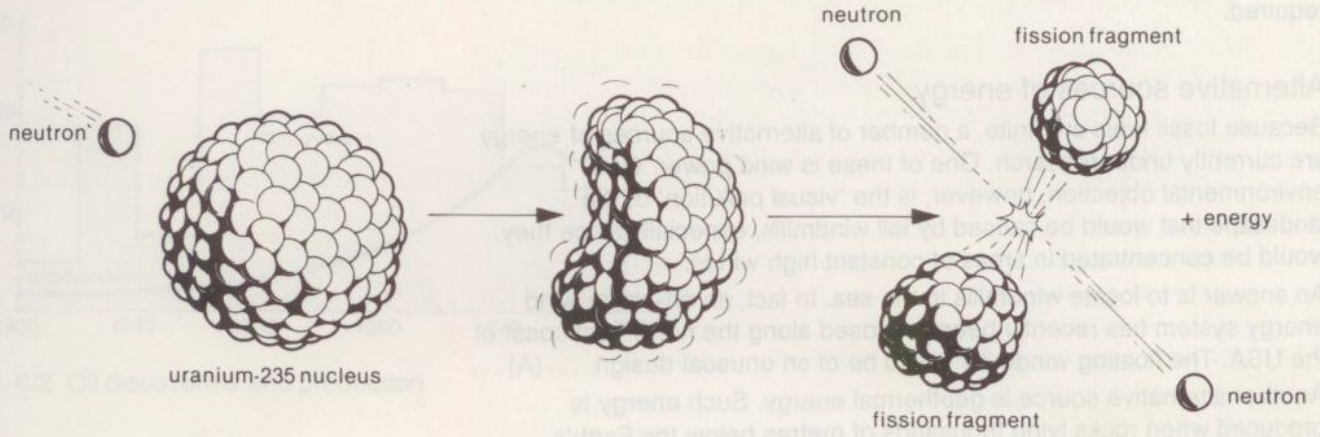
PROCESS DESCRIPTION



To produce energy by means of a nuclear fission reactor, the first step is that a fast fission neutron travelling at about 42 000 km/s is slowed down (moderated) to about 1·5 km/s when it is passed through a moderator such as 'heavy water' (D_2O). Next, the nucleus of a heavy atom such as uranium-235 is split apart by this slow-moving neutron. Splitting is accompanied by a tremendous release of energy in the form of heat, and by the release of two or three fast neutrons. These new neutrons are also slowed down by passage through the moderator. They are then used to split other U-235 atoms, which in turn release more energy and more neutrons. The result is a self-sustaining nuclear chain reaction that continually releases enormous amounts of energy.

This passage is a *process*, i.e. it outlines a sequence of inter-connected stages, without gaps, that combine to describe (for example) how something is produced, how a machine works, or how a natural phenomenon such as a volcanic eruption takes place. The particular process occurs over and over again, often in a 'chain' sequence – as in the nuclear fission process above. A particular process always consists of the same stages, in the same order.

Read the *nuclear fission* process again, then examine the following characteristics of process-writing:

1 What is the function of the phrase *To produce energy by means of a nuclear fission reactor . . .*, and why is it written at the beginning of the passage?

2 Are the stages written in a particular order? If so, what is that order?

3 What is the function of words and phrases such as *the first step, next, then, in turn, the result is . . .*?

4 Which is the more common: *passive* (is/are VERB + ed) or *active* (VERB + (s))?

5 Identify the passive verbs – are they mostly 'activity' verbs? i.e. do they help you to 'see' the activity taking place?

Irregular and foreign plurals

Observe:

REGULAR PLURALS		IRREGULAR PLURALS	
book ▶ books		foot ▶ feet	
class ▶ classes		tooth ▶ teeth	
		mouse ▶ mice	

