
Command Words

Usage in GCSEs & AQA Certificates in the Sciences

This document is designed to clarify the meaning of the Command Words used in the GCSE & AQA Certificates in the Sciences. Below each explanation are examples, with answers which would gain full marks.

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Calculate

Students should use numbers given in the question to work out the answer.

As stated on the front of the paper, students should always show their working, as it may be possible for the examiner to award some marks for the method even if the final answer is wrong.

Students should always give the units when asked to do so. In the question a mark can be awarded for the correct unit/units, even if the calculation is wrong.

Example: Biology

- 1 Each student collected data by using 10 quadrats.

These are the results for one student.

Quadrat number	Number of dandelions
1	3
2	3
3	6
4	2
5	1
6	2
7	0
8	3
9	2
10	0

Calculate the mean number of dandelions per quadrat counted by the student.

Total = 22.....

22/10 = 2.2.....

Mean number of dandelions *2.2*

(2 marks)

Example: Chemistry

2 A drug amphetamine has the formula $C_9H_{13}N$

The relative molecular mass (M_r) of amphetamine is 135.

Calculate the percentage by mass of nitrogen in amphetamine.

Relative atomic mass: N = 14 C=12 H=1

Mass of N $1 \times 14 = 14$

$(14/135) \times 100 = 10.37$

Percentage of nitrogen = **10.4 %**
(2 marks)

Example Physics

3 (a) The following information is an extract from the information booklet supplied with a boiler.

Fuel	Natural Gas
Water temperature	60°C
Energy supplied to gas boiler	8.0 kJ/s (8.0 kW)
Efficiency	0.95

3(a) (i) Use the equation in the box to calculate the energy transferred each second by the gas boiler to the water inside the boiler.

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

Useful energy = efficiency \times total energy

$= 0.95 \times 8.0 = 7.6$

Energy transferred by the gas boiler each second = 7.6 kJ (2 marks)

Compare

This requires the student to describe the similarities and/or differences between things, not just write about one.

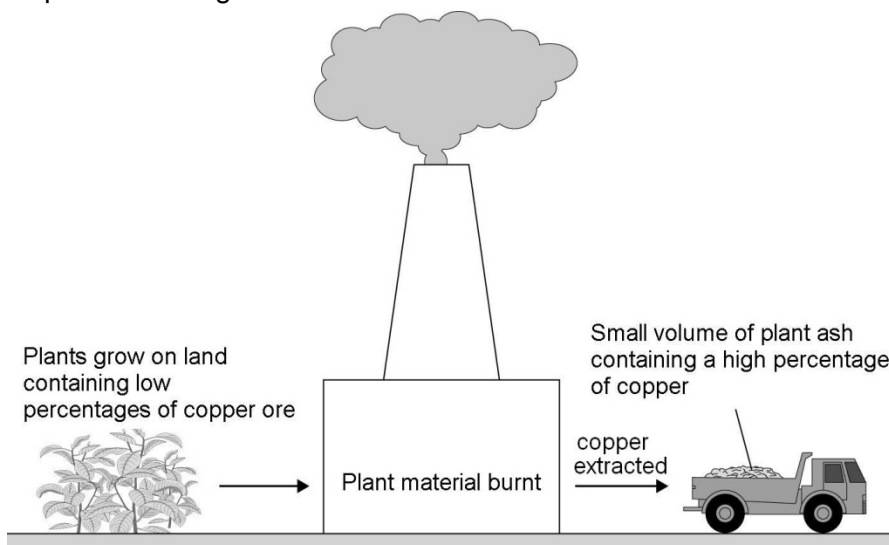
If students are asked to '*compare x with y*', they need to write down something about x compared to y, using comparative words such as '*better*', '*more than*', '*less than*', '*quicker*', '*more expensive*', '*on the other hand*.'

Example: Chemistry

- 4 Copper is found in the Earth's crust as an ore containing copper sulfide. Large areas of land, where this ore was once quarried, are contaminated with low percentages of copper sulfide. Copper would be too expensive to extract from this contaminated land using the traditional method of quarrying and then heating in a furnace.

A new way to extract the copper from land that contains low percentages of copper ore is phytomining.

Phytomining uses plants. Plants are grown on this land and absorb copper compounds through their roots.



