Metals

1. Name an alkali metal.

2. Name the metal discovered in 1775. (Use the data booklet)

3. Name the metal which produces a red flame colour. (Use the data booklet)

4. Name the metal with a density of 8.92 g/cm^3. (Use the data booklet)

5. What is meant by the term alloy?

6. Dental amalgam is made from a mixture of metals.

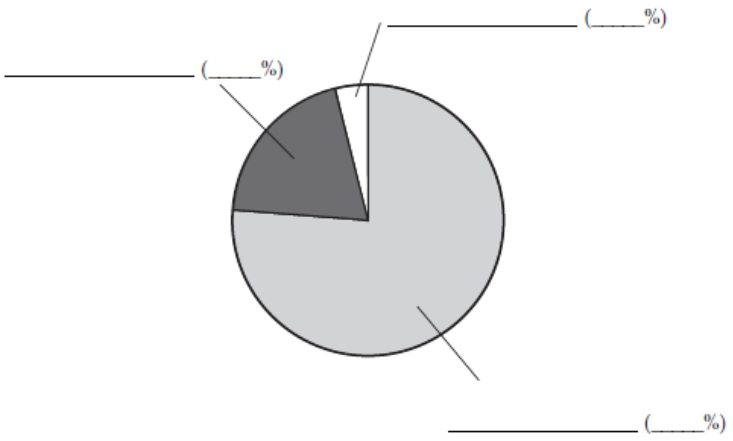
   What term is used to describe such a mixture of metals?

7. Iron can be mixed with other elements to produce steel for different uses. Chromium is added to make steel suitable for use in cooking pots. Railway tracks are made from steel which contains manganese. Titanium is added to make steel suitable for aircraft parts while adding tungsten produces steel used to make hammers.

   Present the above information in a table with suitable headings.

8. Medical instruments can be made from a mixture of metals containing 76 % titanium, 4 % zirconium and the rest is other metals.

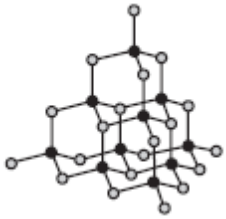
   Copy and label the pie chart to show the name and percentage for each part of the mixture.

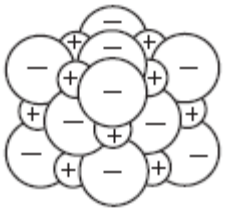


9. Metallic bonds are due to

A pairs of electrons being shared equally between atoms
B pairs of electrons being shared unequally between atoms
C the attraction of oppositely charged ions for each other
D the attraction of positively charged ions for delocalised electrons.

10. Which of the following diagrams could be used to represent the structure of a metal.

A 

B 

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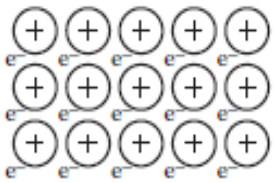
D 

11. Copy and complete the table to show the correct metal extracted by each method. You may wish to use the data booklet to help you.

silver **copper** **sodium**

METAL	**METHOD**
	Electrolysis
	Heating with carbon
	Heating alone

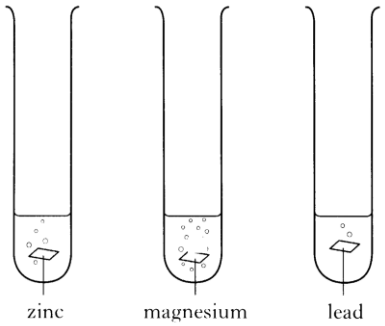
12. Copy and complete the table to show the correct method used to extract each metal. You may wish to use the data booklet to help you.

heating alone **heating with carbon** **electrolysis**

METAL	**METHOD**
Mercury	
Magnesium	
Iron	

13. Platinum is found uncombined in the Earth's crust.
What does this suggest about the reactivity of platinum?

14. A student investigated the reaction of some metals with dilute acid.



(a) Place the metals in order of reactivity. (**Most** reactive first).

(b) Name the **gas** produced when a metal reacts with dilute acid.

(c) Name the **salt** produced when magnesium reacts with dilute hydrochloric acid.

(d) Suggest **one** factor the student should have kept the same to make a fair comparison.