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	LATIN / GREEK PLURALS			
1	**basis**	[beisis]	**bases**	[beisi:z]
	analysis	[ə'næləsis]	**analyses**	[ə'næləsi:z]
	axis	[æksis]	**axes**	[æksi:z]
	hypothesis	[hai'poθisis]	**hypotheses**	[hai'poθisi:z]
2	**stimulus**	[stimjuləs]	**stimuli**	[stimjulai / stimjuli:]
	nucleus	[nju:kliəs]	**nuclei**	[nju:kliai]
	radius	[reidiəs]	**radii**	[reidiai]
	focus	[fəukəs]	**foci**	[fəusai / fəusi: / fəukai / fəuki:]
	fungus	[faŋgəs]	**fungi**	[faŋgai / fandžai / faŋgi:]
3	**formula**	[fo:mjulə]	**formulae**	[fo:mjuli:]
	larva	[la:və]	**larvae**	[la:vi:]
	alga	[ælgə]	**algae**	[ældži: / ælgi: / ældžai / ælgai]
4	**criterion**	[krai'tiəriən]	**criteria**	[krai'tiəriə]
	phenomenon	[fə'nominən]	**phenomena**	[fə'nominə]
	bacterium	[bæk'tiəriəm]	**bacteria**	[bæk'tiəriə]
	curriculum	[kə'rikjuləm]	**curricula**	[kə'rikjulə]
	medium	[mi:diəm]	**media**	[mi:diə]

Ex. 1 Choose the correct word for each of the following and give the plural form:
(*analysis, criterion, memorandum, phenomenon, formula, datum, crisis, medium*)

a) …….. are facts given.
b) …….. are observed events.
c) …….. are decisive moments.
d) …….. are channels of communication.
e) …….. are notes to assist the memory.
f) …….. are standards or means of judging.
g) …….. are general expressions for solving problems.
h) …….. are separations of things into their parts or components.

Ex. 2 Fill in a suitable expression in the correct form:
(*radius, formula, datum, criterion, focus, spectrum, crisis, vertex, nucleus, curriculum vitae*. They may be used more than once)
a) The …….. of a circle is the length of a straight line drawn between the centre and the outside edge.
b) We had to learn many chemical …….. at school but I can only remember H_2O for water.
c) The …….. was/were collected by various researchers.
d) The Health Service should not be judged by financial …….. alone.
e) All the line segments extending from the centre of a circle are called ……..
f) In physics the point where waves of light or sound which are moving towards each other meet is called a ……..
g) A …….. is a short group of letters, numbers or other symbols which represent a scientific or mathematical rule.
h) The set of colours into which a beam of light can be separated is called a ……..
i) Now the …….. is being transferred from magnetic tape to hard disc.
j) The …….. I apply to (= by which I decide about) any problem is "What will make me happiest?"
k) I´ve passed several …….. during my illness, but the fever´s started to go down yesterday.
l) How many …….. are there in a triangle?
m) Nuclear fission means the dividing of a …….. and nuclear fusion means the joining of the two ……
n) My uncle´s …….. written before and after the Velvet revolution differ a lot.

DOPPLER EFFECT

When a vibrating source of waves is approaching an observer, the frequency observed is higher than the frequency emitted by the source. When the source is receding, the observed frequency is lower than that emitted. This is known as the Doppler effect, or Doppler's principle, and is named after an Austrian physicist who lived in the first half of the 19th century. Figs 1 and 2 will help to explain this phenomenon.

Fig. 1

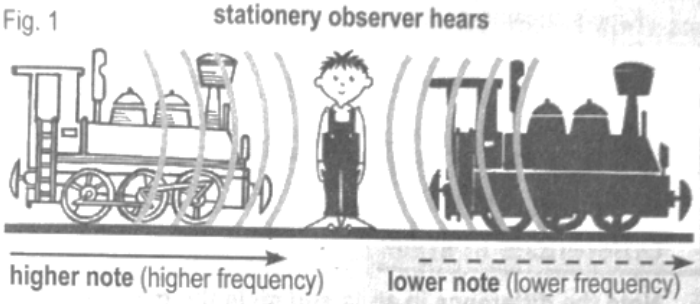
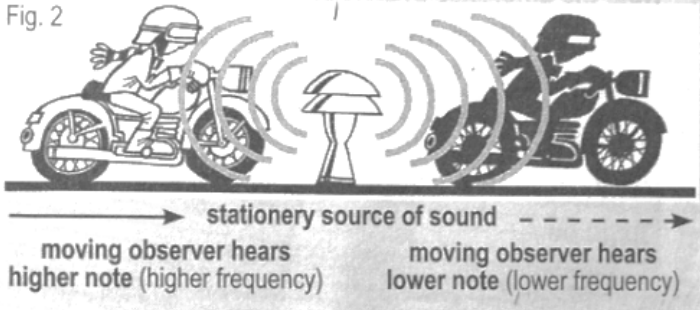
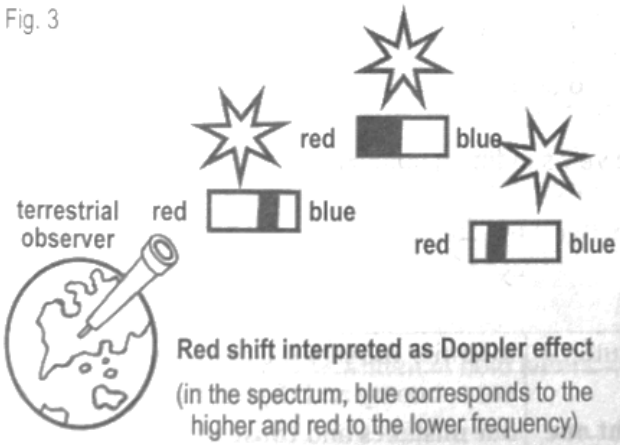