Compare the advantages of phytomining with the traditional method. Use the information given in the passage and the diagram.

The advantages of phytomining are that it would take less energy than the traditional method because it will be carbon neutral because the plants will take the same amount of carbon dioxide out of the atmosphere as they grow as they release when they are burnt.

On the other hand the traditional method is quicker as the plants take a long time to grow.

(2 marks)

Example: Physics

- 5 The water in a domestic hot water tank can be heated by solar panels on the roof or by using an electric immersion heater.

Compare the advantages and disadvantages of using solar energy to heat the water rather than using an electric immersion heater.

Generating electricity for an immersion heater burns fossil fuels, which releases carbon dioxide into the atmosphere but solar energy doesn't release any extra carbon dioxide. Solar energy is a renewable energy source, whereas the immersion heater uses electricity made from a non-renewable source. It also means that we are conserving fossil fuels which are in danger of running out. Solar energy does have disadvantages because it needs sunlight and some countries, like Scotland, don't have enough hours of sunlight in the winter. This means there will be times when not enough hot water is available for the household, whereas an immersion heater can supply hot water all of the time.

(6 marks)

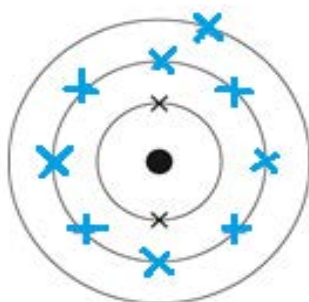
Complete

Answers should be written in the space provided, eg on a diagram, in spaces in a sentence or in a table.

Example: Chemistry

- 6 Use the periodic table on the data sheet to help you to answer this question.

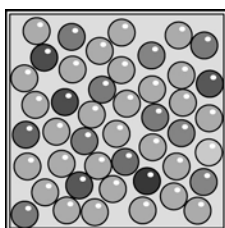
Complete the electronic structure of sodium.



(2 marks)

Example: Physics

- 7 Marbles inside a box can be used as a model for the particles in a solid, a liquid or a gas.



Complete the following sentences using words from the box. Each word can be used once, more than once or not at all.

gas	liquid	solid
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- (a) The particles in a *solid* vibrate about fixed positions. (1 mark)
- (b) The particles in a *gas* move at high speed in any direction. (1 mark)
- (c) The particles in a *solid* are arranged in a pattern. (1 mark)

Example: Biology

- 8 Complete the sentences.
- A vaccine contains an *inactive* form of a pathogen. (1 mark)
- The MMR vaccine protects children against measles mumps and *Rubella* (1 mark)

Describe

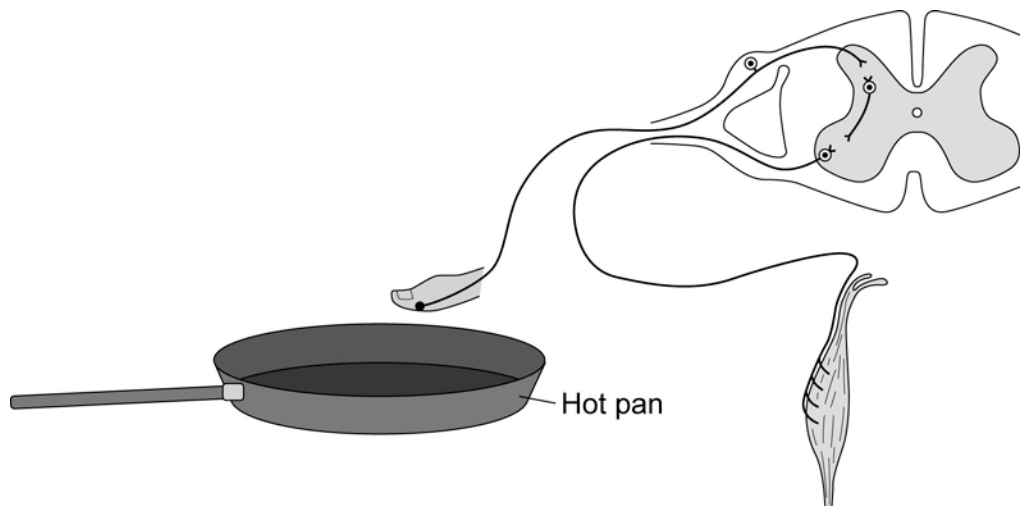
Students may be asked to recall some facts, events or process in an accurate way. For example they may be asked to describe an experiment they have done, or they may need to give an account of what something looked like, or what happened, eg a trend in some data.