(e) The student repeated the experiment with another metal but **no** bubbles of gas was given off.

Suggest a name for this metal.

15.

	Reaction with	
Metal	**Dilute acid**	**Water**
X	reacts	no reaction
Y	no reaction	no reaction
Z	reacts	reacts

Which of the following shows the metals in order of increasing reactivity?

A X Y Z
B Y X Z
C Z X Y

Percentage Mass Calculations

1. Calculate the percentage by mass of lead in lead sulfide, PbS.

2. Calculate the percentage by mass of iron in iron oxide, Fe_2O_3.

3. Mercury can be extracted from the ore cinnabar, HgS.
   Calculate the percentage by mass of mercury in cinnabar.

4. Calculate the percentage, by mass, of potassium in potassium sulfate, K_2SO_4.

5. Calculate the percentage by mass of nitrogen in ammonium nitrate, NH_4NO_3.

6. Anglesite is an ore containing lead (II) sulfate, $PbSO_4$.
   Calculate the percentage by mass of lead in anglesite.

Electrochemistry

1. What happens inside a battery to produce electricity?

2. Why do some batteries stop producing electricity?

3. A car battery is made up of 6 cells and produces 12 volts. What is the voltage of one cell?

4. Name the type of particle which carries the current through the wire in a cell.

5. What is the purpose of an electrolyte in a cell?

6. Which produces the largest voltage: magnesium//copper cell or magnesium//iron cell?

7. In which direction do electrons flow in a cell with the metals copper and zinc?

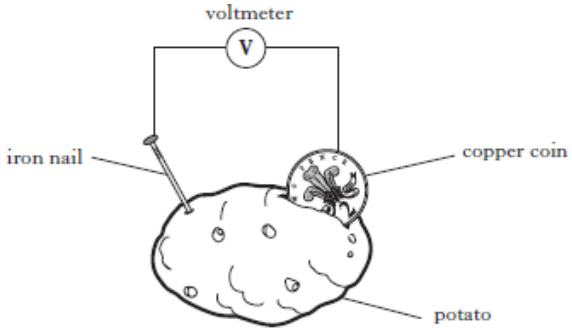
8. Name the type of reaction taking place:

   (a) $Mg \longrightarrow Mg^{2+} + 2e$

   (b) $Cu^{2+} + 2e \longrightarrow Cu$

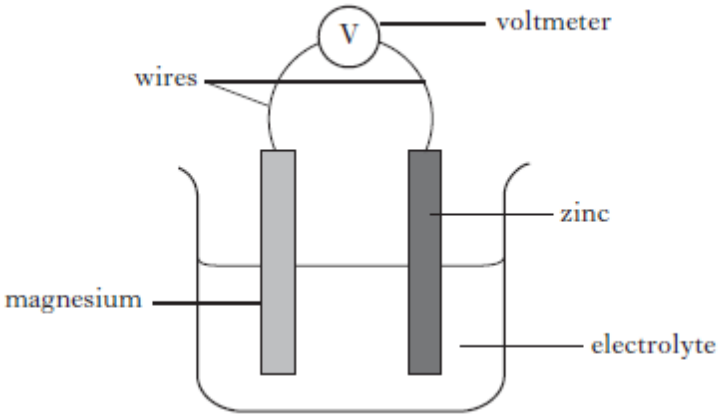
9. Suggest what the voltage would be in a cell where both metals are the same?

10. A simple cell can be made from everyday objects.



(a) In which direction do electrons flow?
(b) What would happen to the size of the voltage if the iron nail was replaced with aluminium foil? You may wish to use the data booklet to help you.