Fig. 2



The Doppler effect is widely used in astronomy for measuring the velocity at which distant stars are approaching or receding. These motions produce a shift in the position of lines in their spectra. A particular spectrum line corresponds to a certain definite light wavelength. If the star emitting the light is moving away from us, its light rays have a longer wavelength (lower frequency) by virtue of the Doppler's principle, and this is manifested in a general shift of the spectrum lines towards the red end of the spectrum. This is known as the "red shift". Similarly, in the spectrum of a star moving towards us, the characteristic lines would show a "blue shift", i.e. they would be displaced towards the blue end of the spectrum, corresponding to shorter wavelengths and higher frequencies. These phenomena are indicated in Fig. 3.

Fig. 3

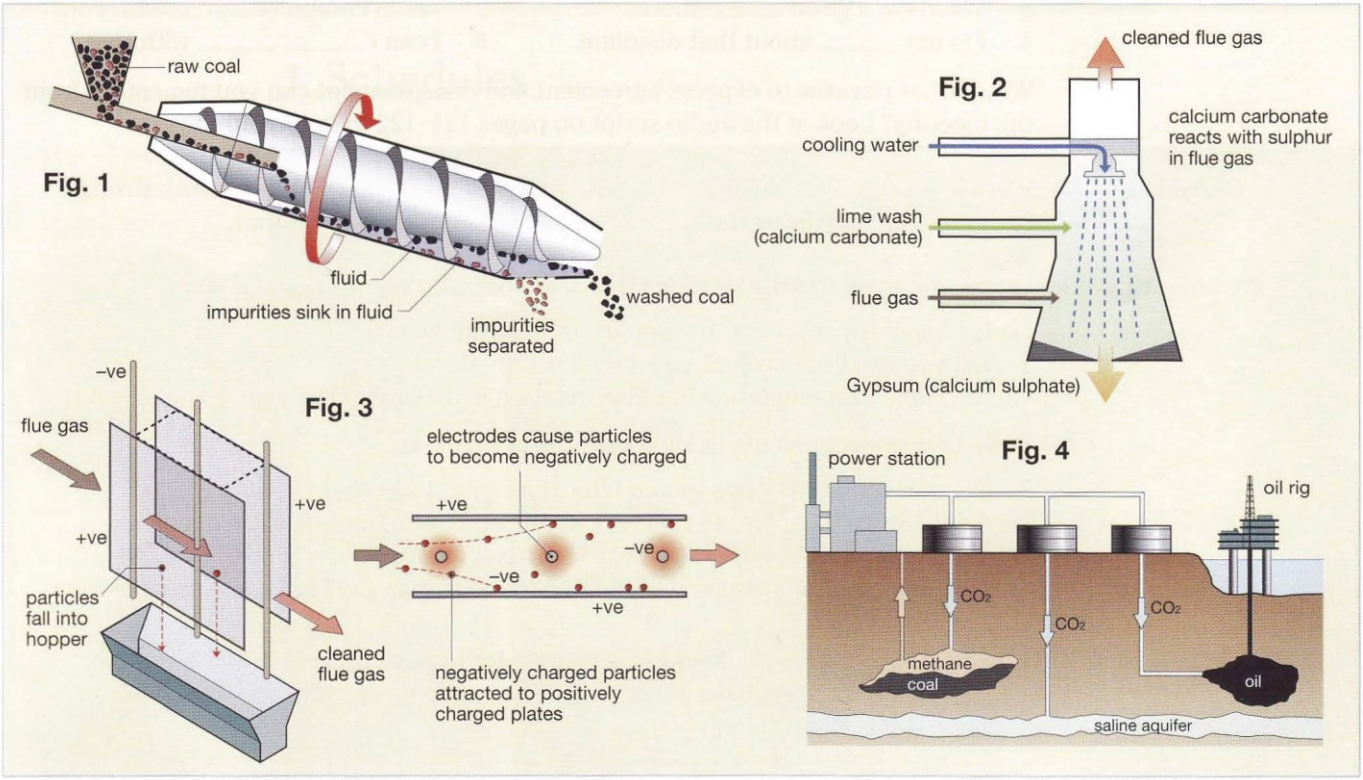


Red shift interpreted as Doppler effect

(in the spectrum, blue corresponds to the higher and red to the lower frequency)

A remarkable thing about the spectra of the spiral nebulae (the galaxies of stars far out in space beyond our own Milky Way system) is that they all display the red shift and must therefore – on the basis of Doppler's principle – all be moving away from us. The theory of the "expanding universe" is based on this phenomenon. However, this interpretation of the red shift is disputed by some authorities.

CAUSES



1 What is the main purpose of the four processes? (The answer concerns *coal*.)
2 Look at Fig. 4. What *extra* benefits does this process bring? (The answer concerns *oil* and *methane*.)

Reading **3** Match the questions in 1–6 with the answers in a–f, and with the diagrams in 1.

1 How are particles removed from flue gas?
2 How is sulphur separated from flue gas and removed from it?
3 How do you take impurities out of small pieces of coal?
4 Isn't it dangerous to store CO_2 in underground saline aquifers?
5 How does carbon capture help us to recover methane from underground coal fields?
6 Why do you say that CCS can help the oil industry to get oil from old oil wells?

a) The *storage* of CO_2 in the aquifer is harmless owing to the *presence* of salt in the water, and because of the depth of the aquifer.
b) The *force* of the oil *rise* is due to the *pressure* from the CO_2.
