

Questions are for both separate science and combined science students unless indicated in the question

Q1.

This question is about water.

A student investigated the concentration of salt in sea water.

This is the method used.

1. Filter the sea water to remove sand.
2. Measure the mass of an empty evaporating dish.
3. Measure 50 cm³ of sea water into the evaporating dish.
4. Heat the evaporating dish and sea water.
5. Evaporate the sea water to dryness.
6. Measure the mass of the evaporating dish and salt.

- (a) What equipment should the student use to measure:
the mass of the evaporating dish
the volume of sea water?

Mass of evaporating dish _____

Volume of sea water _____

(2)

- (b) The table below shows the student's results.

	Mass in g
Evaporating dish	30.44
Evaporating dish and salt	30.49

The student used 50 cm³ of sea water.

Calculate the mass of salt in 1000 cm³ of this sea water.

Mass of salt = _____ g

(3)

- (c) The salt must be completely dry.

Which **two** extra steps are needed to show that the salt is completely dry?

Tick (✓) **two** boxes.

Filter the sea water again.

Heat the evaporating dish and salt again.

Measure the 50 cm³ of sea water again.

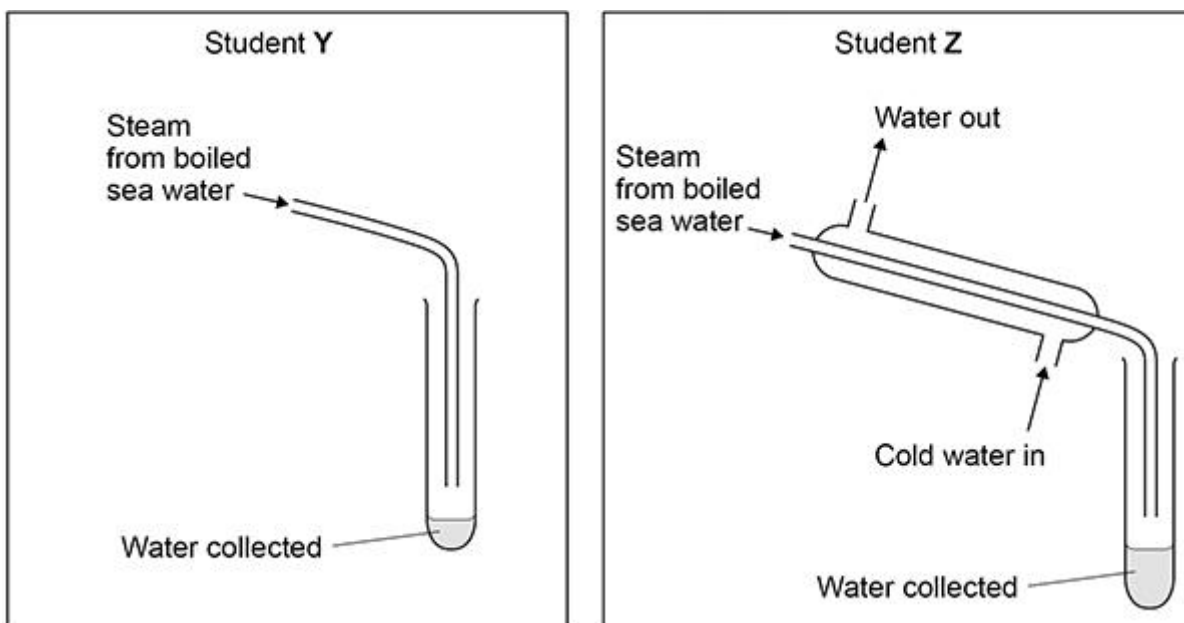
Measure the mass of the empty evaporating dish again.

Measure the mass of the evaporating dish and salt again.

(2)

Two students, **Y** and **Z**, distil sea water to collect water.

The figure below shows the apparatus used by each student to collect the water.



(d) Students **Y** and **Z** boil the same volume of sea water for the same period of time.

Explain why student **Y** collects a smaller volume of water than student **Z**.

(2)

- (e) Water obtained by distillation does **not** need to be sterilised and is safe to drink.

Suggest why.

(1)

Fresh water needs to be sterilised before it is safe to drink.

