Contact Process

[SPM08-22] Which substance is commonly used to manufacture dyes and detergents?

A Sulphuric acid
B Phosphoric Acid
C Sodium chloride
D Ammonium chloride

[SBPTrial07-47] The uses of substance X
- To clean metals.
- To produce detergents.
- To make paints.

What is substances X?

A Nitric acid
B Sulphuric acid
C Ammonia
D Ammonium sulphate

[MRSM09-11]Diagram 4 shows the stages in the Contact Process.

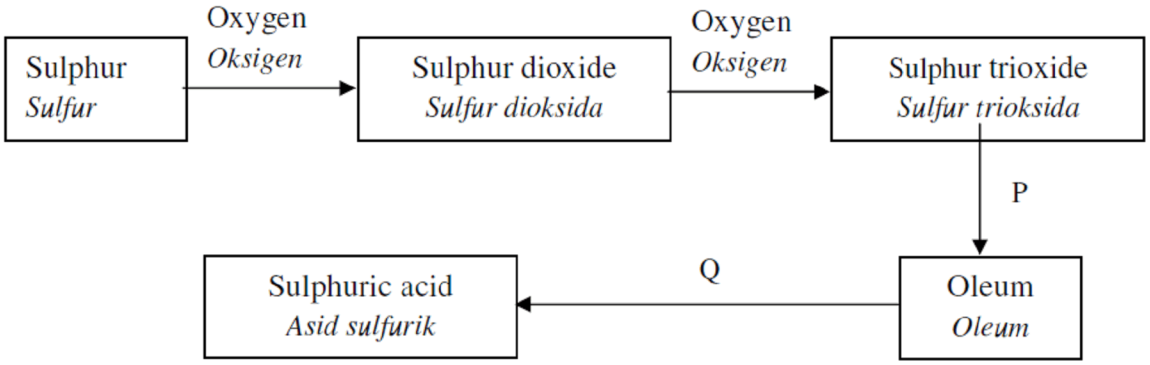


Diagram 4

Name the substances P and Q.

	P	Q
A	Water	Concentrated sulphuric acid
B	Concentrated sulphuric acid	Water
C	Concentrated sulphuric acid	Vanadium (V) oxide
D	Vanadium (V) oxide	Vanadium (V) oxide

[SPM06-12] The manufacturing of sulphuric acid involves several reactions.
Which of the following equations represents the sulphuric acid reaction that uses a catalyst?

A $S + O_2 \text{ -- > } SO_2$
B $2SO_2 + O_2 \text{ -- > } 2SO_3$
C $SO_3 + H_2SO_4 \text{ -- > } H_2S_2O_7$
D $H_2S_2O_7 + H_2O \text{ -- > } 2H_2SO_4$

[SBPtrial11-47] Which of the following reactions needs a catalyst for the production of sulphuric acid by Contact Process?

A $S + O_2 \rightarrow SO_2$
B $2\,SO_2 + O_2 \rightarrow 2\,SO_3$
C $SO_3 + H_2S_2O_7 \rightarrow H_2S_2O_7$
D $H_2S_2O_7 + H_2O \rightarrow 2\,H_2SO_4$

[MRSM07-09] Diagram 1 shows steps in industrial preparation of sulphuric acid.

$$S \xrightarrow{I} SO_2 \xrightarrow{II} SO_3 \xrightarrow{III} H_2S_2O_7 \xrightarrow{IV} H_2SO_4$$

DIAGRAM 1

Which of the following steps requires a catalyst?

A *I*
B *II*
C *III*
D *IV*

[MRSM04-13] The following equation represents the main reaction in the preparation of sulphuric acid.

$$2SO_2 + O_2 \xrightarrow{\text{Catalyst K}} 2SO_3$$

What is catalyst K?

A Iron
B Platinum
C Vanadium (V) oxide
D Aluminium(III) oxide

[SBPTrial08-08] Diagram 3 shows the stages involved in the Contact Process to produce sulphuric acid.

$$2SO_2 + O_2 \xrightarrow{I} 2SO_3 \xrightarrow{II} H_2S_2O_7 \xrightarrow{III} H_2SO_4$$

What is the optimum temperature and the catalyst used in stage I?

	Temperature / °C	Catalyst
A	450	Vanadium(V) oxide
B	200	Vanadium(V) oxide
C	450	Iron powder
D	300	Iron powder

[SBPTrial09-49] Which of the following reactions needs a catalyst for the production of sulphuric acid by the Contact Process?

A $S + O_2 \rightarrow SO_2$
B $2SO_2 + O_2 \rightarrow 2SO_3$
C $SO_3 + H_2S_2O_7 \rightarrow H_2S_2O_7$
D $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

[SPM09-29] The following information is about a reaction.

- **It uses vanadium(V) oxide as catalyst**
- **The product of the reaction is acidic when dissolved in water**

Based on this information, what is the equation for the reaction?

A $S + O_2 \rightarrow SO_2$
B $N_2 + H_2 <\rightarrow 2NH_3$
C $2H_2O_2 \rightarrow O_2 + 2H_2O$
D $2SO_2 + O_2 <\rightarrow 2SO_3$

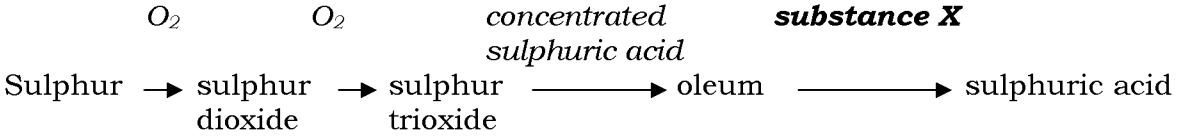
[SBPdiag08-40] The manufacturing of sulphuric acid involves several reactions. Which of the following equations represents the reaction that requires the use of vanadium(V)oxide as catalyst?

A $S + O_2 \rightarrow SO_2$
B $2SO_2 + O_2 \rightarrow 2SO_3$
C $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$
D $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

[SBPmidYearF5-13] Which of the following reactions, vanadium(V) oxide and the temperature of 450 °C are required in the Contact Process?

A $S(l) + O_2(g) \rightarrow SO_2(g)$
B $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$
C $SO_3(g) + H_2SO_4(l) \rightarrow H_2S_2O_7(l)$
D $H_2S_2O_7(l) + H_2O(l) \rightarrow H_2SO_4(l)$

[SPM05-10] The diagram shows the stages in the production of sulphuric acid using the contact process.



What is **substance X?**

A water
B sulphur
C oxygen
D sulphur dioxide

[MRSM10-10] Which of the following chemical equations represents the formation of oleum in Contact Process?

A $S + O_2 \rightarrow SO_2$
B $2\ SO_2 + O_2 \rightarrow 2\ SO_3$
C $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$
D $H_2S_2O_7 + H_2O \rightarrow 2\ H_2SO_4$

[SPM08-09] Which gas is the main agent of pollution which causes acidic rain?