Example: Biology

9 A person accidentally touches a hot pan.

Her hand automatically moves away from the pan.

The diagram shows the structures involved in this action.



Describe fully how the structures shown in the diagram bring about this reflex action.

First of all the heat (the stimulus) will be detected by the temperature receptors in the skin. The receptors will then send an electrical impulse along the sensory neurone to the synapse in the spinal cord. A chemical messenger is released, which crosses the synapse space and triggers an impulse in the relay neurone. The same thing happens at the next synapse so that an impulse is sent down the motor neurone to the muscle, which is the effector. When the impulse reaches the muscle it causes the muscle to contract and pulls the hand away from the heat. This is a reflex action, and it does not have to be processed via the brain.

(6 marks)

Example: Physics

10 A star goes through a life cycle.

Describe the life cycle of a star like the Sun.

In the beginning dust particles and gases are pulled together by the force of gravity. As the atoms of hydrogen gas are forced together the nuclei collide and nuclear fusion begins. The star becomes stable as the forces acting inwards and the forces acting outwards are balanced. Eventually it runs out of hydrogen so it starts to cool and becomes a red giant. Then it starts to shrink under its own gravity and as the material comes closer together the temperature rises and the star glows much brighter as a white dwarf.

(6 marks)

Evaluate

Students should use the information supplied as well as their knowledge and understanding to consider evidence for and against. An evaluation goes further than 'compare'. For example, they may be given a passage to read and told to 'Evaluate the benefits of using system x and system y'. This means they will need to write down some of the points for and against both systems to develop an argument. A mark may also be available for a clear and justified conclusion. For example, if a question is worth 5 marks, and does not specifically ask for a conclusion, then a student can gain all 5 marks for 5 valid points made for and against. If the student only makes 4 points but gives a justified conclusion then the 5th mark can be gained.

However, if a question specifically asks for a justified conclusion then full marks can only be gained if a justified conclusion is given.

When giving comparisons students should be encouraged to compare both sides using linking words. For example in the physics question 'Wind power is a renewable resource whereas fossil fuels are non-renewable.' Useful words for students to use could be 'however', 'whereas', 'but' and 'on the other hand'.

No credit will be given just for giving the information stated directly from the question in either the comparisons or in the conclusion. In the chemistry example a mark is given for 'waste' oils being able to be used whereas just saying 'vegetable' oils can be used would not gain a mark. Likewise there would be no mark for stating that biodiesel produces fewer carbon particles, but a mark is awarded for linking this to less global dimming.

Example: Biology

- 11 Read the information about the trialling of the first contraceptive pill.

The Pill was developed by a team of scientists led by Gregory Pincus. The team needed to carry out large scale trials on humans.

In the summer of 1955, Pincus visited the island of Puerto Rico. Puerto Rico is one of the most densely populated areas in the world. Officials supported birth control as a form of population control. The women in Puerto Rico were mainly poor and uneducated.

The scientists selected a pill with a high dose of hormones. The Pill was found to be 100% effective when taken properly. But 17% of the women in the study complained of side effects.

The women in the trial had been told only that they were taking a drug that prevented pregnancy. They had not been told that the Pill was experimental or that there was a chance of dangerous side effects.

Evaluate the issues involved with methods used by Pincus in trialling the contraceptive pill. Do you think he should have carried out this trial?

This trial involved large numbers so that would have given valid results. It was also a good trial of the general population because if poor uneducated women could make it work it would be reliable. However, the trial was not very ethical by today's standards because we don't know that the women gave informed consent, and they were not told it was experimental or that there could be side effects. The trial was not well designed as there was no placebo control group and they did not do pre-trials to find the best dose and check for side effects.

Overall, I believe that this was an unethical trial and therefore should not have been carried out.

(6 marks)

Example: Chemistry

12 This information about biodiesel was printed in a magazine.

Almost all of the crops we eat can be converted into fuel for cars.
Vegetable oils can be used as biodiesel. Diesel from crude oil is called fossil diesel.

