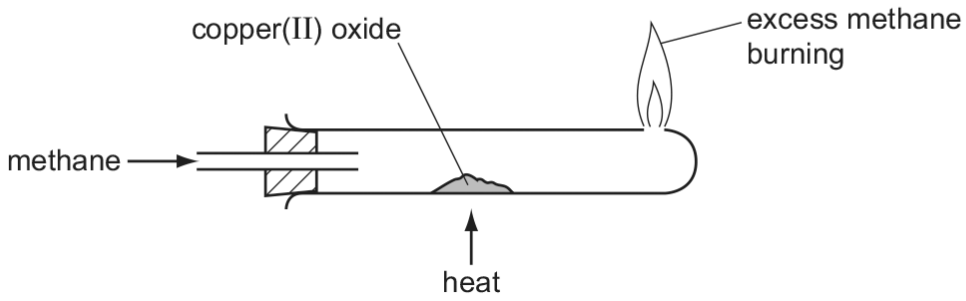
## 6.2 Redox

01. 0620_s13_qp_62 Q: 2

A student investigated the reaction of methane, $CH_4$, and copper(II) oxide. She passed methane gas over hot copper(II) oxide using the apparatus shown.




The solid changed colour to red-brown and drops of liquid condensed in the cold part of the tube.

**(a)** What was the original colour of the solid?

..... [1]

**(b)** Suggest the identity of

**(i)** the red-brown solid, .....

**(ii)** the drops of liquid. ..... [2]

**(c)** Suggest a physical test to identify the liquid.

test .....

result ..... [2]

[Total: 5]

02. 0620_s13_qp_62 Q: 3

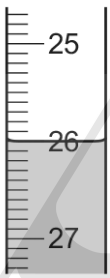
A student investigated the reaction between a solution of deep purple aqueous potassium manganate(VII), and two different colourless solutions, **B** and **C**, of an acidic solution of a sodium salt.

Two experiments were carried out.

*Experiment 1*

A burette was filled with the solution of potassium manganate(VII) to the 0.0 $cm^3$ mark.
Using a measuring cylinder, 25 $cm^3$ of solution **B** was poured into the conical flask.
The potassium manganate(VII) solution was added slowly to the flask and shaken to mix thoroughly. Addition of the solution was continued until there was a permanent pink colour in the contents of the flask.

**(a)** Use the burette diagram to record the volume in the table of results and complete the table.



final reading

| | |
|---|---|
| final reading / $cm^3$ | |
| initial reading / $cm^3$ | |
| difference / $cm^3$ | |

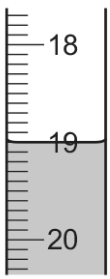
[2]



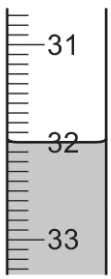
*Experiment 2*

Experiment 1 was repeated using solution **C** instead of solution **B**.

**(b)** Use the burette diagrams to record the volumes in the table and complete the table.



initial reading



final reading

| | |
|---|---|
| final reading / $cm^3$ | |
| initial reading / $cm^3$ | |
| difference / $cm^3$ | |

[2]

**(c)** **(i)** What colour change was observed in the contents of the flask when potassium manganate(VII) solution was added to the flask in Experiment 1?

from ..... to ..... [1]

**(ii)** Why was an indicator not added to the flask?

..... [1]

**(d)** **(i)** In which experiment was the greater volume of potassium manganate(VII) solution used?

..... [1]

**(ii)** Compare the volumes of potassium manganate(VII) solution used in Experiments 1 and 2.

..... [1]

**(iii)** Suggest an explanation for the difference in volumes in **(d)(ii)**.

.....

.....

..... [2]

**(e)** If Experiment 2 was repeated using 12.5 $cm^3$ of solution **C**, what volume of potassium manganate(VII) solution would be used? Explain your answer.

.....

.....

..... [3]



**(f)** A redox reaction occurs when potassium manganate(VII) reacts with solutions **B** and **C**. Explain the term *redox reaction*.

.....