A Ozone
B Methane
C Sulphur dioxide
D Carbon monoxide

[SBPTrial10-09] The chemical equation below shows the reaction of the manufacture of sulphuric acid in stage II.

$$SO_{2\,(g)} + O_{2\,(g)} \longleftrightarrow SO_{3\,9g)}$$

What are the optimum conditions for the reaction in stage II

	Catalyst	Pressure/ atm	Temperature/°C
A	450	Iron	1
B	250	Iron	10
C	250	Vanadium(V) oxide	10
D	450	Vanadium(V) oxide	1

[SBPmidYearF508-44] Sulphur dioxide gas, SO_2 causes environmental pollution. Which of the following environmental pollutions is affected by sulphur dioxide, SO_2?

I pH of the soil increases
II Lakes and rivers become acidic
III Salts are leached out of the top soil
IV Buildings and metal structures will corrode

A I and II only
B I and III only
C II, III and IV only
D I, II, III and IV

[MRSM07-04] Acid rain causes the land to become acidic. Farmers neutralize the acidity in the soil by adding

A lime
B sulphur
C zinc nitrate
D ammonium sulphate

Haber Process

[MRSM06-06] Which of the following is the main usage of the product in Haber Process?

A To produce pesticides
B To produce paint
C To produce detergent
D To produce fertilizers

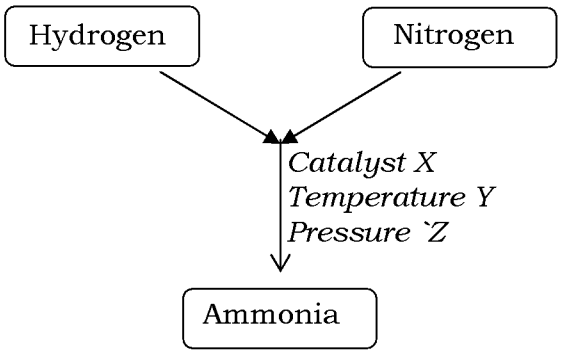
[SBPtrial11-09] The equation in Diagram 2 represents the reaction in the industrial preparation of ammonia.

$$N_2 + 3\,H_2 \xrightarrow[450\ °C/\ 60\ atm]{\text{Catalyst M}} 2NH_3$$

What is M?

A Iron
B Nickel
C Copper(II) oxide
D Manganese(IV) oxide

[SBPmidYearF508-09] The diagram shows the formation of ammonia through Haber process.



Which of the following represent catalyst X, temperature Y and pressure Z?

	Catalyst X	Temperature Y, °C	Pressure Z / atm
A	Vanadium(V) oxide	550	200
B	Platinum	450	100
C	Iron	200	450
D	Iron	450	200

[SBPmidYearF508-28] Ammonium sulphate is used as a chemical fertilizer. This fertilizer can be prepared in the laboratory through the reaction between

A aqueous of ammonia solution and dilute sulphuric acid
B aqueous of ammonia solution and sulphur dioxide
C ammonia gas and sulphur and oxygen
D ammonia gas and sulphur trioxide

[SPM04-06] The following chemical equation shows the reaction of the Haber process.

$$N_2(g) + H_2(g) \xrightarrow[\text{Temperature Y, pressure Z}]{\text{Catalyst X}} 2NH_3(g)$$

Which of the following represent catalyst X, temperature Y and pressure Z ?

	Catalyst X	Temperature Y/ °C	Pressure Z/ atm
A	Platinum	900	5
B	Platinum	450	1
C	iron	900	450
D	iron	450	300

[SBPTrial10-20] The chemical equation below shows the reaction which occur in Haber Process.

$$N_{2(g)} + 3\,H_{2(g)} \longleftrightarrow NH_{3(g)}$$

Which of the following represents catalyst, temperature and pressure?

A Temperature 2000C, pressure 60 atm and platinum as catalyst.
B Temperature 4500C, pressure 200 atm and iron as catalyst.
C Temperature 8000C, pressure 1 atm and nickel as catalyst.
D Temperature 4500C, pressure 1 atm and iron as catalyst.

[SBPdiag08-16] Haber process can be represented by the following equation:

$$N_2\,(g) + H_2\,(g) \rightarrow 2NH_3\,(g)$$

What is the catalyst, temperature and pressure used in this process?

	Catalyst	**Temperature(˚C)**	**Pressure (atm)**
A	Iron	450	200
B	Platinum	900	150
C	Platinum	800	10
D	Iron	200	1050

[MRSM11-44] Diagram 17 shows the flow chart of processes in industry.

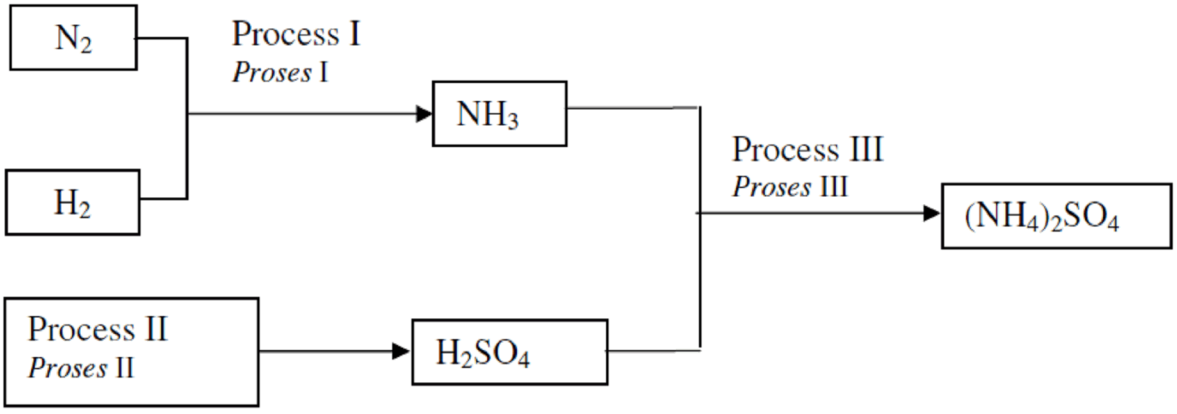


Diagram 17

Identify the processes involved.

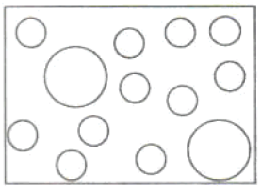
	Process I	**Process II**	**Process III**
A	Haber	Contact	Ostwald
B	Hydrogenation	Haber	Ostwald
C	Haber	Contact	Neutralisation
D	Contact	Ostwald	Haber

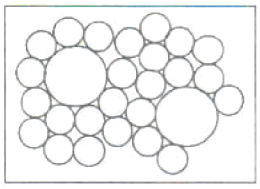
Alloy

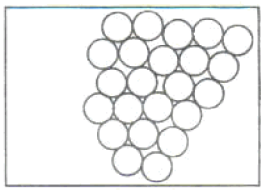
[MRSM10-28] Pure metals are ductile and malleable. This is because

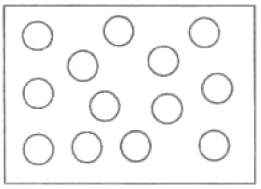
A atoms can move freely
B layers of atoms can slide easily
C bonding between atoms are weak
D atoms are orderly and closely packed

[SPM08-02] Which of the following shows the arrangement of the atoms in an alloy?