- (f) How is fresh water sterilised?

Tick (✓) **two** boxes.

Using ammonia

Using chlorine

Using chromatography

Using filtration

Using ozone

(2)

- (g) A student tests the pH of fresh water using universal indicator solution.

When added to the fresh water, the colour of the universal indicator solution is green.

What is the pH of this fresh water?

pH = _____

(1)

(Total 13 marks)

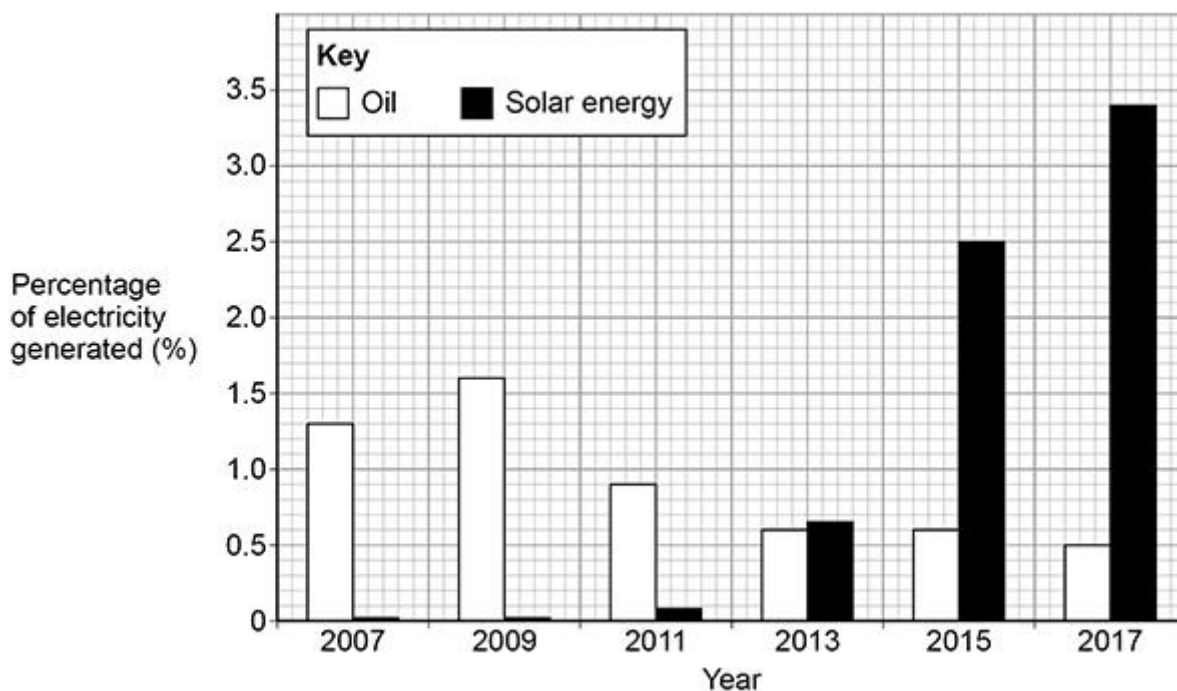
Q2.

This question is about fuels and energy.

The graph below shows the percentage of electricity generated in the UK between 2007 and 2017 using:

- oil

- solar energy.



(a) Describe the changes in the percentage of electricity generated in the UK between 2007 and 2017 using:

- oil
- solar energy.

Use data from the graph above in your answer.

(3)

(b) Oil contains carbon and some sulfur.

When oil is burned, the products of combustion may be released into the atmosphere.

Explain the environmental effects of releasing these products of combustion into the atmosphere.

(6)

- (c) Suggest **one** reason why using solar energy is a more sustainable way of generating electricity than burning oil.

(1)

- (d) Solar energy may **not** be able to replace the generation of electricity from fossil fuels completely.

Suggest **two** reasons why.

1 _____

2 _____

(2)

(Total 12 marks)

Q3.

This question is about copper and alloys of copper.

Solders are alloys used to join metals together.

Some solders contain copper.

The table below shows information about three solders, **A**, **B** and **C**.

Solder	Melting point in °C	Metals in solder
A	183	tin, copper, lead
B	228	tin, copper, silver
C	217	tin, copper, silver

- (a) Solder **B** and solder **C** are now used more frequently than solder **A** for health reasons.

