13 + Entrance Examination

Paper 1

Chemistry - Level 2

Total marks: 60

Time allowed: 40 minutes

Calculators may be used

Full name .....

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1. **Circle the correct answer for each of the following questions**

   a. How would you separate out different pigments based on their solubility?

   distillation | filtration

   chromatography | evaporation

   b. Heating up copper carbonate produces copper oxide and carbon dioxide. This is an example of what sort of reaction?

   displacement | decomposition

   reduction | neutralisation

   c. If sulphuric acid and calcium carbonate react what gas will be produced?

   hydrogen | oxygen

   nitrogen | carbon dioxide

   d. When a salt dissolves in water, what is the salt known as.

   solution | insoluble

   solute | solvent

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e. Which non-metal is a good conductor?

sulphur	nitrogen
carbon	helium

f. A solid turning directly into a gas when heated is called

melting	subliming
precipitating	solidifying

g. Which gas contributes most significantly to acid rain from burning coal?

sulphur dioxide	carbon monoxide
carbon dioxide	nitrogen oxides

h. Which metal won't be attracted to a magnet?

iron	nickel
copper	cobalt

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i. A glowing splint is put into a test tube containing a gas. The glowing splint does not relight. What is the gas definitely not?

nitrogen	oxygen
carbon dioxide	hydrogen

j. In the thermite reaction iron oxide + aluminium $\longrightarrow$ aluminium oxide + iron, what is occurring?

just oxidation	just reduction
oxidation and reduction	decomposition

(10 marks)

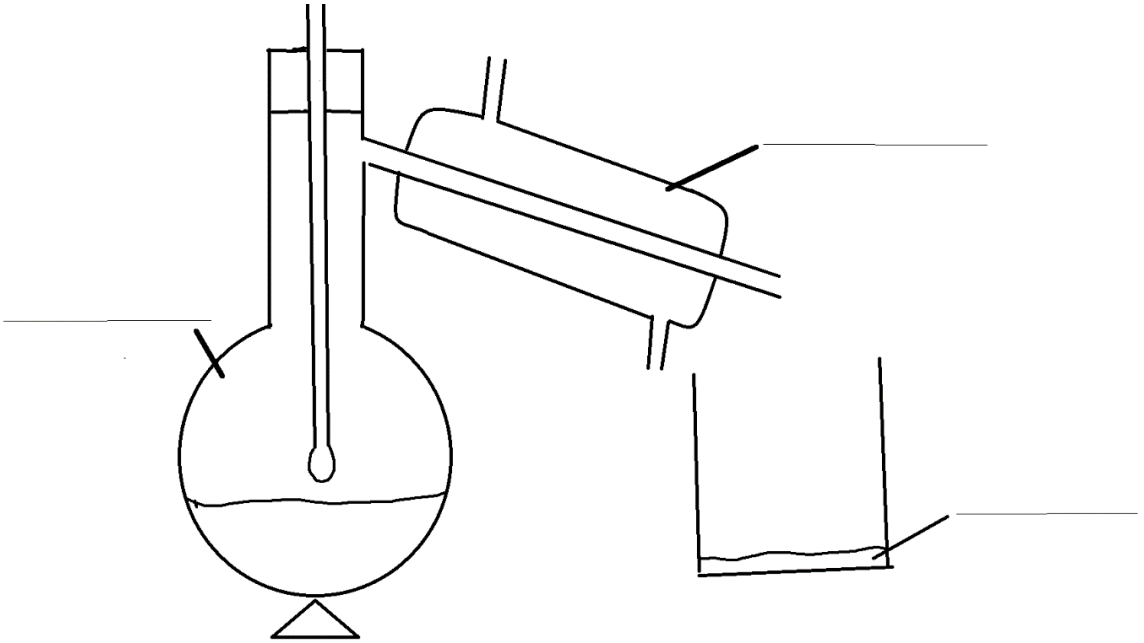
2. Match the following apparatus and instruments on the left with their function on the right.

A thermometer	used for accuracy when measuring volumes of liquids
A funnel	used to measure temperature or temperature changes
A measuring cylinder	used for heating and testing small quantities of solids and liquids
A beaker	used for heating and boiling liquids and for general use
A test tube	used for heating and for collecting liquids and gases
A conical flask	used to separate solids and liquids

(6 marks)

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3. **The diagram below shows the apparatus required for a technique to separate a water and ethanol mix.**



a. Label the 3 parts of the diagram **(3 marks)**

b. Something has been set up incorrectly. Describe and explain what it is.

