Trilogy P3: Energy Resources

Collins revision guide: Energy

Knowledge Organiser

Key points to learn

1.Fuel	Substance that we burn to release heat energy
	Stores chemical energy
2. Fossil fuels	Coal, oil and gas
	Remains of ancient organisms. Millions of years to form.
	Are non-renewable
	Release carbon dioxide when burnt
3. Non-renewable	Are used quicker than they are made. So will run out.
4. Renewable fuels	Made quicker than they are used. Will not run out
	These energy sources are renewable: • Biofuel • Wind and Wave • Geothermal • Hydroelectric and Tidal • Solar
5. Biofuel	Fuel made from living organisms eg vegetable oil, ethanol, wood
	Are considered carbon-neutral because CO_2 released is balanced by amount taken in by photosynthesis
	Reliable – can even be used fossil fuel power stations
	Reduces land available for food growth
	Renewable
6. Burning fuels	Releases carbon dioxide which contributes to the greenhouse effect and global warming.

Key points to learn

7. Decommission	Take apart and make safe at the end of its life
8. Wind and wave power	Kinetic energy of the air/water turns turbines
	Unreliable as both need wind
	Renewable
9. Geothermal power	Use heat energy from deep underground instead of fuel
	Not available everywhere
	Renewable
10. Hydroelectric and Tidal power	Water stored high up in dams then released to spin a turbine
	Very quick start-up time
	Can destroy habitats for animals
	Renewable
11. Solar power	Use light or heat energy from the Sun
	Unreliable as needs sun
	Renewable
12. Nuclear fuel	Energy stored in nucleus as nuclear energy. Uranium or Plutonium.
	Heat release in reactor core
	High energy yield
	Very slow start-up time as potentially dangerous
	Fuel and waste is radioactive
	Very expensive to set up and decommission

Big picture (Physics Paper 1)

- Energy and energy resources
  - Conservation and dissipation of energy
  - Energy transfer by heating
  - **Energy resources**
- Particles at work
  - Electric circuits
  - Electricity in the home
  - Molecules and matter
  - Radioactivity

Background

It is hard to imagine a World without electricity. It reaches into every aspect of our lives. But where do we get the energy to make it from? Will they run out? Have we got a backup plan?

Additional

To make electricity, we usually spin a turbine which we then attach to a generator. Making that turbine spin, is the problem…

The most common way is by burning fuels to boil water, then shooting the steam at the turbine. But there are issues with this, as you will find out.

Trilogy P2: Energy transfer by heating

Collins revision guide: Energy

Knowledge Organiser

Big picture (Physics Paper 1)

- Energy and energy resources
  - Conservation and dissipation of energy
  - **Energy transfer by heating**
  - Energy resources
- Particles at work
  - Electric circuits
  - Electricity in the home
  - Molecules and matter
  - Radioactivity

Background

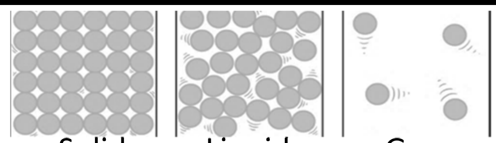
Not wasting heat energy in your home is important for the environment and for your finances. This topic will help you make more informed decisions so that you can save even more.

Maths skills

You should be able to use the specific heat capacity equation to find energy change and the specific heat capacity when given all other variables. Rearranging to make c the subject:

$$c = \frac{E}{m \ \theta}$$

Key points to learn

1. States of matter	
2. Solid	Particles held together in fixed positions by strong forces. Least energetic state of matter.
3. Liquid	Particles move at random and are in contact with each other. More energy than solids, less than gas
4. Gas	Particles move randomly and are far apart. Weak forces of attraction. Most energetic.
5. Vacuum	No particles at all. Space is a vacuum
6. Metals	Have free electrons which makes them good conductors
7. Non-metals	Have fixed electrons which makes them good insulators
8. Conductor	Is good at carrying heat energy or electrical energy
9. Thermal conductivity	A measure of how good something is at conducting
10. Insulator	A poor conductor
11. Friction	Two surfaces rubbing together
	Causes energy to be transferred as heat
	Can be reduced by using a lubricant
12. Lubricant	Fluid (eg oil) that smooths contact points between surfaces

Key points to learn

13. More energy loss from a building	If walls are thin
	If walls have high thermal conductivity
	Big temperature difference between inside and outside
14. Reduce heat loss by	Using material with low thermal conductivity ie an insulator
	Make insulator thicker
15. Specific heat capacity, c [J/kg°C]	Amount of energy needed to change temperature of 1kg by 1°C
	$E = mc \ \theta$ *(You are given this equation)* • E: Change in energy [J] • m: mass of object • c: *specific heat capacity* • θ: change in temperature [°C]
	Objects with high specific heat capacity take a long time to heat up and cool down. They are good at storing heat energy.
16. Loft insulation	Fibreglass which traps air which is a good insulator.
17. Cavity wall insulation	Traps air pockets in gaps which is a good insulator
18. Double glazing	Traps air in gaps between glass which is a good insulator
19. Foil behind radiator	Reflects heat away from wall back into room