c) The rise of methane to the surface and its *recovery* from the ground are due to the pressure of the CO_2 in the underground coalfield.
d) The *desulphurisation* of the flue gas happens as a result of a chemical *reaction*. This is due to the *insertion* of calcium carbonate and the *addition* of water to the gas.
e) The *removal* of polluting particles from the flue gas is caused by their *attraction* to the collection plates. This is due to the negative electric *charge* that they get from the electrodes.
f) The *purification* of the pulverised coal is due to the *rotation* of the barrel and the density of the fluid.

These suffixes indicate *causation*.	
verb	**noun**
-ify *purify* (= to make something pure)	*-ification* *purification* (= the process of purifying)
-efy *liquefy* (= to change something into liquid)	*-efaction* *liquefaction* (= the process of liquefying)
-ise (BrE); *-ize* (AmE) *sulphurise* (= to make something contain sulphur)	*-isation* (BrE); *-ization* (AmE) *sulphurisation* (= the process of sulphurising)

Note: BrE *sulphur sulphurise sulphurisation*; AmE *sulfur sulfurize sulfurization*

Language Ways of expressing causation

using a verb		using a noun	
because	*the barrel **rotates***	due to	*the **rotation** of the barrel*
	*water **is added***	owing to	*the **addition** of water*
	*the chemicals **react***	caused by	*the **reaction** of the chemicals*
	*the CO_2 **pressurises** the oil*	as a result of	*the **pressure** of the CO_2 on the oil*

7 Rewrite each sentence to give a similar meaning, making these changes

- replace *because* with the phrase in brackets.
  Example: *because* ➔ *owing to*
- replace the verbs in italics with related nouns.
  Example: *rotate* ➔ *rotation*

Example: *1 We have to use international time zones owing to the rotation of the earth.*

1 We have to use international time zones because the earth *rotates*. (owing to)
2 There's no need to pump the oil, because the CO_2 *pressurises* it. (due to)
3 The iron filings are moving because the magnet *is attracting* them. (as a result of)
4 The pressure on the methane is because CO_2 *is injected*. (caused by)
5 People must not drink this water because impurities *are present*. (owing to)
6 This concrete has flaws because too much water *was added*. (caused by)
7 Our astronauts are safe because the capsule *was recovered* from the sea. (due to)
8 We emit no carbon because our CO_2 *is stored* underground. (as a result of)