_____

_____

_____

_____

_____

(2 marks)

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c. Referring to the various changes of state happening along the way as well as the specific boiling points of the two substances, fully explain how this process works in order to separate water and ethanol.

_____

_____

_____

_____

_____

_____

(3 marks)

d. Will the substance recovered in the beaker be pure? Explain your answer.

_____

_____

_____

_____

_____

(2 marks)

e. Ethanol and water are both examples of compounds. Explain what a compound is.

_____

_____

_____

_____

_____

(2 marks)

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f. When a gas turns to a liquid what is happening in terms of particle arrangement and particle movement?

_____

_____

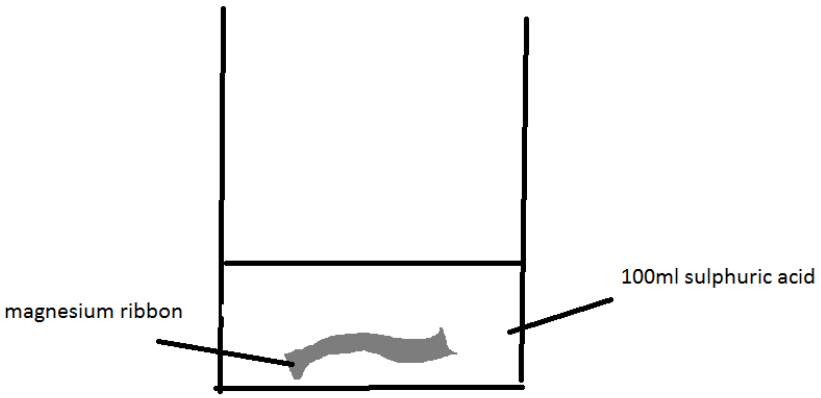
_____

_____

_____

(2 marks)

4. In an investigation, different amounts of magnesium were added each time to 100ml of the same concentration of sulphuric acid.



Before conducting each test, universal indicator was added to the acid. As the reaction took place, the original colour of the universal indicator changed as shown in the results below. Universal indicator will keep changing colour if the conditions in which it is in keep changing.

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Mass of magnesium at start (g)	End colour the Universal Indicator turned when the reaction had finished	Mass of magnesium at end of reaction (g)
2	Orange	0
4	Yellow	0
6	Green	0.25
8	Green	0.5

a. What colour would the universal indicator have turned when added to the acid?

_____ **(1 mark)**

b. What pH did the 6 and 8 gram tests reach?

_____ **(1 mark)**

c. Explain why not all of the magnesium reacted in the 6 and 8 gram tests but did in the other two tests.

_____

_____

_____

_____

_____

_____

(3 marks)

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d. During each of the tests, a gas was released. A lit splint was placed over the test tube and it gave a pop. What was this gas?

_____ **(1 mark)**

e. On closer inspection each test felt warmer at the end of the test than at the start. Which test do you think rose in temperature by the smallest amount? Explain your answer.

_____

_____

_____

_____

_____

(2 marks)

f. Write the word equation to show this reaction.

_____

(2 marks)

g. Predict the least amount of magnesium needed to get all the acid neutralised:

_____ **(1 mark)**

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h. Give two safety precautions that should be taken.

_____

_____

_____

_____

_____

(2 marks)

5.

a. What are the two conditions required for something made of iron to rust?

_____

_____

_____

_____

_____

(2 marks)

b. If rust is such a problem, why do we continue to use iron and steel so much in industry when there are other metals that won't rust? Give two reasons.

_____

_____

_____

_____

_____

(2 marks)

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c. On the underside of ships, a block of a more reactive metal, such as zinc, may be added in order to prevent the ship from rusting. What is this prevention technique called?

_____ **(1 mark)**

Explain how it works:

_____

_____

_____

_____

_____

(2 marks)

d. If a lump of iron (with mass 1kg) rusts extensively over time, will the mass of the rust be the same, less or more than 1kg? Explain your answer fully.