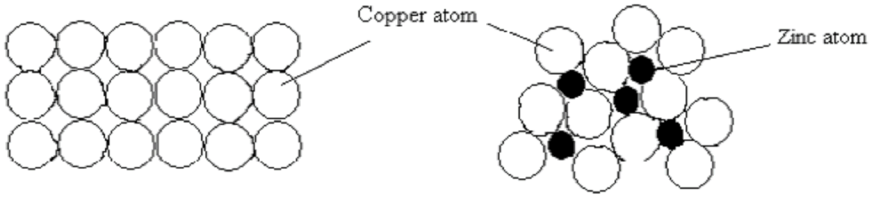
A 

B 

C 

D 

[MRSM05-27] Diagram shows the atomic arrangements of substances X and Y.



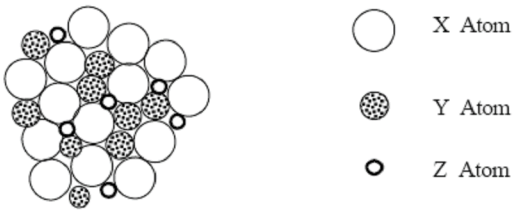
Substance Y is harder than substance X because atoms in Y

A are strongly bonded to each other
B are closer to each other
C do not slip easily
D are properly arranged

[SPM03-06] Which the following properties do **not** show that an alloy is better than its pure metal form?

A Harder
B Stronger
C More Ductile
D More Corrosion Resistant

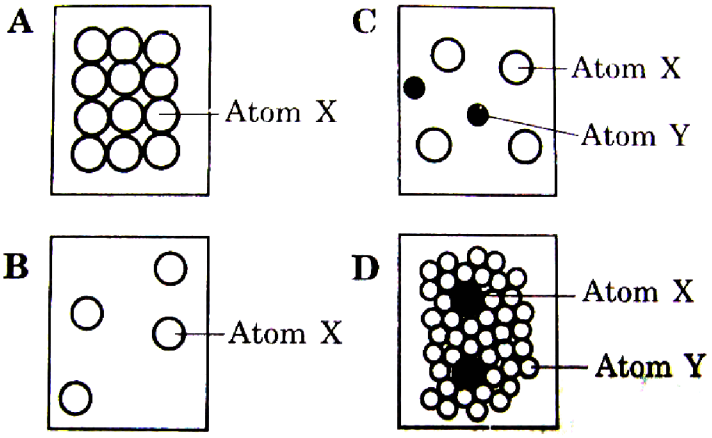
[MRSM06-15] Figure shows the atomic arrangement in an alloy.



This alloy is harder than its pure metal because ....

A arrangement of atoms in alloy is more orderly
B vibration of atoms in alloy is more vigorous
C layers of atoms in alloy is less able to slide
D absence of empty spaces between atoms in alloy

[SPM03-26] Which of the following shows the arrangement of atoms in an alloy?



[SBPTrial10-37] Diagram 7 shows the arrangement of atoms in alloy X.

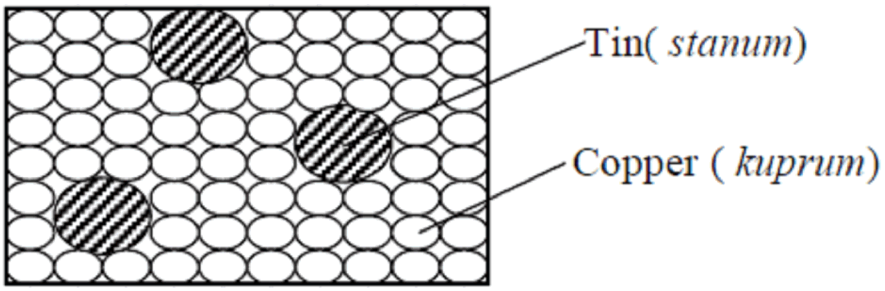


Diagram 7

What is the name of alloy X?

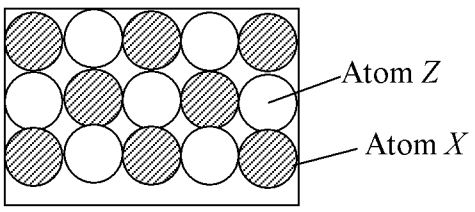
A Steel
B Brass
C Bronze
D Duralumin

[SBPmidYearF5-43] Below are the symbols of element X and Z.

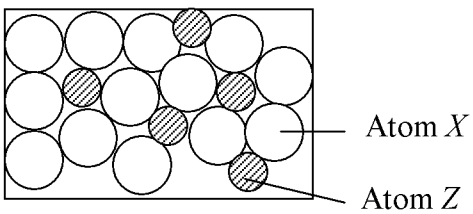
$$^{27}_{13}X \qquad ^{12}_{6}Z$$

If elements X and Z combine together to form an alloy Q, what is the arrangement of atoms in alloy Q?

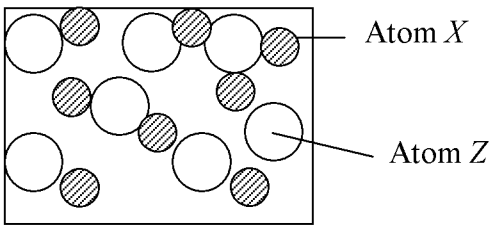
A



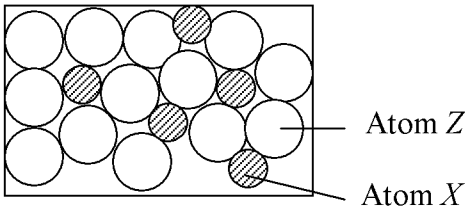
B



C



D



[MRSM10-11] An alloy which is used to make surgical forceps has the following composition:

Iron	-	74 %
Chromium	-	18 %
Carbon	-	8 %

This alloy is strong and does not corrode easily. What is this alloy?

A Bronze
B Pewter
C Duralumin
D Stainless steel

[SPM10-45] Which pair is matched correctly?

	Alloy	Major component
A	Brass	Copper
B	Pewter	Zinc
C	Bronze	Tin
D	Steel	Carbon

[MRSM04-06] Figure 4 shows the arrangement of atoms in bronze.

