being heated or cooled more than the rest.
- **Geothermal power**: Making electricity using heat from hot rocks underground.
- **Hydroelectric power**: Making electricity by forcing falling water to turn turbines and subsequently powering huge generators. The water is usually fed from a reservoir.
- **Nuclear power**: A form of energy produced by an atomic reaction, capable of producing an alternative source of electrical power to that supplied by coal, gas, or oil.
- **Photosynthesis**: The process that plants use to make their own food. It needs light to work. Carbon dioxide and water are used up. Food (a sugar called glucose) and oxygen are produced.
- **Non-renewable energy resource**: Any energy resource that will run out and we cannot renew our supplies of it (e.g. oil).

Task: Complete the blanks in energy definitions table below.

Definition	Definition
 Anything with a temperature above absolute zero (-273°C) has _____ energy. That means everything has some _____ energy.	 _____ energy is very useful, because it is easily converted into other forms. Wherever there's a current flowing there is _____ energy.
 Anything that moves has _____ energy.	 Anything above the ground has gravitational _____ energy i.e. anything that can fall, like ski jumpers, aeroplanes and climbers.
 _____ Energy is released only from nuclear reactions e.g. The sun and all of the stars. Hydrogen bomb (Fusion). _____ power plants and the Atomic bomb (Fission).	 Anything with stored energy which can be released by a chemical reaction has _____energy, things like food, fuels and batteries.
 Anything noisy gives off _____ energy like vocal chords, speakers and instruments.	 Anything stretched (and returns) , has _____ energy. Items such as rubber bands, springs, etc.
 Anything luminous gives off _____ energy, like the sun, light bulbs , candles and glow worms.	

Energy is the ability to do work. There is only one thing called energy but it can be stored or moved in different ways.

Task: List as many types of energy examples you can think of which exist in a fairground.

Object at the fair	Type of energy

Task: Identify the different energy types as this trampolining elephant works off her lunch!

1. _____ energy
(from food)

2. _____ energy
(the elephant makes the trampoline bounce)

3. _____ _____ energy
(the strings in the trampoline stretch)

4. _____energy
(elephant is **moving** upwards)

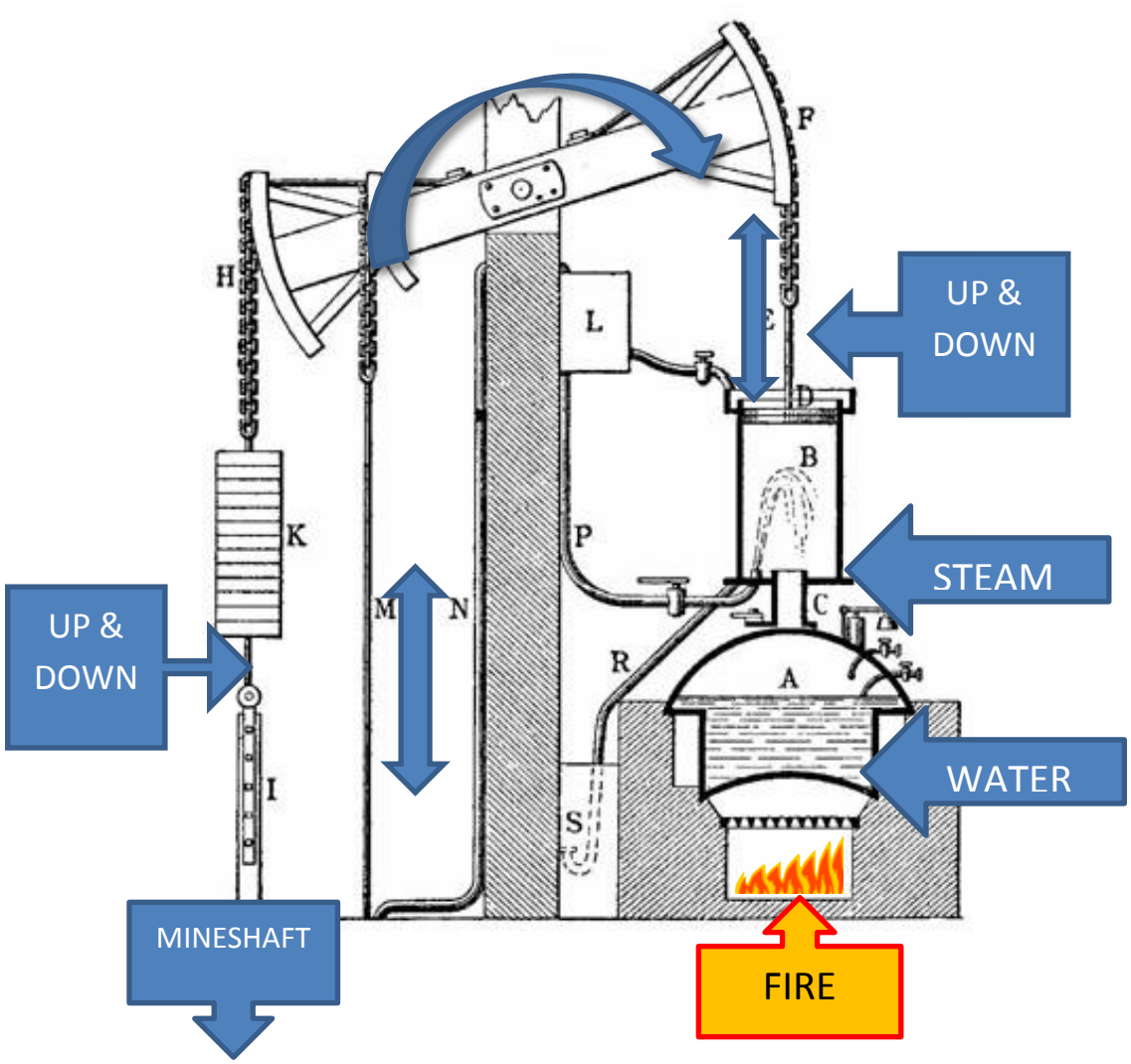
5. _____ energy
(elephant is **above the ground**)