When either biodiesel or fossil diesel burn they both produce similar amounts of carbon dioxide. Both types of diesel produce carbon monoxide. However, biodiesel produces fewer carbon particles and less sulphur dioxide.

Use the information from the magazine and your knowledge and understanding to evaluate the use of biodiesel compared with fossil diesel as a fuel for cars.

Fossil diesel is mainly used because it is quick to produce from crude oil and so is far cheaper than biodiesel. However, biodiesel has a lot to recommend it as it is a renewable resource whereas crude oil is running out. It is carbon neutral as well as it takes in the same amount of carbon dioxide when the plants are growing as it gives out when burnt as fuel.

Although burning biodiesel does produce the same amounts of both carbon dioxide and carbon monoxide as fossil diesel, there is less sulfur dioxide so there will be less acid rain, and less carbon particles which cause global dimming. Also waste vegetable oils can be used up to produce fuel.

Overall I think we should be using more biodiesel as it is important for us all to reduce our carbon footprint in an effort to halt global warming.

(5 marks)

Example: Physics

13 Wind turbines can be used instead of power stations to generate electricity.



Evaluate the use of wind turbines for generating electricity.

Wind power is a renewable source of energy which will never be used up whereas fossil fuels are non-renewable. When we eventually run out of fossil fuels we will need something to replace them. There are no waste gases from wind turbines so they do not pollute the atmosphere like fossil fuels. However they do make a noise which some people living near to them object to. Also unless you live in a windy place they will not work all the time as they don't generate electricity when the wind is not blowing.

I think wind turbines are a good idea as global warming from burning coal is an increasing problem and needs to be stopped.

(5 marks)

Explain

Students should make something clear, or state the reasons for something happening. The answer should **not** be a simple list of reasons.

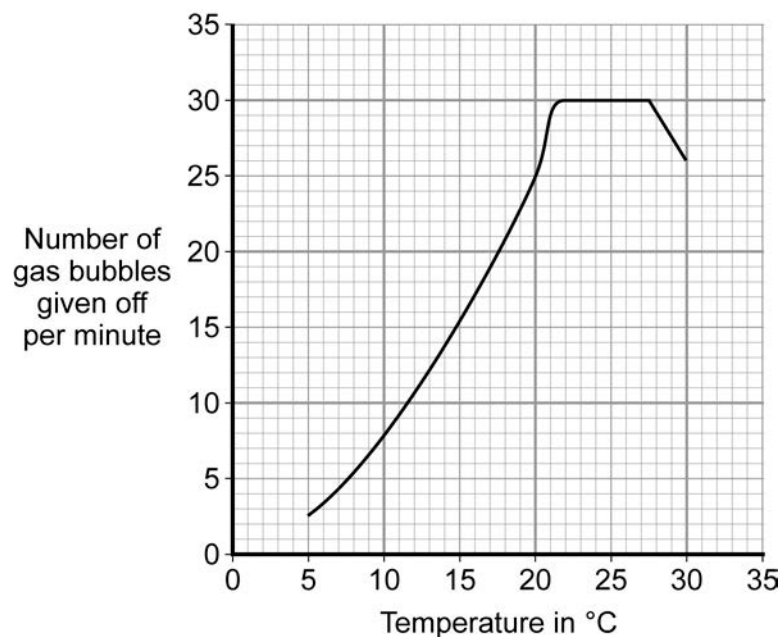
This means that points in the answer **must be linked** coherently and logically. Suitable linking words could be 'so', 'therefore', 'because', 'due to', 'since', 'this means' or 'meaning that'.

All of the stages/steps in an explanation must be included to gain full marks.

Example: Biology

- 14 Some students investigated the effect of temperature on the rate of photosynthesis in pond weed. They set up the apparatus and altered the temperature using ice and hot water. They counted the number of bubbles given off in a minute at different temperatures.

The graph shows the students' results.



Explain the shape of the graph between 22 °C and 27 °C.