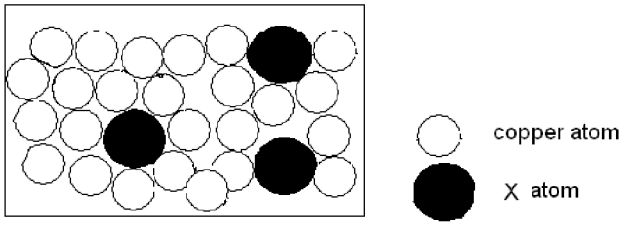


FIGURE 4

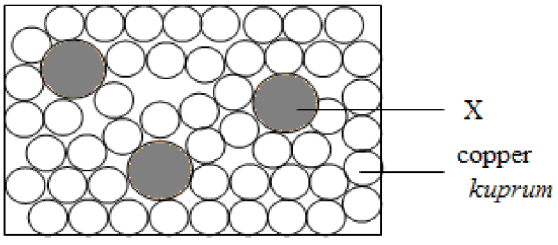
What is X?

A Zinc
B Lead
C Carbon
D Tin

[SBPTrial09-08] Which of the following pairs of elements is correct for the type of alloy?

	Main Element	Element added	Type of alloy
A	Copper	Zinc	Brass
B	Copper	Iron	Bronze
C	Tin	Carbon	Pewter
D	Iron	Tin	Steel

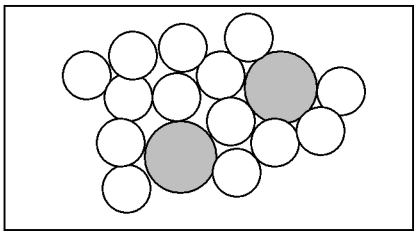
[MRSM07-10] Diagram 2 shows the arrangement of atoms in brass.

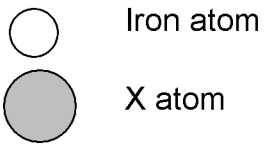


What is atom X?

A Aluminium
B Zinc
C Tin
D Carbon

[SBPmidYearF508-29] The diagram shows the arrangement of atoms in steel.

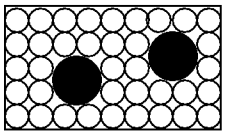




What is X?

A Tin
B Zinc
C Carbon
D Copper

[SBPdiag06-08] The diagram shows the arrangement of atoms of a substance.



Which of the following substances has the same arrangement of atoms as in the diagram?

A Aluminium
B Copper
C Brass
D Iron

[SPM07-31] Diagram 10 shows the arrangements of atoms in four metals.

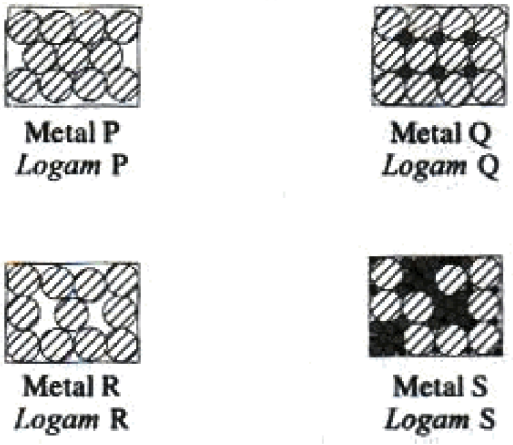


Diagram 10

Arrange the metals from the most easily malleable to the most difficult

A R, P, Q, S
B Q, P, R, S
C Q, S, P, R
D S, Q, R, P

[MRSM03-07] A type of alloy contains copper and another metal, X. This alloy is used to make trophies. Metal X could be

A iron
B tin
C zinc
D calcium

[MRSM11-13] Diagram 3 shows The National Monument which is made of bronze.

Diagram 3

What is the main metal in bronze?

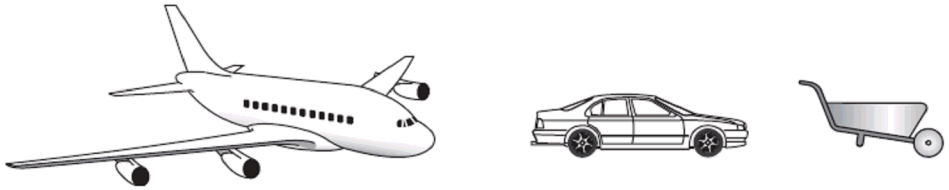
A Magnesium
B Copper
C Iron
D Tin

[MRSM06-16] The diagram shows vases made from pewter.

Which of the following is the main metal used to produce pewter?

A Tin
B Copper
C Antimony
D Aluminium

[MRSM07-09] The bodies of an aeroplane, a car and a wheelbarrow are made of alloy.



Which alloy is used in making the bodies of aeroplane, car and wheelbarrow?

	Aeroplane	Car	Wheelbarrow
A	Magnalium	Brass	Steel
B	Duralumin	Steel	Steel
C	Pewter	Bronze	Brass
D	Steel	Stainless steel	Solder

[SPM04-07] The body of the aero plane shown in the figure below is made of alloy X

What is alloy X?

A Pewter
B brass
C bronze
D duralumin

[SPM05-08] The body of an aeroplane is made of duralumin. What is the main metal in duralumin?

A iron
B copper
C aluminium
D magnesium

[SBPTrial07-08] The body of the car shown in the diagram below is made of alloy T.

What is alloy T?

A Steel
B Brass
C Bronze
D Duralumin

[SBPdiag08-08] The National Monument is made of bronze. Which is the main metal in bronze?

A Aluminium
B Iron
C Tin
D Copper

[SBPdiag08-32] Diagram 1 below shows the atom arrangement in brass that is represented by atom P and atom Q.

DIAGRAM 1

Which of the following represents metals P and Q?

	P	***Q***
A	Copper	Zinc
B	Tin	Copper
C	Zinc	Carbon
D	Zinc	Copper

[SPM11-03] Which alloy is correctly matched to its uses?

	Alloy	Uses
A	Brass	Building of monument
B	Bronze	Making of surgical instrument
C	Stainless steel	Making of medals
D	Duralumin	Making of the body of aeroplanes

Glass

[SPM10-47] In order to produce a glass that is more resistant to heat and chemicals, substance X is added to soda lime glass in the manufacturing process. What is X?

A Boron oxide
B Lead(II) oxide
C Sodium carbonate
D Calcium carbonate

[MRSM04-07] The following are the characteristics of a glass :

- **No resistance to heat**
- **Malleable**

Which of the following glass has the above characteristics?

A Lead glass
B Soda-lime glass
C Borosilicate glass
D Fused silica glass

[MRSM09-10] The following items are made of glass.

- **Mirror**
- **Electrical bulbs**
- **Glass windows**

Which type of glass is used to manufacture the items?

A Lead crystal glass
B Borosilicate glass
C Soda lime glass
D Fused silica glass

[MRSM04-17] Photochromic glass is used in making .....

I spectacles.
II office windows.
III car screen.
IV volumetric flask.

A I and II only
B III and IV only
C I, II and III only
D II, III and IV only

[SBPdiag06-32] Which of the following substances is found in a photochromic glass?