11. The diagram below shows a cell.



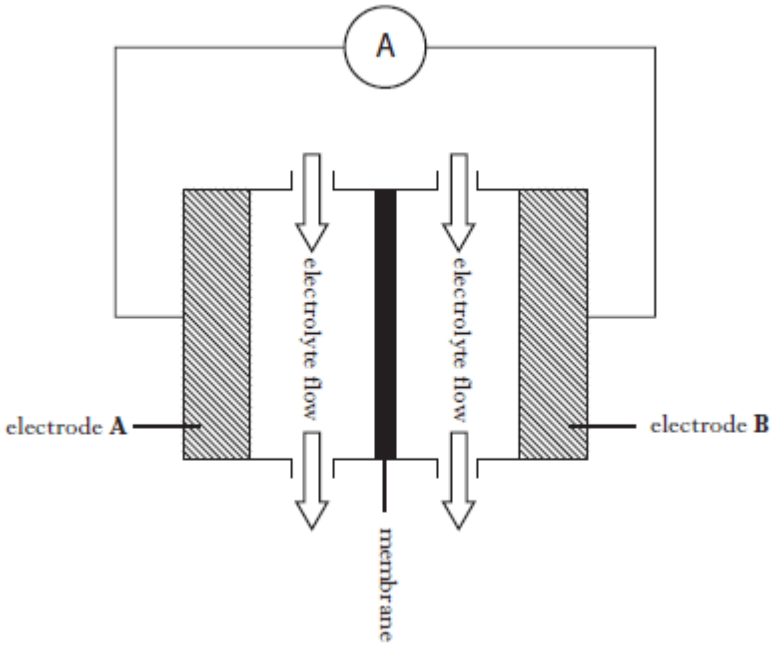
(a) Name the type of charged particle that flows through the wires.

(b) The voltage of the cell shown above is 1·51 V.

Name a metal which could replace **zinc** to produce a **greater** voltage.

You may wish to use the data booklet to help you.

12. In Australia flow cells are used to store the energy from solar cells.



(a) The reaction taking place at electrode **A** when the cell is providing electricity is:

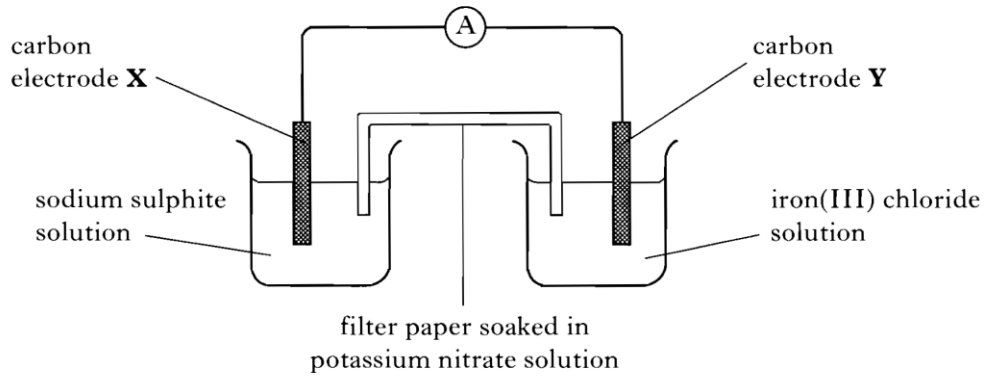
$$Zn \longrightarrow Zn^{2+} + 2e^-$$

Name the type of chemical reaction taking place at electrode **A**.

(b) In which direction do electrons flow, **A to B or B to A?**

(c) Name the non-metal, that conducts electricity, which could be used as an electrode

2. A student set up the following cell.



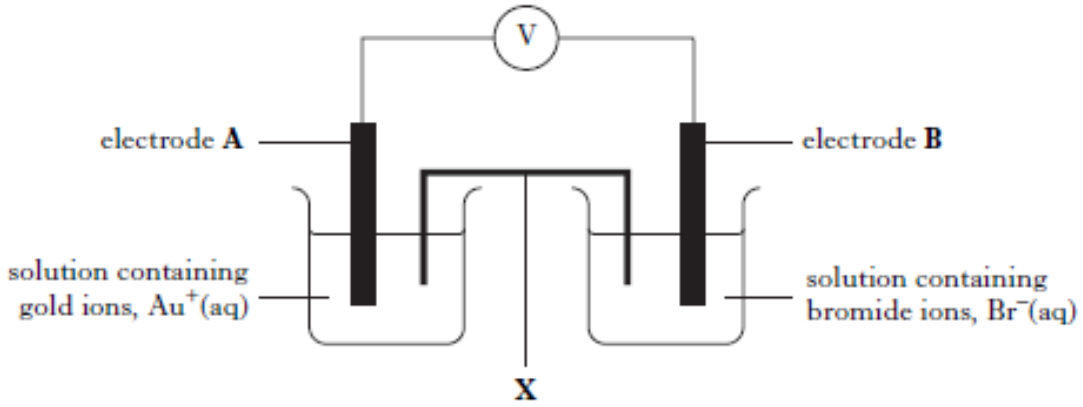
The reaction taking place at electrode Y is : $Fe^{3+} + e^- \longrightarrow Fe^{2+}$