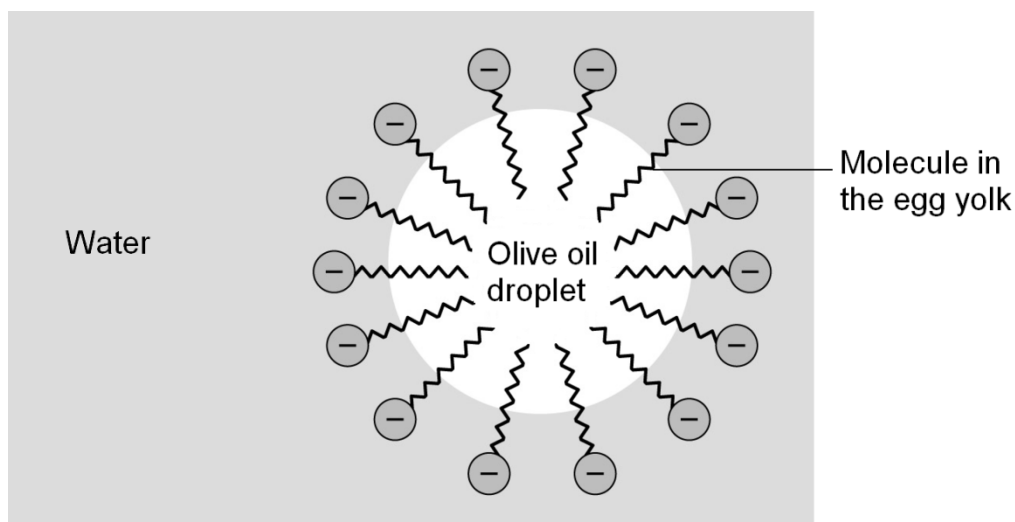
By the time the temperature is 22°C the photosynthesis enzymes are working at the maximum rate for the conditions and the graph is flat. It means that either light intensity or carbon dioxide is rate limiting at that stage, not temperature.

(2 marks)

Example: Chemistry

- 15 A mixture of the olive oil, water and egg yolk was shaken and left to stand. The olive oil and water do not separate.

The diagram shows a simple model of how a stable mixture of olive oil and water is produced by the addition of egg yolk.



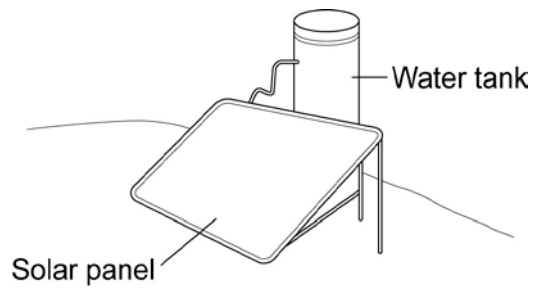
Use this simple model to explain how the molecules in the egg yolk are able to produce a stable mixture of olive oil and water.

The molecules in the egg yolk have a 'head' part that dissolves in water, but a long 'tail' part that dissolves in oil. A large number of these molecules surround the oil droplet and so it can stay suspended in the water as an emulsion which is stable. Therefore, the egg yolk molecules act as an emulsifier.

(3 marks)

Example: Physics

- 16 The picture shows one type of solar water heater. Water from the tank is slowly pumped through copper pipes inside the solar panel where the water is heated by energy from the Sun.



Explain why the copper pipes inside the solar panel are painted black.

Black is a good absorber of radiation therefore, more of the energy from the Sun is transferred into heating the water.

(2 marks)

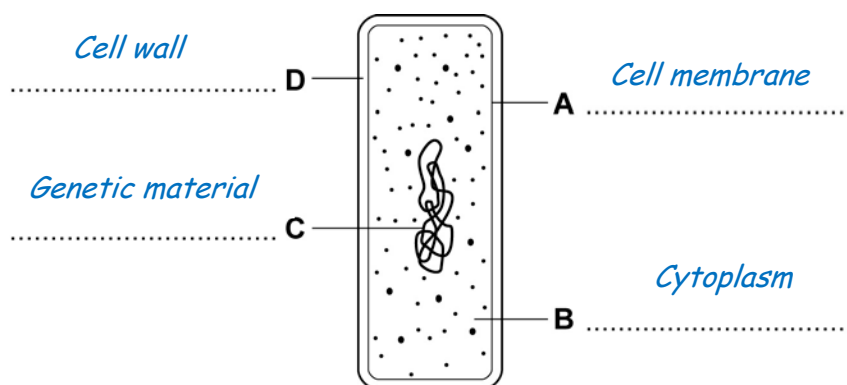
State, give, name, write down

Only a short answer is required, not an explanation or a description. Often it can be answered with a single word, phrase or sentence.