Suggest **one** reason why.

Use the table above.

(1)

- (b) Suggest **one** reason why solders **B** and **C** have different melting points.

Use the table above.

(1)

Copper can be obtained by:

- processing copper ores
- recycling scrap copper.

- (c) Suggest **three** reasons why recycling scrap copper is a more sustainable way of obtaining copper than processing copper ores.

1 _____

2 _____

3 _____

(3)

Copper is extracted from low-grade ores by phytomining.

- (d) Describe how copper is extracted from low-grade ores by phytomining.

(4)

(e) Phytomining has **not** been widely used to extract copper.

Suggest **two** reasons why.

1 _____

2 _____

(2)

(Total 11 marks)

Q4.

This question is about water.

(a) In the UK, potable (drinking) water is produced from different sources of fresh water.

Explain how potable water is produced from fresh water.

(4)

(b) A different country has:

- very little rainfall
- a long coastline
- plentiful energy supplies.

Suggest **one** process this country could use to obtain most of its potable water.

(1)

(c) Waste water is not fit to drink.

Treatment of waste water produces two substances:

- liquid effluent
- solid sewage sludge.

Draw **one** line from each substance to the way the substance is processed.

Substance	Process
	Aerobic biological treatment
Liquid effluent	Anaerobic digestion
	Grit removal
Solid sewage sludge	Screening
	Sedimentation

(2)

The table below shows information about the disposal of processed solid sewage sludge in the UK in 1992 and in 2010.

Year	Mass of processed solid sewage sludge in millions of kilograms				
	Used as fertiliser	Sent to landfill	Burned	Other methods	Total
1992	440	130	90	338	998
2010	1118	9	260	26	1413

- (d) Calculate the percentage of processed solid sewage sludge that was burned in 2010.

Give your answer to 3 significant figures.

Use the table above.

Percentage (3 significant figures) = _____%

(3)

- (e) Suggest **one** reason why the total mass of processed solid sewage sludge increased between 1992 and 2010.

(1)

- (f) Between 1992 and 2010 the proportion of processed solid sewage sludge used as fertiliser increased.

Suggest **two** reasons why.

1 _____

2 _____

(2)

(Total 13 marks)

Q5.

This question is about drinking water.

There are two main steps in producing drinking water from fresh water.

- (a) Draw **one** line from each step to the reason for the step.

Step	Reason for step
	Desalination
Filtration	Improve taste
	Increase pH
Sterilisation	Kill bacteria
	Remove solids

(2)

(b) Which **two** substances are used to sterilise fresh water?

Tick (✓) **two** boxes.

Ammonia

Chlorine

Hydrogen

Nitrogen

Ozone

(2)

A large amount of aluminium sulfate was accidentally added to the drinking water supply at a water treatment works.

(c) Scientists tested a sample of the drinking water to show that it contained dissolved solids.

Which **two** methods show the presence of dissolved solids in the sample of drinking water?

Tick (✓) **two** boxes.

Add damp litmus paper to the sample.

Evaporate all water from the sample.

Measure the sample's boiling point.

Test the sample with a glowing splint.

(2)

- (d) Scientists tested two water samples from the drinking water supply.

The scientists tested one sample for aluminium ions and the other sample for sulfate ions.

Draw **one** line from each ion to the compound needed to identify the ion. (**separate only**)

Ion	Compound needed to identify ion
Aluminium ion	Barium chloride
	Copper sulfate
Sulfate ion	Silver nitrate
	Sodium hydroxide
	Sulfuric acid

(2)

- (e) How could pure water be produced from drinking water that contained dissolved solids?

Tick (✓) **one** boxes.

Chromatography

Cracking	<input type="checkbox"/>
Distillation	<input type="checkbox"/>
Sedimentation	<input type="checkbox"/>

(1)
(Total 9 marks)

Q6.

Some central heating boilers use methane as a fuel.

Carbon monoxide detectors are placed near central heating boilers.

- (a) Which **three** properties of carbon monoxide make it necessary to use carbon monoxide detectors?

Choose answers from the box.

acidic	alkaline	colourless	corrosive
	insoluble	odourless	toxic

1 _____

2 _____

3 _____

(3)

- (b) Complete the sentence.