(a) In which direction will electrons flow, **X to Y or Y to X?**

(b) Do electrons travel through the wires or the solution/ion bridge?

(c) Name the type of chemical reaction taking place at electrode **Y**.

3. A technician set up the following cell.



The reaction taking place at electrode **B** is:

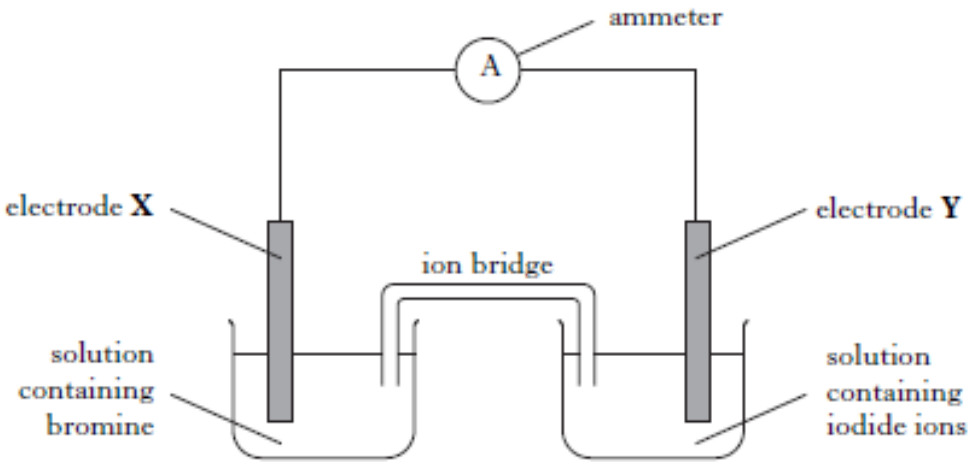
$$2Br^-(aq) \longrightarrow Br_2(l) + 2e^-$$

(a) In which direction will electrons flow, **A to B or B to A?**

(b) Write the ion-electron equation for the reaction taking place at electrode **A**. You may wish to use the data booklet to help you.

(c) Name the piece of apparatus labelled **X**.

4. A student set up the cell shown.



The reaction taking place at electrode **Y** is: $2I^-(aq) \longrightarrow I_2(s) + 2e^-$

(a) Name the type of chemical reaction taking place at electrode **Y**.

(b) In which direction will electrons flow, **X to Y or Y to X?**

(c) Write the ion-electron equation for the chemical reaction taking place at electrode **X**.

Plastics

1. Using the word bank provided, complete the following sentences.

chemical, thermosetting, synthetic, manufacturing, natural, thermoplastic, polymerisation

a) Chemicals derived from oil are used to make plastics and _____ fibres.
b) Plastics which soften on heating are _____ polymers.
c) Simple plastics are made by a process called _____.

2. Copy and complete the table to give information about monomers and the polymers they form.

MONOMER	POLYMER FORMED
Ethene	
	Poly(chloroethene)
Ethenol	
	Poly(tetrafluorethene)

3. Poly(propene) is a thermoplastic whereas Bakelite is a thermosetting plastic
Explain the meaning of the following words:

i) Thermoplastic
ii) Thermosetting

4. Burning plastics can be dangerous as harmful gases can be released into the atmosphere.
   a) Name the gas released when plastics are burned in a poor oxygen supply.
   b) Name the acidic gas formed when poly(chloroethene) is burned.
   c) Name the extremely toxic gas released when polyurethane foam burns.