A Plastic and ceramic
B Glass and silver chloride
C Plastic and sodium chloride
D Ceramics and silver chloride

[SBPmidYearF5-12] What substance is embedded into glass to make a photochromic glass?

A Silver chloride
B Sodium chloride
C Copper(II) nitrate
D Silicon dioxide

[SBPmidYearF508-19] The diagram shows the lead crystal glass.

What are the major components used in the making of lead crystal glass?

A Copper(II) oxide and lead(II) oxide
B Aluminium silicate and silicon dioxide
C Silicon dioxide and lead(II) oxide
D Iron(III) oxide and boron oxide

Seramic

[SPM04-09] Kaolin is used to make porcelain. A substance is added to kaolin to harden it. What is the substance?

A silicone
B feldspar
C sodium oxide
D calcium carbonate

[SBPtrial11-34] A substance has the following properties:

- Hard and opaque
- Good insulator of heat and electricity
- Inert towards chemicals

Which of following substances has the above properties?

A Ceramics
B Glass
C Metal
D Polymer

[SPM04-08] The diagram shows porcelain pots.

What are the substance and the major component used in the making of porcelain pots?

	Substance	Major component
A	Glass	Cupronickel
B	Ceramic	Aluminium silicate
C	polymer	Silicon oxide
D	Alloy	Iron (III) oxide

[MRSM03-15] Which of the following describe the characteristics of ceramics?

I Hard
II Brittle
III High melting point
IV Good electrical insulator

A I and IV only
B II and III only
C I, II and IV only
D I, II, III and IV

[SPM05-09] Why is ceramic used for the wall of a nuclear reactor?

A ceramic is very hard
B ceramic is malleable
C ceramic is inert towards chemicals
D ceramic can withstand high temperature

[SBPTrial08-34] Which of the following statements explains why ceramic is suitable to make an engine block?

A Ceramic is chemically inert
B Ceramic is an electric conductor
C Ceramic can withstand high temperature
D Ceramic has a low specific heat capacity

[SBPdiag07-39] *Plaster of Paris* which is used to make plaster casts for supporting broken bones is made up of

A calcium sulphate
B calcium silicate
C calcium phosphate
D calcium carbonate

[SBPdiag08-48] Which of the following properties of ceramics are **correctly** matched to the ceramic articles?

	Ceramic articles	**Properties of ceramic**
I	Tiles	Resistant to chemical reactions
II	Spark plug	High melting point
III	Superconductor	Low electrical resistance
IV	Electrical cable holder	Good conductor of electricity

A I and II only
B II and III only
C I, II and III only
D II, III and IV only

Composite Materials

[SPM10-49] Which substance is a composite material?

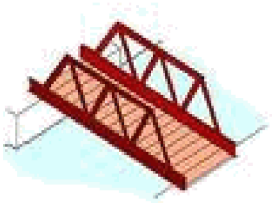
A Alloy
B Glass
C Ceramics
D Fibre glass

[SBPTrial10-36] Which of the following is not a composite material?

A Photochromic glass
B Reinforced concrete
C Fiber optic
D Perspexs

[MRSM11-27] The following diagrams show some uses of composite material in daily life. Which of the following uses requires a light and stronger composite material?

A 

B 

C 

D 

[SPM11-11] Digital communication plays a very important role in modern living. Effective transmission of data, voices and images in a digital format requires a suitable material. What is the material?

A Copper
B Aluminium
C Fibre optic
D Superconductor

[SBPmidYearF5-20]What is the main purpose of using superconductors?

A Devices made from superconductors are very cheap.
B To minimize the electrical resistance.
C To produce durable devices.
D To prevent the devices from corrosion.

[MRSM10-43] Diagram 9 shows the layout of water pipe system in a house.

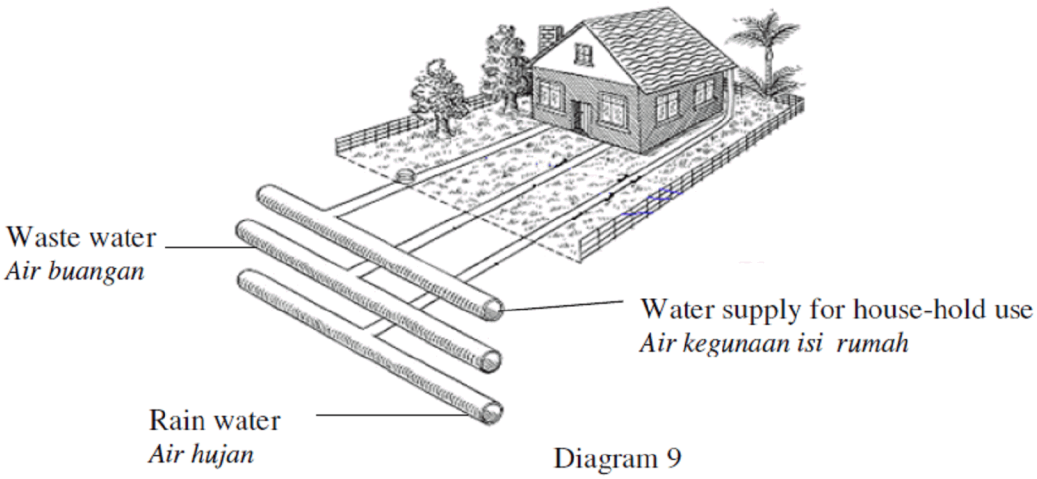


Diagram 9

What are the best materials that can be used as pipes for the above purposes?

	House hold water supply	**Waste water**	**Rain water**
A	Polypropene	Ceramics	Polyvinylchloride
B	Lead	Copper	Polyvinylchloride
C	Fibre glass	Steel	Perspex
D	Polythene	Cast iron	Concrete

Mix

[SPM11-04] Polymer, glass, alloy and composite material are some examples of manufactured substances in industry. Which statement is correct about these substances?

A A polymer is a large molecule formed by joining many monomers
B Soda lime glass is able to withstand very high temperature
C An alloy is a mixture of two or more non-metals in a fixed composition
D A composite material is a substance which has low melting point

Structure {Paper02}

[SBPTrial10-02a]

(a) Diagram 2.1 shows the stages in the industrial process for the manufacture of sulphuric acid.