_____

_____

_____

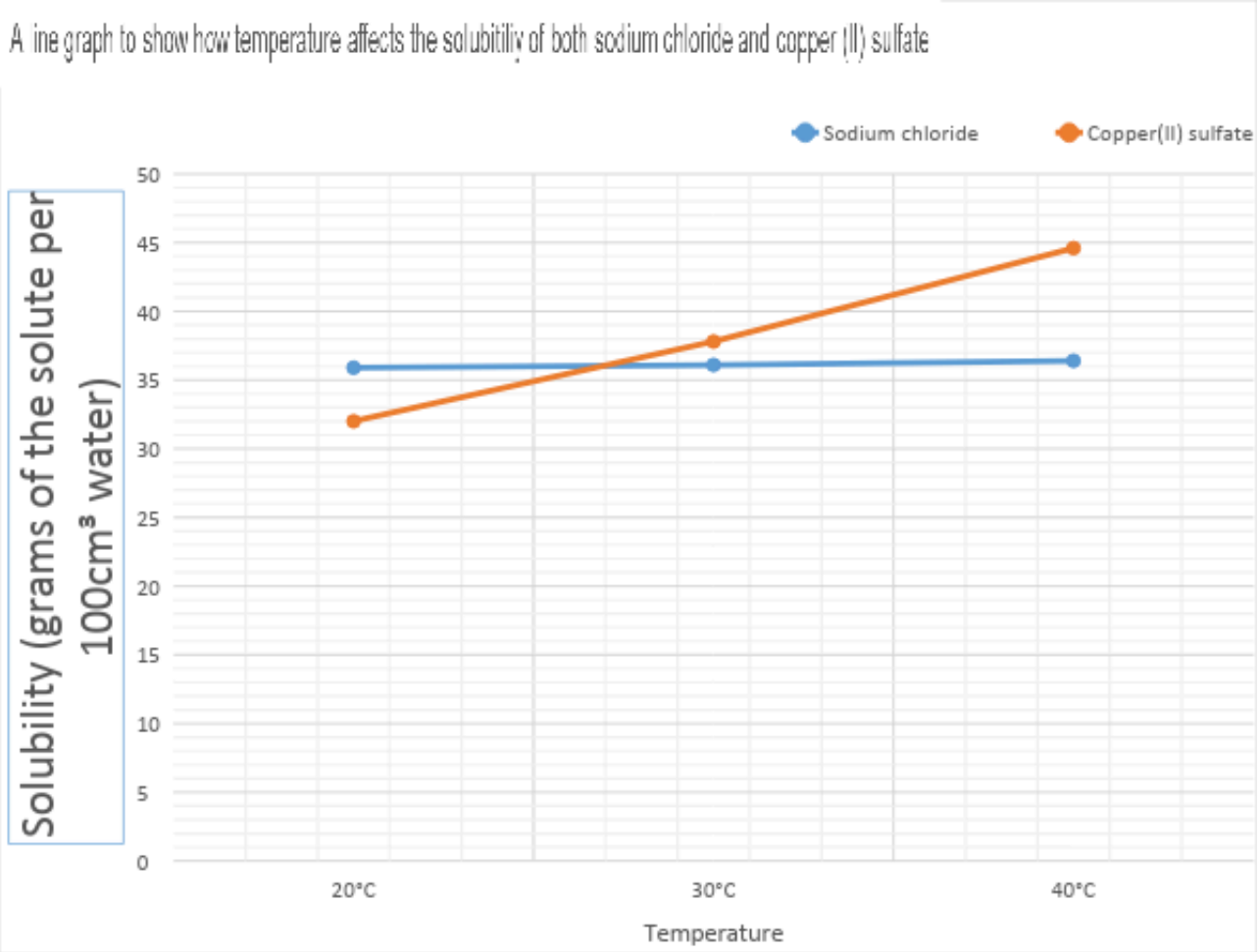
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(2 marks)

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6. Look at the graph below.



a. At what approximate temperature do both sodium chloride and copper (II) sulfate have the same solubility?

_____ **(1 mark)**

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b. Describe how the solubility of sodium chloride compares to the solubility of copper (II) sulfate at different temperatures.

_____

_____

_____

_____

_____

(2 marks)

c. What do you predict would be the solubility of copper (II) sulfate at 50 °C? (1 mark)

_____ **(1 mark)**

d. What is a solution called when it reaches a point where no more solute can be dissolved?

_____ **(1 mark)**

e. The salt solutions are left in a beaker on a window sill, and over the next few days the level starts to fall. What is the name of the process causing the level fall?