5. Many plastics have been developed with interesting and useful properties. **Poly(ethenol)** is a plastic which is soluble in water. It has a variety of uses such as surgical stitches or laundry bags for use in hospitals. Polymers which are biodegradable such as **Biopo**l have been developed for use as shopping bags. **Kevlar** is a very interesting polymer. It is used in bullet-proof vests and motorcycle suits as it is very strong and resistant to wear.

   Present this information in a table with suitable headings.

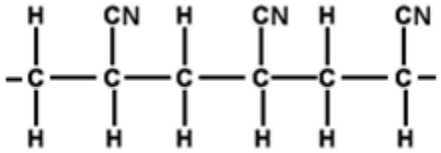
6. Using the word bank provided, complete the following sentences.

double, addition, single, condensation, unsaturated, polymerisation, saturated

   a) Addition polymerisation occurs when small _____ momomers join together.
   b) During addition polymerisation the _____ bond in each monomer breaks.
   c) Polyamides are examples of _____ polymers.

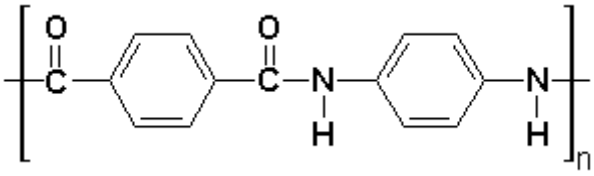
7. Plastics and fibres can be natural or synthetic.
   a) What is meant by the term synthetic?
   b) State one advantage of synthetic fibres over natural fibres.

8. The structure below represents part of a polymer molecule:



   a) Draw the repeating unit and the monomer for this polymer chain.
   b) Is this an addition or condensation polymer?

9. Kevlar is a condensation polymer which is used because of its strength and durability. The repeating unit of Kevlar is shown below.



   a) Draw the structural formula of the polymer when this unit is repeated 3 times.
   b) Draw the 2 monomers used to produce Kevlar.
   c) Is this an addition or condensation polymer?

10. Polymers can be made by addition or condensation depending on the structure of the monomer(s).

A	B	C
CH_3CHCH_2	$NH_2(CH_2)_6NH_2$	C_2H_4
D	**E**	**F**
HOOC(CH2)COOH	$CH_3CH_2CH_2CH_3$	$CH_3CH(CH_3)CH_3$

   Identify the monomer(s) which would

   a) Take part in an addition reaction
   b) Undergo a condensation reaction

11. A pupil had been absent when polymerisation had been taught. He asked you to explain it to him.
   Using the words; very large molecules, small molecules, monomers and polymers,

   write down breifly what you would tell him.

12. Copy and complete the following table giving information about a variety of polymers.

Polymer	Use	Addition or Condensation polymer
Polystyrene		
Nylon		
Poly(ethene)		
Polyester		
Polyamide		

Agrochemicals

1. Using the word bank provided, complete the following sentences.

essential, natural, decreasing, synthetic, fertilisers, important, compost, increasing

a) Plants require nitrogen, phosphorus and potassium for growth; these are known as the _____ elements.
b) Chemists produce substances called _____ to provide plants with nutrients.
c) Efficient food production is vital due the _____ population of the planet.

2. Using your data book, copy and complete the table below:
a)

Compounds	Solubility
Ammonium Nitrate	
Potassium Sulphate	
Silver Phosphate	
Sodium Phosphate	

b) Which of these compounds would not make a suitable synthetic fertiliser? Explain your answer.

3. Ammonium Nitrate, NH_4NO_3, is a fertiliser commonly used in the farming industry.
   a) Calculate the mass of 1 mole of the fertiliser.
   b) Calculate the percentage of the essential element present in the fertiliser.

4. Different plants need the essential elements in different proportions. Synthetic fertilisers contain mixtures of different compounds providing these essential elements. Natural fertilisers such as manure and compost also provide nutrients for plants. In areas of high rainfall, some synthetic fertilisers can be washed away, ending up in river systems or lochs. In situations such as these, nitrates encourage bacteria to grow and this uses up the dissolved oxygen in the water. Fish and other marine animals cannot get the oxygen they need to survive. Urea is a synthetic fertiliser with only slight solubility and is an excellent alternative in wet areas.