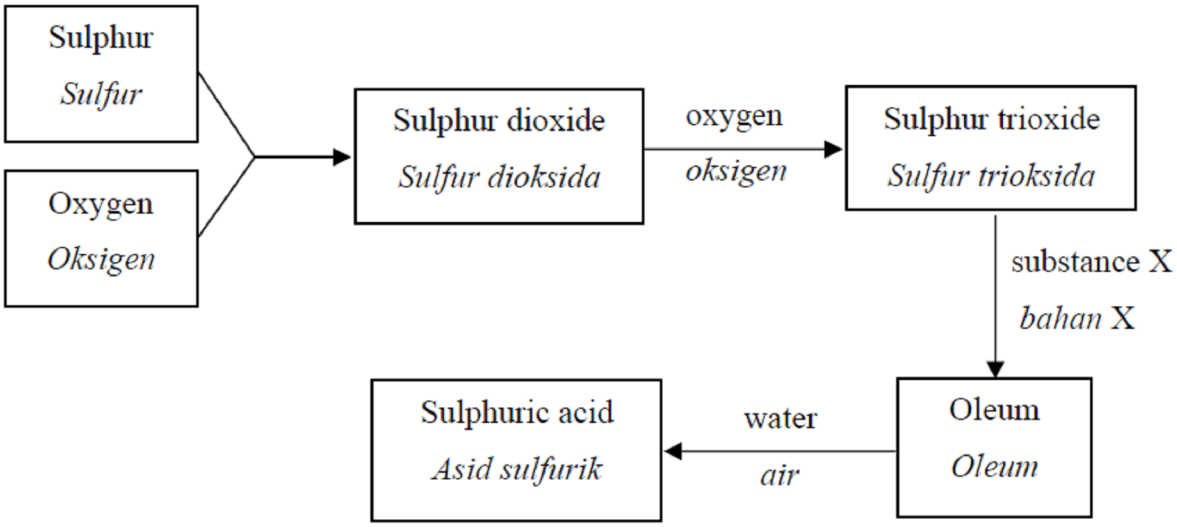


Diagram 2.1

(i) State the name of this process. [1M]

.....

(ii) State the name of substance X. [1M]

.....

(iii)Sulphur dioxide reacts with oxygen to form sulphur trioxide .Write the chemical equation for this reaction. [2 marks]

.....

[SPM08-01]

Diagram 1 shows the manufacture of sulphuric acid.

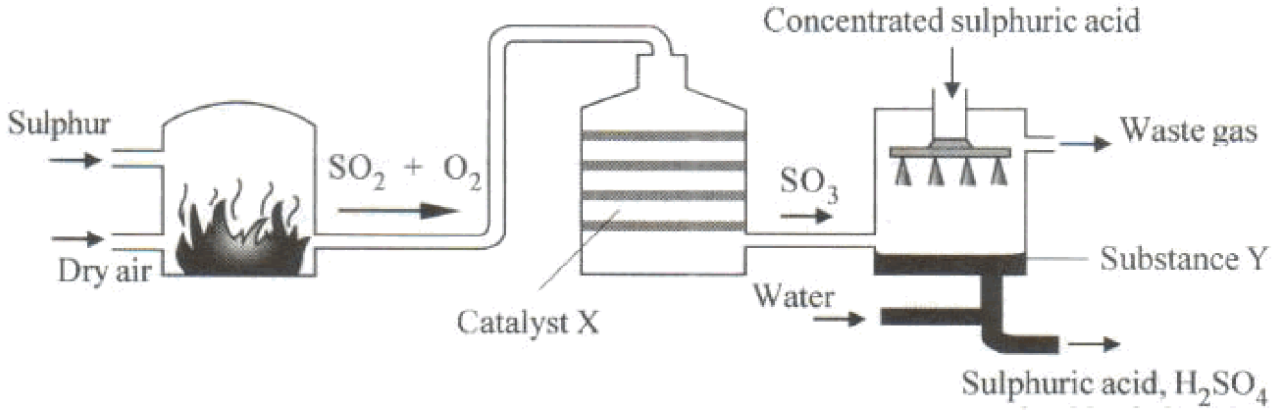


Diagram 1

(a) What is the name of this process? [1 M]

.....

(b) State the name of catalyst X. [1 M]

.....

(c) (i) State the name of substance Y. [1 M]

.....

(ii) substance Y is formed when sulphur trioxide reacts with concentrated sulphuric acid. Write the chemical equation for this reaction. [2 M]

.....

(d) A waste gas is produced during the manufacture of sulphuric acid. Explain briefly how this gas can cause environmental pollution. [2 M]

.....

.....

(e) The sulphuric acid produced can be used to manufacture fertilizers.

(i) Name one fertilizer manufacture from sulphuric acid. [1 M]

.....

(ii) State another use of sulphuric acid. [1 M]

.....

[SBPdiag08-06]

Diagram 6 shows the flow chart for the industrial manufacture of sulphuric acid.

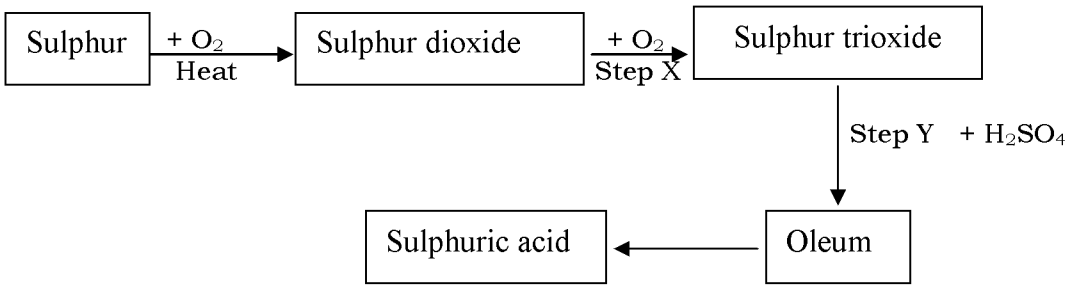


DIAGRAM 6

(i) Name the process of manufacturing sulphuric acid. [1M]

.....

(ii) Write a balanced chemical equation for Step X and Step Y. [2M]

Step X : .....

Step Y : .....

(iii) State the three conditions required for the reaction in Step X. [3M]

.....

.....

.....

(b) Sulphuric acid reacts with aqueous ammonia to form ammonium sulphate, $(NH_4)_2SO_4$ salt.

(i) Name the reaction. [1M]

.....

(ii) State **one** use of ammonium sulphate in daily life? [1M]

.....

(iii) Calculate the percentage of nitrogen in ammonium sulphate. [2M]
[Relative atomic mass: H=1, O=16, N=14, S=32]

[SBPdiag06-03]

(a) Figure 3 shows the flow chart for the industrial manufacture of sulphuric acid.