6. _____ energy
(elephant starts to **move** downwards)

Scene: During the Victorian times, steam powered engines worked all day to pump water out of the deep mine shafts. They used innovative methods to transfer energy.

Task: Identify and label the different energy types in this steam powered water pump. Create a simple flow chart of each type of energy transfer; beginning with the furnace that boils the water.

Energy transfers



Task: Identify the different energy types when this biker races and jumps around a dirt track.

SoCalRacePicsBy: SoCalRacePics

Three shot sequence of Josh Grant going over Mt. Whitney at Glen Helen '07 National

Task: Identify the types of energy in six *things* you use on a daily basis which all improve the quality of life (e.g. washing machine or bus).

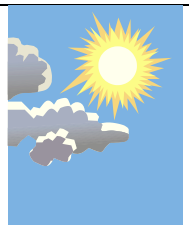
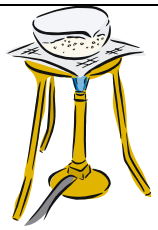
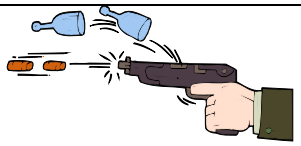
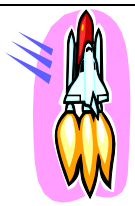
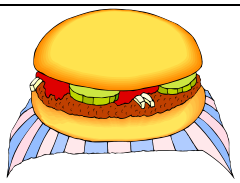
Task: List two examples for each type of energy listed below

- **Thermal:**_____
- **Light:**_____
- **Sound:**_____
- **Elastic:**_____
- **Gravitational:**_____
- **Kinetic:**_____
- **Electrical:**_____
- **Chemical:**_____
- **Nuclear:**_____