Read the passage and answer the following questions.

a) Do all plants require the same amount of nutrients?
b) Name 2 natural fertilisers.
c) Describe the effects fertilisers can have on rivers.
d) What property of fertilisers can cause environmental problems?

5. Using the word bank provided, complete the following sentences.

ammonia, pleasant, acidic, nitric acid, alkaline, pungent

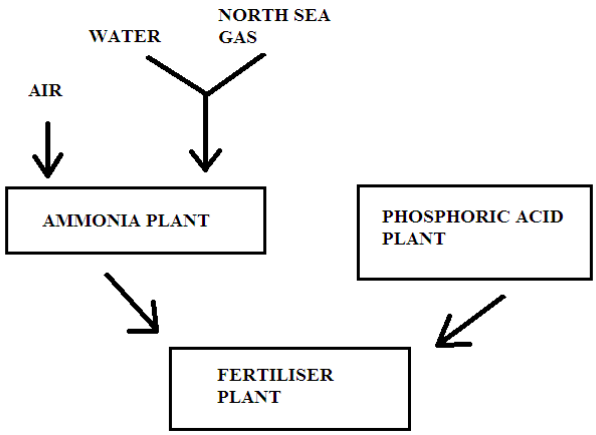
a) The Haber process is used to produce _____ industrially.

c) This gas gives off an odour which can be described as _____.

d) pH paper turns blue in the presence of this gas, showing that it is _____.

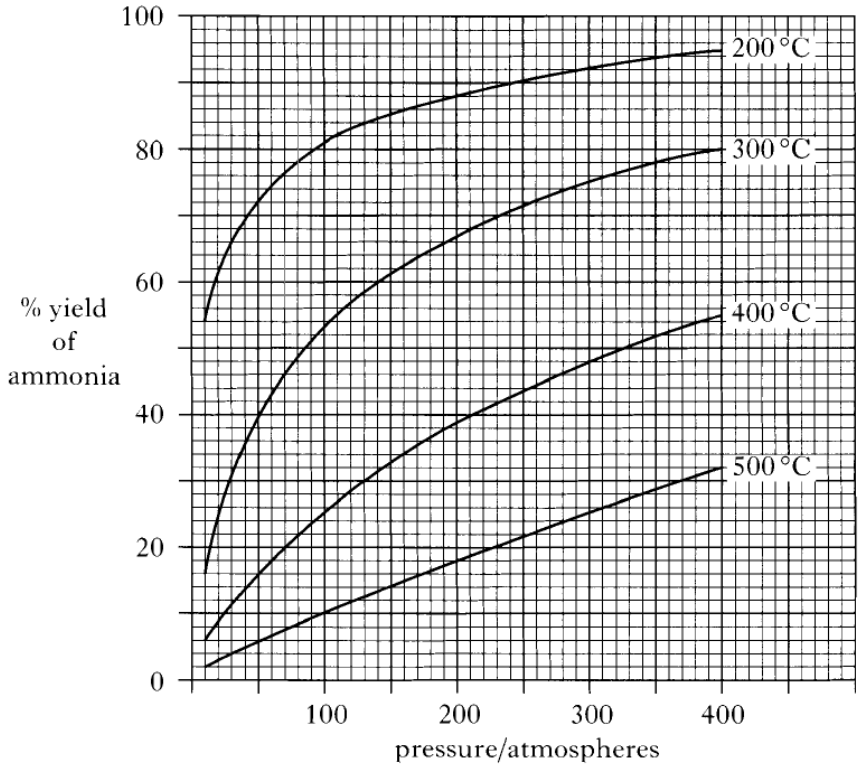
6. Ammonia manufacture is a very important part of the agrochemical industry.
   a) Write the word equation for the formation of ammonia by the Haber process.
   b) What are the reaction conditions required to produce a high yield of ammonia?
   c) What is the major use of the ammonia produced this way?

7. The flow chart shows some processes which take place in an industrial chemical complex.



a) Air and water are used as raw materials because they contain the elements needed to make ammonia.
Suggest one other reason why they are used as raw materials.