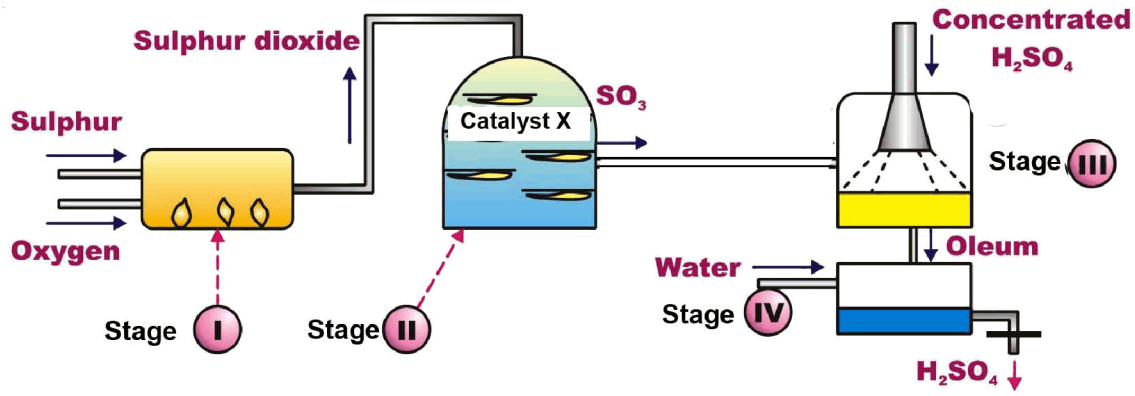


FIGURE 3

Based on Figure 3, answer the following questions.

(i) Name the process of manufacturing sulphuric acid. [1M]

.....

(ii) Describe how sulphur dioxide gas can be produced at stage I. [1M]

.....

(iii) Name catalyst X in stage II. [1M]

.....

(iv) Write the chemical equation for the reaction that takes place at stage II. [1M]

.....

(v) At stage III, sulphur trioxide is dissolved in concentrated sulphuric acid to produce oleum. Write the chemical formula of oleum. [1M]

.....

(b) Brass is an example of alloy.

(i) Name the main element which is added to copper to form brass. [1M]

.....

(ii) Draw the arrangement of atoms in pure copper and brass. [2M]

Pure copper **Brass**

(iii) Brass is harder than copper. Explain why. [2M]

.....

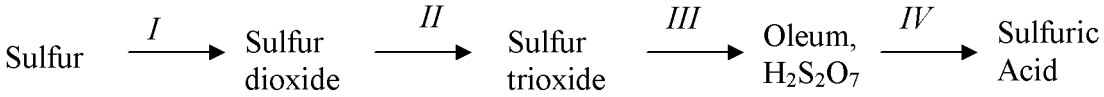
.....

.....

.....

[SBPdiag05-05]

(a) The flow chart below shows chemical substance formed in each stage in the manufacture of sulphuric acid.



(i) Write the formula of chemical substance which is the major contributor to air pollution. [1M]

.....

(ii) State one way that should be taken by factory to reduce the emission of the substance in 5 (i). [1M]

.....

(iii) State one use of sulphuric acid in our daily life. [1M]

.....

(iv)According to the equation below, the reaction between sulfur dioxide gas with excess oxygen forms sulphur trioxide:

$$2SO_{2(g)} + O_{2(g)} \text{ -- > } 2SO_{3(g)}$$

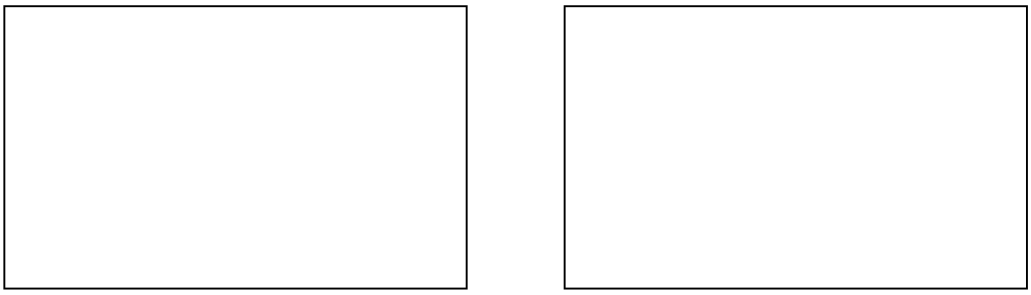
Calculate the number of molecules of sulphur trioxide gas produced if 48,000 cm^3 of sulphur dioxide gas used in this reaction at room condition.
Use information: molar volume gas at room condition = 24 $dm^3\ mol^{-1}$;
Avogadro constant = $6.02 \times 10^{23}\ mol^{-1}$

(b) Alloy is an important substance in industry.

(i) Name one alloy formed from the mixture of carbon and iron. [1M]

.....

(ii) Draw and label the atom arrangement in iron and alloy for iron in (b)(i). [2M]



Iron Alloy for iron

(iii) Explain why alloy for iron is harder than pure iron. [2M]

.....

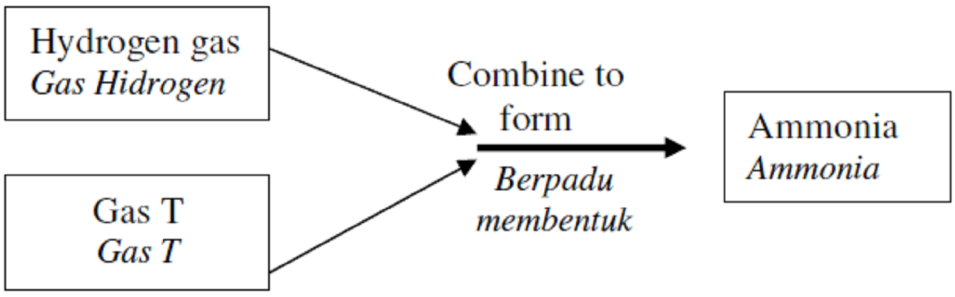
.....

.....

.....

[MRSM10-01a]

(*a*) Diagram 1.1 shows the step involved in an industrial process to produce ammonia.



(i) Name the process in the production of ammonia. [1 *mark*]

.....

(ii) Name gas T. [1 *mark*]

.....

(iii) Write the chemical equation for the reaction between hydrogen and gas T to produce ammonia. [1 *mark*]

.....

[SBPmidyearF508-03]

Diagram 3 shows a flow chart for the industrial manufacture of compound Z from sulphuric acid and ammonia.

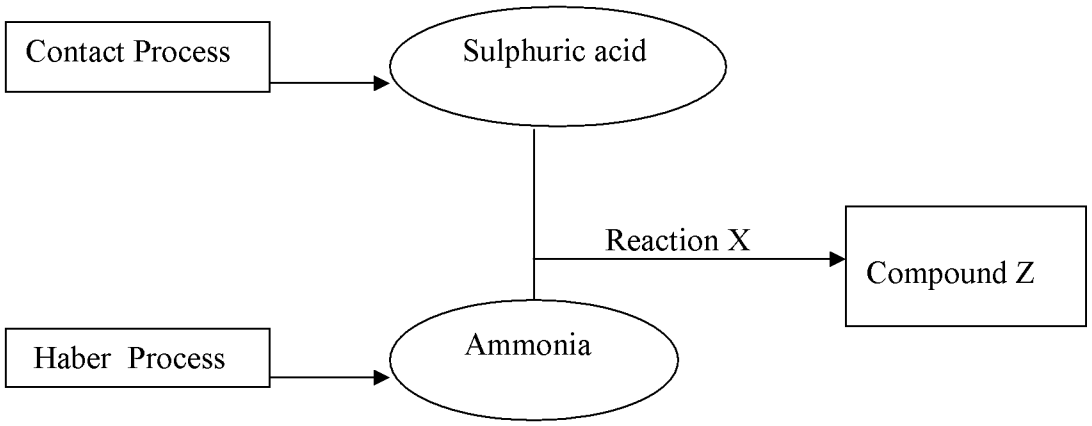


Diagram 3

(a) (i) Ammonia is produced during Haber process.
Write the chemical equation for the formation of ammonia. [1M]

.....