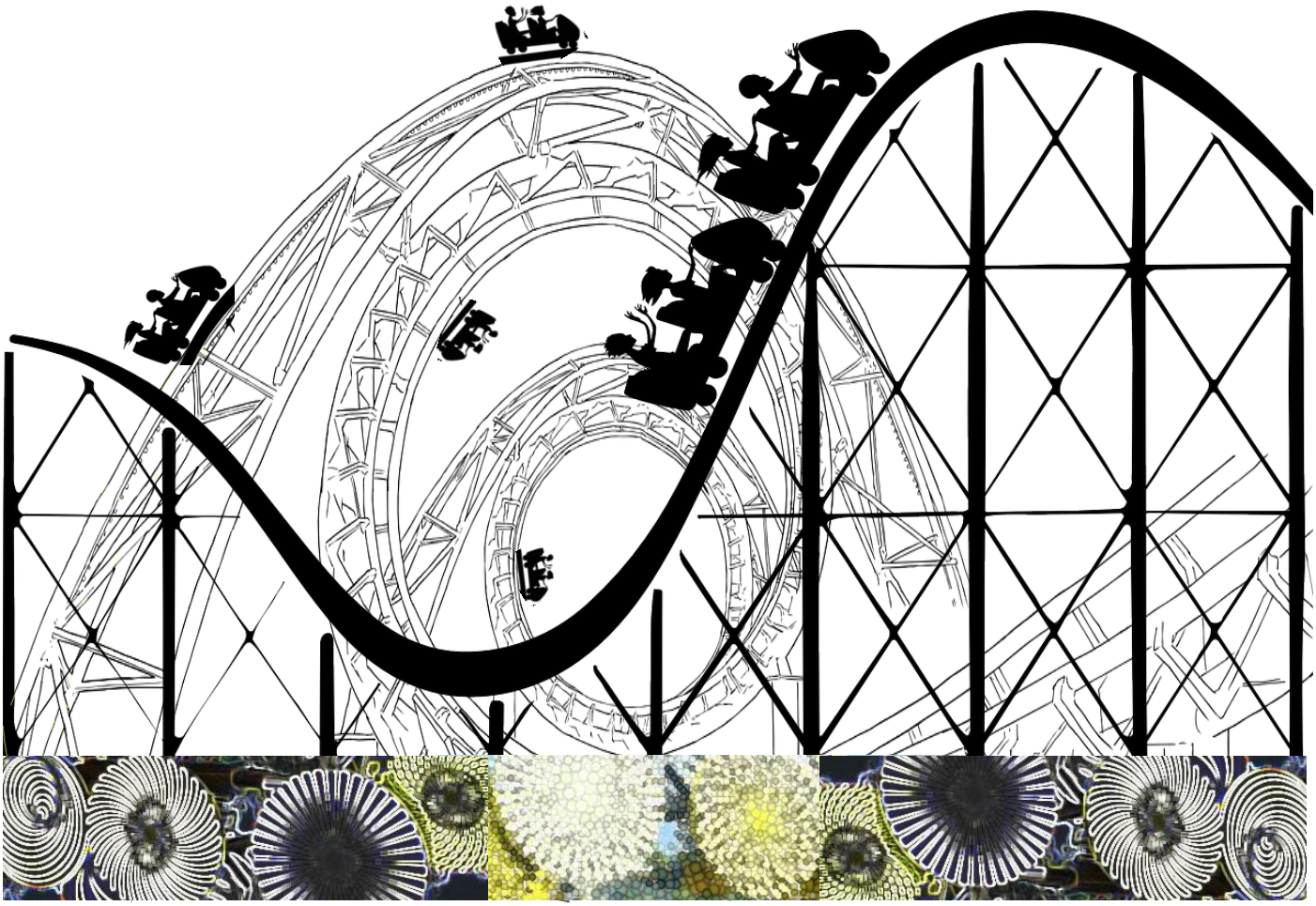
Task: What is the standard unit of energy? _____

Task: Identify the different energy types experienced when these soldiers are just about to parachute from the air transporter.

Task: Look at each pair of pictures below and decide which form of energy they represent.

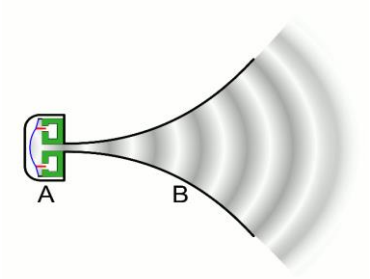
Item 1 + Item 2		**= Form of energy?**
 The sun	 A light bulb	
 A bonfire	 A Bunsen burner	
 A speeding bullet	 A galloping horse	
 A climber climbing	 A rocket gaining height	
 A hamburger	 Coal	

Task: Identify different energy types and any transfers of energy between stages (up or downhill) of riding on a rollercoaster. Begin with the initial (slow) climb on the first uphill slope. Label the diagram with as many energy transfers you can think of.