If the question asks the student to state, give, or write down **one** (or **two** etc) examples, they should write down **only** the specified number of answers, or they may not be given the mark for some correct examples given.

Example: Biology

17 The diagram shows a bacterium.

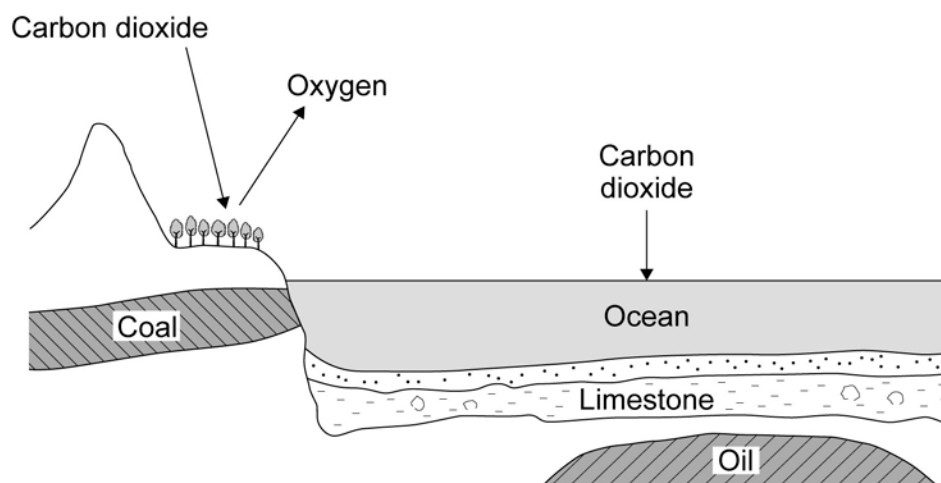


Name the structures labelled **A**, **B**, **C** and **D**.

(4 marks)

Example: Chemistry

- 18 The diagram shows part of the Earth and ways that carbon dioxide can be removed from the Earth's atmosphere.



Give **three** ways that carbon dioxide can be removed from the Earth's atmosphere.

1. *It is taken in by plants to use in photosynthesis.*
2. *It dissolves in the oceans.*
3. *It is used by marine organisms to make skeletons and shells which form limestone.*

(3 marks)

Suggest

This term is used in questions where students need to apply their knowledge and understanding to a new situation.

Often there may be more than one correct answer as students are expected to base their answers on scientific knowledge and/or principles.

Useful words to use are 'may', 'might', 'could', and 'I think that'.

Example: Chemistry

- 19 Using sun creams containing nano-sized particles is beneficial because they absorb harmful radiation.

Suggest **one** possible risk of using these sun creams.

The particles might be small enough to pass through the skin and they might be toxic inside the body.

(1 mark)

Example: Physics

- 20 Scientific research carried out in 13 countries has tried to find out if there are any links between using a mobile phone and developing different types of cancer.

About 13000 people, half with cancer and half in good health, were interviewed about their mobile phone use.

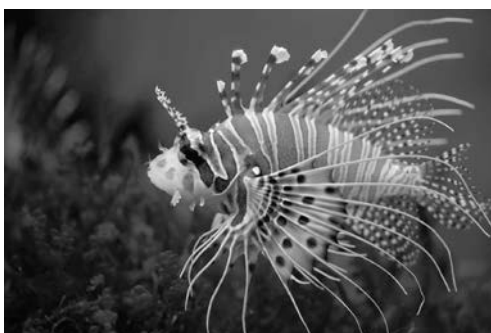
Suggest why people in good health were interviewed.

This could be a control group so that the researchers had a group with no cancer to compare their results with.

(1 mark)

Example: Biology

- 21 The photograph shows a lionfish. Lionfish are normally found in the Pacific Ocean.



In 1992 six lionfish escaped from an aquarium into the Atlantic Ocean.

Now there are thousands of lionfish in the Atlantic Ocean. Numbers of the native Atlantic fish have gone down because the lionfish have eaten many native Atlantic fish.