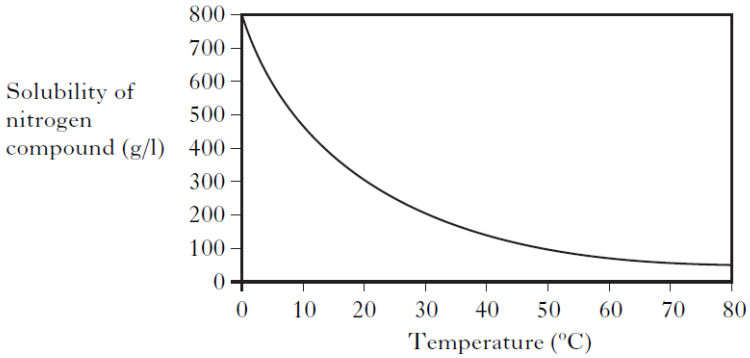
b) Which reactant for the ammonia plant must be produced in the reaction between North Sea gas and water?
c) Name the salt formed in the fertiliser plant.
d) The graph shows the different percentage yields of ammonia which can be obtained under different conditions in the ammonia plant.



i) What is the relationship between the percentage yield of ammonia and the temperature at constant pressure?

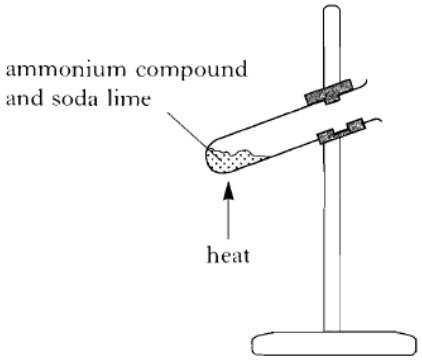
ii) Explain why all of the nitrogen and hydrogen are not converted to ammonia.

8. The nitrogen compound produced in the Haber process dissolves in water. The graph shows the solubility of the nitrogen compound at different temperatures.



Write a general statement describing the effect of the temperature on the solubility of the nitrogen compound.

9. Ammonium compounds can be identified by heating them with soda lime. Ammonia gas will be released.



a) Describe a test that could be carried out to detect and identify the ammonia gas produced.

b) An ammonium compound was dissolved in water.
A precipitate was produced when this solution was added to a solution of barium chloride.

Suggest a name for this compound.
(You may wish to use your data book to help you.)

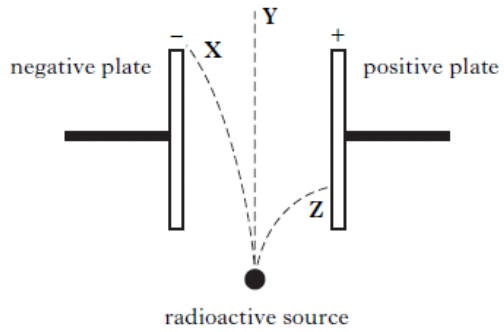
Nuclear Chemistry

1. Name one source of radiation.

2. Name the three types of radiation.

3. The diagram shows the paths of alpha, beta and gamma radiations as they pass through an electric field.

   Which line in the table correctly identifies the types of radiation which follow paths **X**, **Y** and **Z**?



	Path X	Path Y	Path Z
A	gamma	beta	alpha
B	beta	gamma	alpha
C	beta	alpha	gamma
D	alpha	gamma	beta

4. The half-life of a radioisotope is 21 years. Calculate the **fraction** which would remain after 63 years.

5. The half-life of technetium-99m is 6 hours.

   (a) How much of a 2 g sample of technetium-99m would be left after 12 hours?

   (b) Technetium-99m is formed when molybdenum-99 decays. The decay equation is:

$$^{99}_{42}Mo \longrightarrow {}^{99}_{43}Tc + \mathbf{X}$$

   Identify **X**.

6. $^{14}_{6}C$ has a half-life of 5600 years. An analysis of charcoal from a wood fire shows that its $^{14}_{6}C$ content is 25% that of living wood.
   How many years have passed since the wood for the fire was cut?

   A. 1400
   B. 4200
   C. 11200
   D. 16800

7. $^{222}_{86}Rn \longrightarrow {}^{4}_{2}He + \mathbf{X}$

Name element **X**.

8. $^{228}_{88}Ra \longrightarrow {}^{0}_{-1}e + \mathbf{Y}$

Name element **Y**.