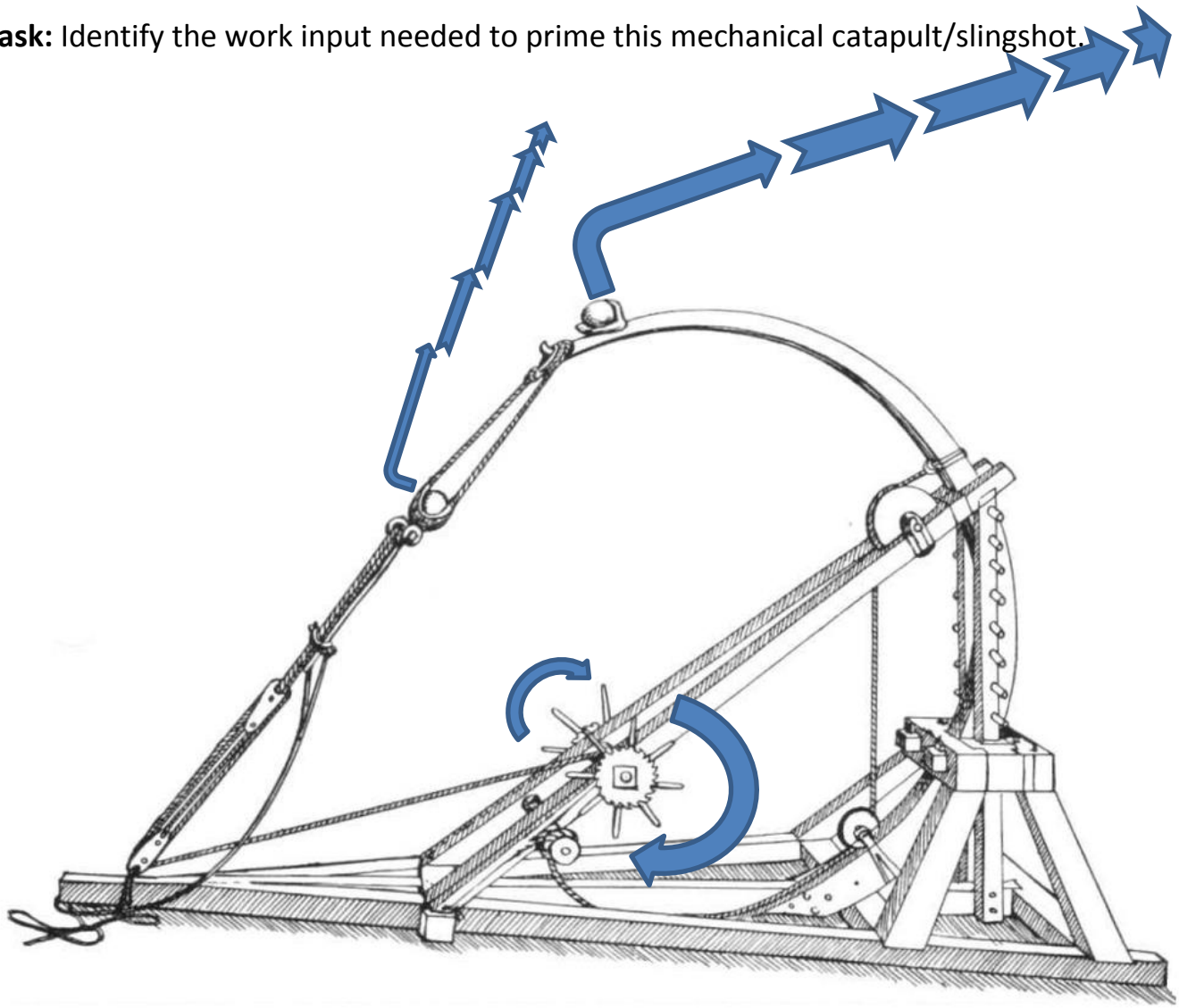


Task: Identify the different energy types when this singer performs at a local gig.

Task: Write a sentence explaining how electrical energy is transformed to sound waves using a <u>moving coil</u> loudspeaker. Use the diagram below to illustrate your answer.



Task: Identify the work input needed to prime this mechanical catapult/slingshot.



Task: Identify the two types of energy states that exist within the boulder before and after firing the mechanical catapult/slingshot.

Before	
After	

Task: List what types and relative amounts (portion sizes) of foods these family members should expect to consume. Explain your reasons for each.

Family members	• **Portion sizes** • **Food groups** 
Grandparents (age 60 -75)	
Parents (age 40 -50)	
Sons (age 16 – 25)	
Daughters (age 12 – 24)	
Male grandchild (age 3)	

Tasks: List the five main food groups in the table below. Give three examples of common meals which contain a healthy combination of these major food groups.

Food groups:					
Meals:					

Task: Define the term "work" in relation to energy transfer.