Suggest explanations for the large increase in the numbers of lionfish in the Atlantic Ocean.

The lion fish might not have many predators to eat them, so there is nothing to stop their numbers continuing to increase. There's lots of food for them and none of the other fish in the Atlantic have seen them before so don't know they are a threat. The Atlantic Ocean may have perfect conditions for the lion fish to breed at such a rate.

(3 marks)

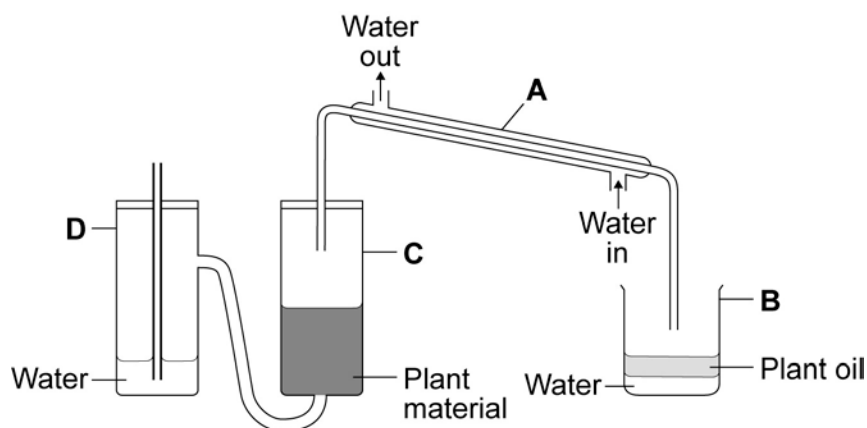
Use the information in the passage/diagram/graph/table to...

The answer **must** be based on the information given in the question. Unless the information given in the question is used, no marks can be given.

In some cases you might be asked to use your own knowledge and understanding and credit will be given as in the biology example.

Example: Chemistry

22 The diagram shows some apparatus used to obtain oil from plant material.



Four parts of the apparatus are labelled, **A**, **B**, **C** and **D**.

Use the information in the diagram to complete the sentences.

Steam is made in part .

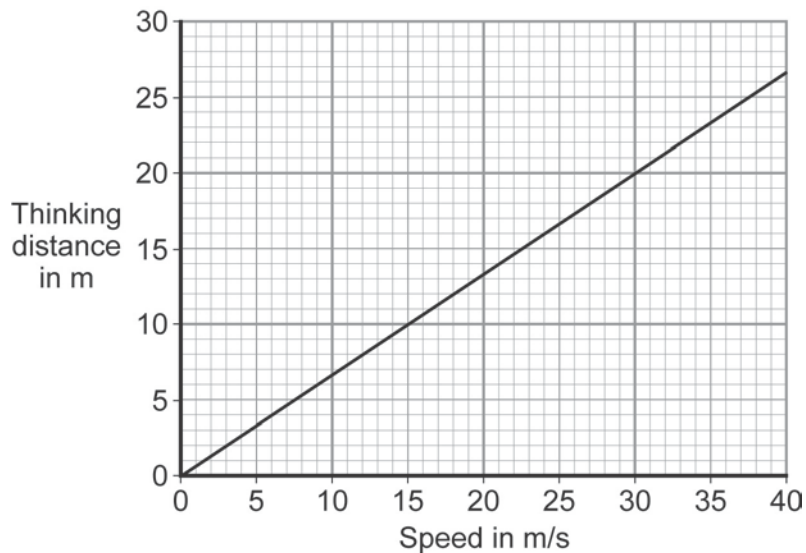
Oil from the plant material is vaporised in part .

Steam and oil vapour are condensed in part .

(3 marks)

Example: Physics

23 The graph shows that speed affects thinking distance



Use the graph to find the thinking distance for a car driven at 30 m/s.

Thinking distance = 20 m

(1 mark)

24 This label was on a bottle of tablets.

PARACETAMOL
 “This medicine will not cure an infection. If symptoms persist consult your doctor”

Use the information on the label, and your own knowledge and understanding of disease causing organisms to say why this medicine will not cure the infection.

Paracetamol is a painkiller and will not kill the organisms which cause disease. So the medicine will only make you feel better, not cure the infection.

(2 marks)