..... [2]

**(g)** Give **one** advantage and **one** disadvantage of using a measuring cylinder for solution **C**.

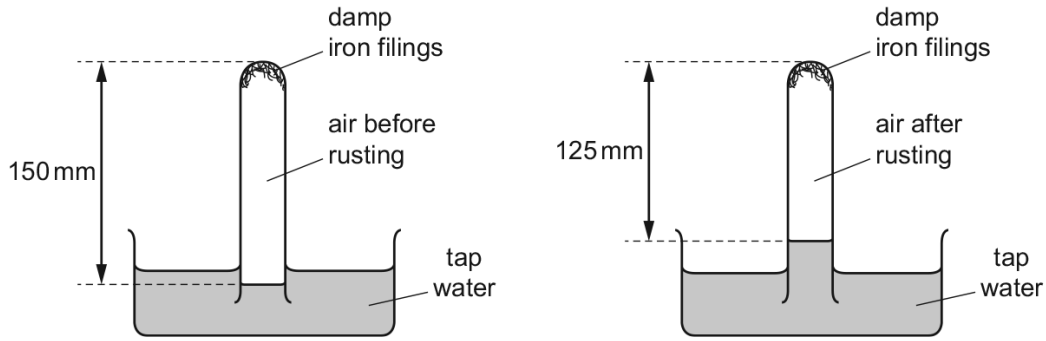
advantage .....

disadvantage ..... [2]

[Total: 17]

03. 0620_s15_qp_63 Q: 3

An investigation into the rusting of iron filings was carried out using damp iron filings in an inverted boiling tube.




**(a)** After one week the colour of the iron filings changed from grey to ..... [1]

**(b)** **(i)** Why did the water rise up the boiling tube?

..... [1]

**(ii)** Use the information on the diagram to work out the percentage decrease in the volume of the air in the boiling tube after one week.

.....

..... [2]

**(c)** What would be the effect if this experiment were repeated using boiled distilled water instead of tap water?

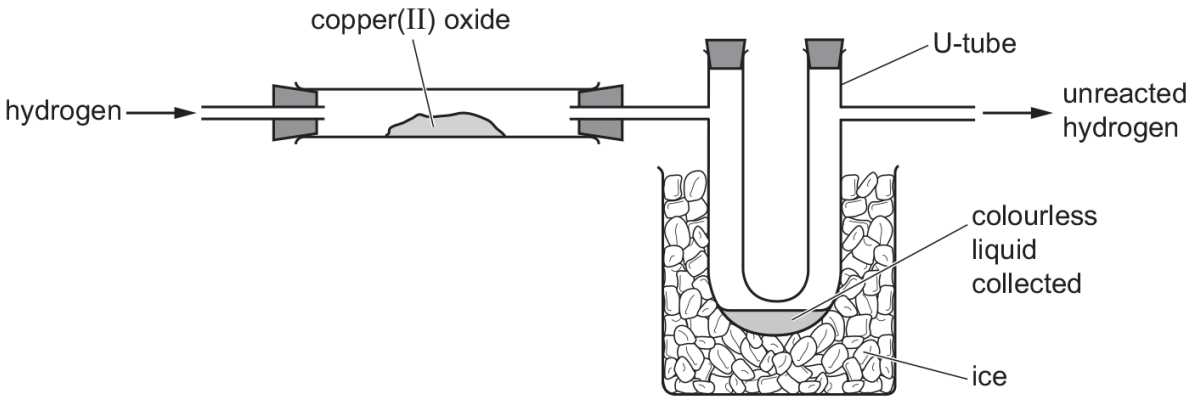
..... [1]

[Total: 5]

04. 0620_s20_qp_62 Q: 1

Hot copper(II) oxide reacts with hydrogen. The products are copper and steam.

The apparatus used to react copper(II) oxide with hydrogen is shown.




**(a)** Draw an arrow **on the diagram** to show where the apparatus should be heated. [1]

**(b)** During the reaction the colour of the copper(II) oxide changes.

State the colour change.

from ..... to .....
[1]

**(c)** Identify the colourless liquid collected.

..... [1]

**(d)** Explain why the U-tube is in ice.

.....

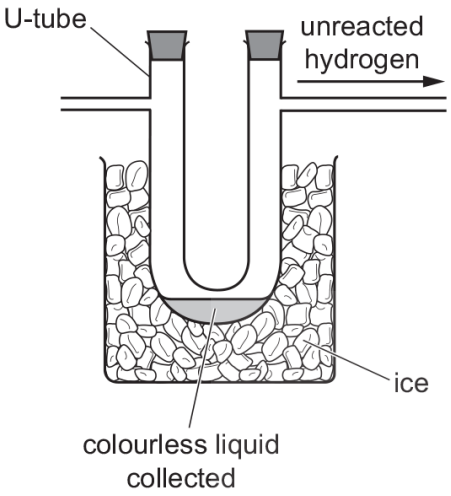
..... [2]

**(e) (i)** Large amounts of unreacted hydrogen should **not** be allowed to escape into the laboratory.

State why.

..... [1]

**(ii)** Complete the diagram to show how the unreacted hydrogen could be collected and its volume measured.
Label any apparatus that you draw.