_____ **(1 mark)**

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f. If 70 grams of copper (II) sulfate was added to 200 cm^3 of water, what is the approximate minimum temperature you would expect for the whole amount to dissolve? Show your working.

_____

_____

_____

_____

_____

(2 marks)

END OF TEST

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Mark Scheme 13+ Chemistry Paper x

1. **(10 marks)**
   a. chromatography
   b. decomposition
   c. carbon dioxide
   d. solute
   e. carbon
   f. subliming
   g. sulphur dioxide
   h. copper
   i. oxygen
   j. oxidation & reduction

2. **(6 marks)**
   A thermometer→used to measure temperature or temperature changes
   A funnel→used to separate solids from liquids
   A measuring cylinder→used for accuracy when measuring volumes of liquids
   A beaker→used for heating and boiling liquids and for general use
   A test tube→used for heating and testing small quantities of solids and liquids
   A conical flask→used for heating and for collecting liquids and gases

3.
   a. **(3 marks)**
      Round bottomed flask
      Liebig condenser
      Distillate / recovered ethanol
   b. The thermometer is not positioned correctly. The bulb / bottom of the thermometer should be higher / level with the tube of the liebig condenser. **(up to 2 marks)**
   c. Ethanol's boiling point is lower than water's (78 degrees compared to 100 degrees but specific recall isn't required for full marks). As such, when the thermometer temperature reaches ethanol's boiling point, it will be in gas form and will pass through the Liebig condenser. Water, at this temperature, is still in liquid form and so will remain in the round bottomed flask. The ethanol vapour will cool as it travels along (by the cold water surrounding it) and will condense to liquid ethanol and so will drip out the other end. **(up to 3 marks)**
   d. No. To evaporate, water doesn't need 100 degrees (it doesn't need to reach its boiling point) and so some will pass through as gas also with the ethanol (although most will remain). **(2 marks)**
   e. Two or more different elements chemically bonded. **(2 marks)**

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f. The particles are still in a random arrangement although have now pulled close together (they are not so spaced apart as the gas was). Although still free to move, the liquid particles are moving much less rapidly than they were in gas form (as they have much less energy). **(up to 2 marks)**

4.

a. Red **(1 mark)**
b. 7 **(1 mark)**
c. As the magnesium and acid react together and form new substances, there becomes less and less of these original reactants. If there is too much of one and not enough of the other for the reaction), then the one - in this case magnesium - will keep reacting as long as there are acid particles left. The moment all the acid particles have been used up, then no more magnesium can react and it will be left over. **(up to 3 marks)**
d. Hydrogen **(1 mark)**
e. The 2 gram test. There was only a small amount of magnesium to cause this small reaction. Therefore less heat would have been produced compared to the others. **(2 marks)**
f. Magnesium + sulphuric acid → magnesium sulphate + hydrogen **(2 marks)**
g. pH 5 **(1 mark)**
h. Wear gloves and wear safety specs / goggles **(2 marks)**

5.

a. Water / Oxygen **(2 marks)**
b. Iron and steel are very strong metals and this strength is obviously very useful. They are also very cheap to extract / form compared to other metals. **(2 marks)**
c. Sacrificial protection **(1 mark)**. Because the second block of metal is more reactive than the iron / steel used for the underside of the ship, it will continue to react with any available oxygen, meaning the ship itself will not react / rust. **(2 marks)**
d. It will be more. The original iron atoms have now reacted with oxygen atoms from the air. These have mass and, once combined with the iron, will mean it's now the original iron plus the newly combined oxygen atoms together. **(2 marks)**

6.

a. Values between 27 and 28 degrees **(1 mark)**
b. As the temperature increases from 20 to 40 degrees there is no apparent change in the solubility of sodium chloride, ie the same amount will dissolve at any of these temperatures. However, copper sulphate's solubility increases with temperature meaning that at higher temperatures more will dissolve than at lower temperatures. **(2 marks)**
c. Answers within the range: 51-54 grams **(1 mark)**

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d. A saturated solution **(1 mark)**
e. Evaporation **(1 mark)**
f. Proportionally 70 grams added to 200㎤ would be the same as adding 35 grams to 100㎤. Therefore, reading off the graph at 35g gives an approximate answer of 25℃. **(2 marks)**

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