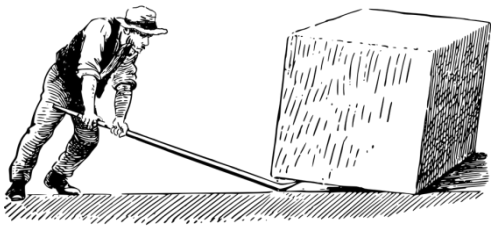
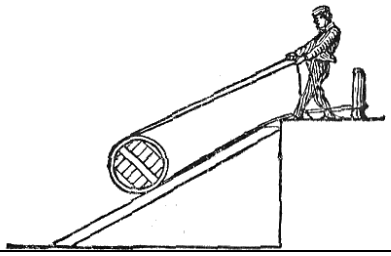
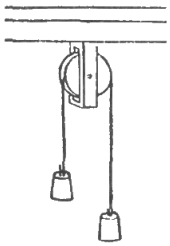
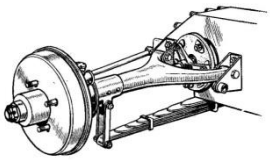
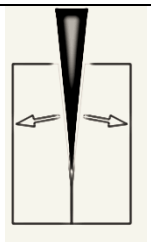
Task: Identify the (input) force and distance covered for these working horses, by pulling a plough behind them. Use correct SI units for force and distance.

Task: If the force exerted by the horses is 2kN, and the distance travelled is 500M, then what is the work output? Ensure your answer is given in the standard unit (SI) of work.

Task: Define the term “power” in relation to energy transfer.

Task: Using the answer to the previous question, calculate their power output. If the work output performed by those heavy horses took 15 minutes; then what is their power output? Ensure your answer is given in the SI unit of power.

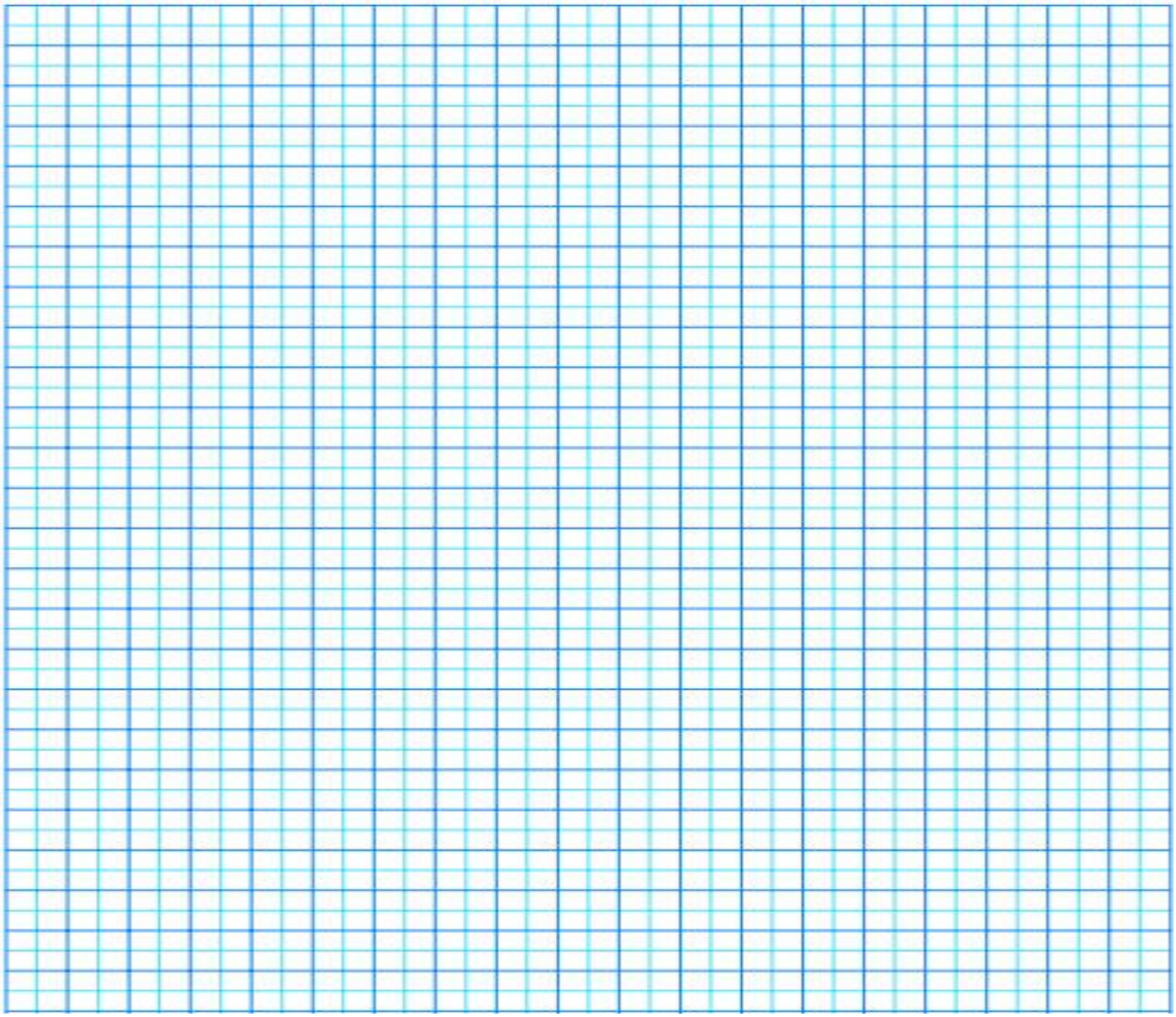
Task: Explain how we use these six simple machines (listed below) to help reduce input force, and make work easier. Justify your answer with a common use for each type.