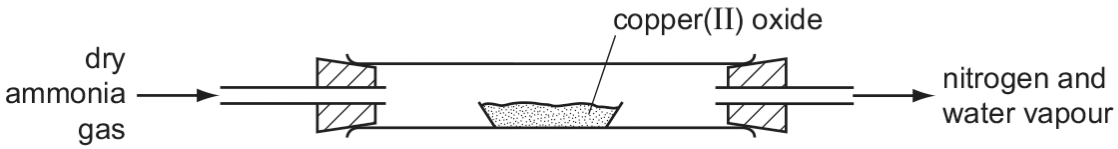

[2]

[Total: 8]

05. 0620_w12_qp_61 Q: 1

A student reacted dry ammonia gas with hot copper(II) oxide.
The apparatus used is shown below.
The equation for the reaction is

$$2NH_3 + 3CuO \rightarrow 3Cu + N_2 + 3H_2O$$




**(a)** Indicate with an arrow where the heat is applied. [1]

**(b)** The colour of the copper(II) oxide would change

from ..... to ..... [2]

**(c)** Draw a labelled diagram to show how liquid water could be obtained from the water vapour produced.



[2]

**(d)** Suggest the effect of nitrogen on a lighted splint.

..... [1]

[Total: 6]

01. 0620_s13_ms_62 Q: 2

**(a)** black (1) [1]

**(b)** **(i)** copper / Cu (1)

**(ii)** water / $H_2O$ (1) **accept:** steam [2]

**(c)** boiling point / freezing point (1)

100 °C / 0 °C (1)
**note:** do not accept a chemical test [2]

**(a)** table of results for Experiment 1

final and initial volumes and difference completed correctly 26.00, 0.0 and 26.0 (1)

to 1 decimal place (1) **accept:** volumes to 2 d.p. (e.g. 26.00) [2]

**(b)** table of results for Experiment 2

final and initial volumes and difference completed correctly 19.0 and 32.0 (1) 13.0 (1) [2]
**ignore:** decimal places, **accept:** 19, 32,13, **allow:** ecf on final and initial volumes

**(c)** **(i)** colourless **not:** clear to purple / pink (1) [1]
**accept:** colour change either way round

**(ii)** not an acid / alkali reaction or potassium manganate is coloured or pink / acts as an indicator / there is already a colour change / owtte (1) [1]

**(d)** **(i)** experiment 1 (1) **allow:** ecf on **(a)** and **(b)** [1]

**(ii)** experiment 1 is twice the volume of experiment 2 / experiment 2 is half the volume of experiment 1 (1) **note:** must be a quantitative comparison, do not allow quotes of figures from table **allow:** ecf (e.g. 13 times as much as experiment 2) [1]

**(iii)** solution B / experiment 1 more concentrated / stronger (1) or converse

double / twice (1) [2]
**ignore:** reference to reactivity

**(e)** half value from table result for experiment 2 (6.5) (1) **allow:** ecf

$cm^3$ (1)

half volume of **C** used (1) [3]



**(f)** oxidation (1) reduction (1)

**or:** electrons are lost (1) gained (1) transferred (2) [2]
**accept:** oxidation numbers increase (1) decrease (1)
**accept:** hydrogen / $H_2$ / H lost (1) gained (1)
**accept:** oxygen / $O_2$ / O gained (1) lost (1)

**(g)** advantage easy to use / quick / convenient (1) **ignore:** large volumes

disadvantage not accurate / owtte (1) [2]

03. 0620_s15_ms_63 Q: 3

| | | | |
|---|---|---|---|
| (a) | brown / red-brown / orange; | 1 | **A** black |
| (b)(i) | oxygen / air used up / reacted; | 1 | |
| (b)(ii) | 150 – 125 = 25;<br>25 / 150 × 100 = 16.7%; | 2 | |
| (c) | same results; | 1 | |

04. 0620_s20_ms_62 Q: 1

| Question | Answer | Marks |
|---|---|---|
| (a) | arrow under copper(II) oxide pointing up to the copper(II) oxide | 1 |
| (b) | start: black<br>final: brown | 1 |
| (c) | water | 1 |
| (d) | to cool | 1 |
| | so that the steam / gas condenses / turns into a liquid | 1 |
| (e)(i) | flammable / explosive | 1 |
| (e)(ii) | method of collection shown would work | 1 |
| | collection apparatus is graduated | 1 |

05. 0620_w12_ms_61 Q: 1

**(a)** arrow under copper oxide (1) [1]

**(b)** black (1) to brown/red (1) [2]

**(c)** diagram of tube entering test-tube or similar in beaker of cold water/ice/Liebig condenser (1) [2]

labelled water/ice/condenser (1)

**(d)** extinguished/goes out (1) **not:** no effect/no reaction [1]