Methane produces carbon monoxide when burning in a limited supply of

_____.

(1)

- (c) 8 g of methane has a volume of 12 dm³ at room temperature and pressure.

Calculate the mass of 36 dm³ of methane. **(separate only)**

Mass = _____ g
(2)

(d) Most methane is obtained from natural gas, which is a fossil fuel.

Methane can also be produced renewably.

Which **two** are renewable sources of methane?

Tick (✓) **two** boxes.

- | | |
|----------------------------|--------------------------|
| Animal waste | <input type="checkbox"/> |
| Food in landfill | <input type="checkbox"/> |
| Nitrogen in the air | <input type="checkbox"/> |
| Non-biodegradable plastics | <input type="checkbox"/> |
| Scrap iron | <input type="checkbox"/> |

(2)
(Total 8 marks)

Q7.

Potable water is water that is safe to drink.

Seawater can be changed into potable water by desalination.

(a) Name the substance removed from seawater by desalination.

_____ (1)

(b) Desalination requires large amounts of energy.

Desalination is only used when there is no other source of potable water.

Give **one** reason why.

_____ (1)

Water from lakes and rivers can be treated to make it potable.

(c) The first stage is to filter the water from lakes and rivers.

Why is the water filtered?

(1)

- (d) Chlorine gas is then added to the filtered water.

Why is chlorine gas used to treat water?

(1)

- (e) Describe a test for chlorine gas.

Give the result of the test if chlorine is present.

Test _____

Result _____

(2)

Some students investigated different water samples.

The table shows some of their results.

Water	pH	Mass of dissolved solid in g / dm ³
Tap water	6.5	0.5
Seawater	8.1	35.0
Pure water		

- (f) Complete the table above to show the expected results for pure water.

(2)

- (g) What mass of dissolved solid is present in 100 cm³ of the sample of tap water?

Tick (✓) **one** box.

0.05 g

0.5 g

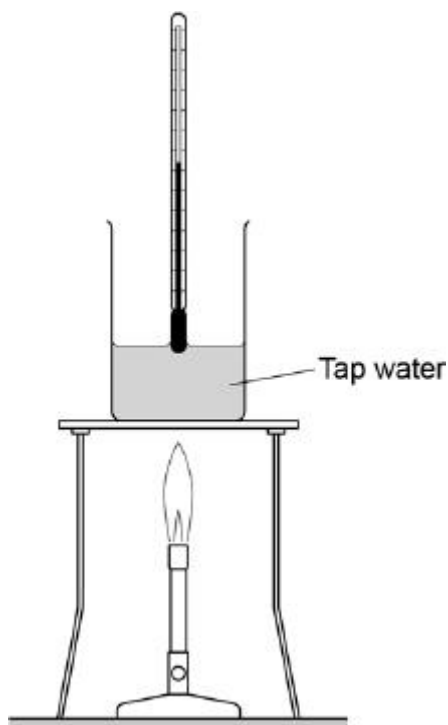
5 g

50 g

(1)

- (h) Boiling points can be used to show whether substances are pure.

The diagram shows the apparatus the students used to find the boiling point of tap water.



The students made a mistake setting up the apparatus.

What mistake did the students make?

(1)

(Total 10 marks)

Q8.

Water from a lake in the UK is used to produce drinking water.

- (a) What are the two main steps used to treat water from lakes?

Give a reason for each step.

Step 1 _____

Reason _____

Step 2 _____

Reason _____

(2)

- (b) Explain why it is more difficult to produce drinking water from waste water than from water in lakes.

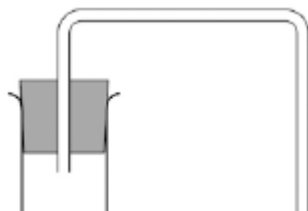
(3)

- (c) Some countries make drinking water from sea water.

Complete the figure below to show how you can distil salt solution to produce and collect pure water.

Label the following:

- pure water
- salt solution



(3)

- (d) How could the water be tested to show it is pure?

Give the expected result of the test for pure water.

(2)

(e) Why is producing drinking water from sea water expensive?

(1)

(Total 11 marks)