Lever 	
Inclined plane 	
Screw 	
Pulley 	
Wheel and axle 	
Wedge 	

The table below shows the amount of energy needed for ten different activities.

Activity / kJ per hour	
Climbing stairs / 1200	Sleeping / 200
Cycling / 900	Snooker / 450
Eating / 360	Swimming / 1800
Manual work / 1250	Walking / 900
Writing / 400	Reading or TV / 350

Task: Draw a bar chart on the graph paper below to show the above information. Put the activities in order of energy required, so that the one that requires the most energy is on the left.



NOTE: Chose a suitable scale to ensure the chart fits neatly on the graph paper.

Task: Answer the seven questions below by underlining the correct answers.

1. Which of these energy resources does not originally come from the sun?

wind energy **solar power** **fossil fuels** **geothermal energy**

2. Plants get their energy from:

water **fertiliser** **the sun** **the soil**

3. Which statement is true?

- Coal has energy because it is black.
- Fossil fuels have energy because the animals that became fossils ran a lot.
- Coal has energy because it is warm inside the earth.
- The plants that formed coal got their energy from the sun.

4. Which one of these is a true statement about hydroelectricity?

- Reservoirs are filled up by water rising up from the earth.
- Electricity is generated using energy in falling water.
- Energy from the sun makes water evaporate and form clouds.
- The energy in hydroelectricity originally came from the sun.

5. The units for measuring energy are:

horsepower **degrees** **Joules** **Newtons**

6. Which of these is a non-renewable energy resource?

solar **wind** **natural gas** **moving water**

7. Fossil fuels are formed from:

water **electricity** **dead plants and animals** **rocks**

Coal, oil and gas are fossil fuels. Coal is mainly made of carbon. Oil and gas are made of carbon and hydrogen. We burn these fuels all day, every day to make our lives easier. They will not last forever! There are alternative methods of obtaining energy from renewable sources.

Task: list four types of renewable forms of energy, and give one advantage for each of these over burning traditional coal/oil (fossil) fuels to obtain energy.

1.

2.

3.

4.

Task: List four reasons why biomass and biofuel are better for the environment compared to fossil fuels

1.

2.

3.

4.

Task: Fill in the blanks for the following energy transfer questions.

These words might help you: ***Heat, Kinetic, Electrical, Chemical, Light, Sound, Potential.***

1. A loudspeaker transfers _____ energy into _____ energy.

2. A man falling down is transferring (_____) _____ energy into _____ energy.

3. A simple electrical circuit with a light bulb transfers _____ energy (in the battery) into _____ energy (in the wires) and then into _____ energy and _____ energy (in the bulb).

4. A hairdryer transfers _____ energy into _____ energy, + _____ energy + _____ energy.

5. When an arrow is released, the bowstring in a bow will transfer…

_____ energy into _____ energy + _____ energy.

6. A burning candle is transferring _____ energy into _____ energy, _____ energy and even some _____ energy.

7. Fireworks transfer _____ energy into _____ energy + _____ energy + _____ energy + _____ energy.

8. A green photosynthesising plant is transferring _____ energy into _____ energy.

NOTES

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