Trilogy P1: Conservation and dissipation of energy

Collins revision guide: Energy

Knowledge Organiser

Big picture (Physics Paper 1)

- Energy and energy resources
  - **Conservation and dissipation of energy**
  - Energy transfer by heating
  - Energy resources
- Particles at work
  - Electric circuits
  - Electricity in the home
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  - Radioactivity

Background

Energy is the capacity of something to make something happen.
The Universe and everything in it is constantly changing energy from one form into another.

Maths skills

You should be able to recall, use and rearrange all the equations on this page except number 5.

g is Earth's acceleration due to gravity. It has a constant value of approximately 9.8m/s^2

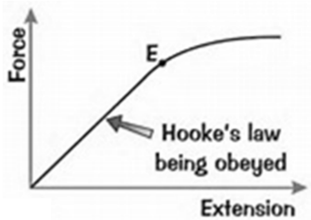
You need to remember the units for each quantity. They are in [ ] next to equations.

You should be able to calculate the gradient of a Force – extension graph.

Key points to learn

1. Energy stores [J]	Chemical energy
	Kinetic energy
	Gravitational potential energy
	Elastic potential energy
2. Chemical energy [J]	Transferred during chemical reactions eg fuels, foods, or in batteries
3. Kinetic energy [J]	All moving objects have it.
	k.e = 0.5 x mass x (speed)^2 E_k = ½ x m x v^2 [J] [kg] [m/s]
4 Gravitational potential energy [J]	Stored in an object lifted up.
	g.p.e = mass x g x height E_p = m x g x h [J] [kg] [N/kg] [m]
5. Elastic potential energy [J]	Energy stored in a springy object
	e.p.e = 0.5 x spring constant x (extension)^2 E_e = ½ x k x e^2 [J] [N/m] [m] *(You are given this equation)*
6. Energy can be transferred by…	Heating (thermal energy always flows from hot to cold objects)
	An electrical current flowing
	A force moving an object
7. Useful energy [J]	Energy transferred to the place and in the form we need it.
8. Wasted energy [J]	Not useful. Eventually transferred to surroundings

Key points to learn

9. Work done [J]	Equal to the energy transferred.
	When a force moves an object.
	Work done = Force x distance moved W = F x s [J] [N] [m]
10. Energy flow diagram	Show energy transfers eg for a torch lamp:
	Chemical → Light + Heat
11. Conservation of energy	Energy cannot be created or destroyed. It can only be transferred usefully, stored or dissipated.
12. Dissipated energy [J]	Wasted energy, usually spread to the surroundings as heat.
13. Hooke's Law and k the spring constant	The extension of a spring is proportional to the force on it.
	The gradient of this graph is known as k, the spring constant. 
14. Efficiency	Proportion of input energy transferred to useful energy. 100% means no wasted energy. Efficiency = useful energy ÷ total input energy
15. Power [W]	Energy [J] transferred in 1 second.
	Power [W] = Energy [J] ÷ time [s]
16. Wasted power [W]	Total power in – useful power out

Quick fire questions;

This worksheet is fully supported by a video tutorial; https://youtu.be/q5CwATii6OA

1. What are the different types of energy?
2. What energy changes happen in a lightbulb?
3. What energy changes happen in TV?
4. What does the word system mean?
5. What is the law of conservation of energy?
6. What is the equation linking kinetic energy, mass and velocity?
7. What are the units for velocity?
8. What are the units for mass?
9. What are the units for kinetic energy?
10. What is elastic potential energy?
11. What is equation linking elastic potential energy, the spring constant and extension?
12. What are units for elastic potential energy?
13. What are the units for the spring constant?
14. What are the units for extension?
15. What is gravitational potential energy?
16. What is the equation linking gravitational potential energy, mass, gravity and height?
17. What are the units for gravitational potential energy?
18. What is the value and the units for gravity?
19. What are the units for height?
20. What does this symbol mean Δ?
21. What is specific heat capacity?
22. What is the equation linking changing energy, mass, specific heat capacity and change in temperature?
23. What are the units for energy?
24. What are the units for specific heat capacity?
25. What are the units for change in temperature?
26. What is the equation linking power, energy and time?
27. What are the units of power?
28. What are the units for time?
29. What is the equation linking power, work done and time?
30. What are the units for work done?
31. What happens to waste energy?

32. How can we reduce wasting energy?
33. Give three examples of insulation that can be used in the house.
34. Why is a system not 100% efficient?
35. What is the equation for working out efficiency?
36. What are the units for efficiency?
37. What different ways we can get energy?
38. What is a renewable resource?
39. What is finite resource?