(ii) What is the source of nitrogen used? [1M]

.....

(b) In the above diagram, sulphuric acid reacts with aqueous ammonia to form compound Z.

(i) Name the reaction X. [1M]

.....

[1 mark]

(ii) Write the chemical equation for reaction X. [1M]

.....

(iii) What is the use of compound Z in daily life? [1M]

.....

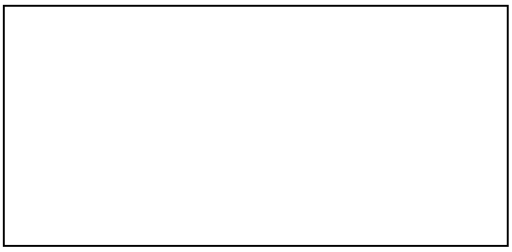
(c) Bronze and pewter are two example of an alloy.

Bronze is made up of copper as a major component and other elements. Bronze is harder than pure copper.

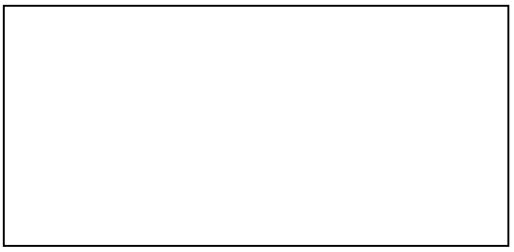
(i) Name the element added to copper to form bronze. [1M]

.....

(ii) Draw an arrangement of the particles in:



pure copper [1M]



bronze [1M]

(iii) Explain why bronze is harder than pure copper? [2M]

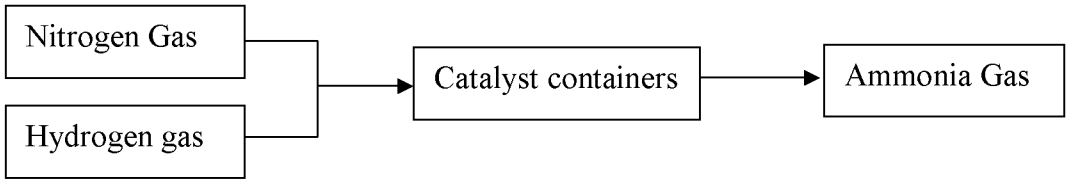
.....

.....

.....

[SBPtrial04-06] {Translate}

Ammonia was produce in industry by using one process, as show in diagram above.



(a) Name the process that produces ammonia. [1M]

.....

(b) Write the chemical equation for the process stated at (a). [1M]

.....

(c) What the catalyst used in this process? [1M]

.....

(d) Other than used the catalyst, state the other condition needed to produce maximum of ammonia. [2M]

.....

(e) Ammonia can react with sulphuric acid to produce a fertiliser. Name that fertiliser. [1M]

.....

(f) The reaction between ammonia and carbon dioxide produce urea, $CO(NH_2)_2$ and water.

(i) Write the equation for the reaction. [1M]

.....

(ii) Calculate the percent of mass of nitrogen in the urea. [2M]
[Relative atomic mass: H=1, C=12, N=14, O=16]

(g) Aqueous ammonia can be used as chemical test to determine the cation. What can be observed when aqueous ammonia was added slowly into Cu^{2+} ions solution until excess. [2M]

.....

.....

[SPM07-02]

Diagram 2 shows how ammonium sulphate is produces.

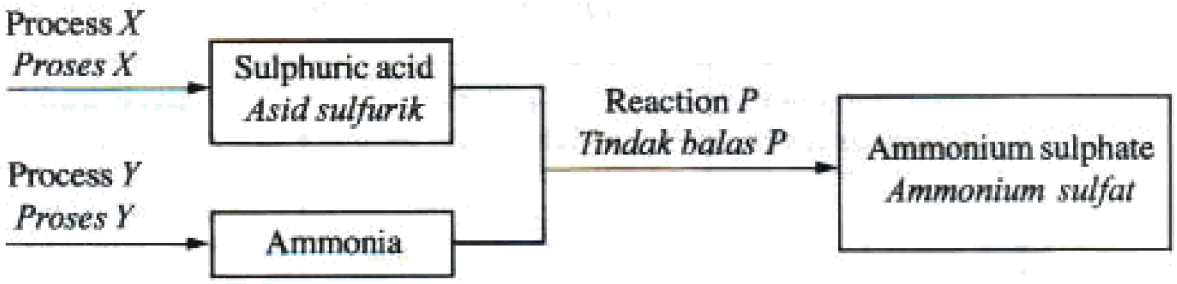


Diagram 2

(a) Process X and process Y are industrial processes.

What are the names of each of these processes? [2M]

X : .....

Y : .....

(b) What are the three raw materials needed for process X ? [3M]

1. .....

2. .....

3. .....

(c) (i) write a balance chemical equation for reaction P. [1 M]

.....

(ii) Use the answer in 2(c)(i) to determine the number of moles of sulphuric acid and the number of moles of ammonia used to produce 1 mol of ammonia sulphate. [2 M]

Sulphuric acid : ..... mol

Ammonia : ..... mol

(d) State one use of ammonium sulphate. [1 M]

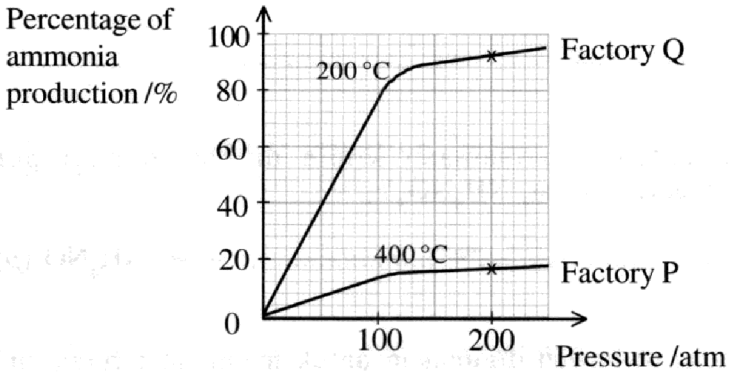
.....

[SPM06-05]

(a) Write the chemical equation for the reaction used in Haber Process for the industrial production of ammonia. [2M]

.....

(b) Graph 5 shows the percentage of ammonia production from Factory P and its competitor, Factory Q.



Graph 5

(i) Based on graph 5, compare the percentage of ammonia produced at the pressure of 200 atm from each factory. [1M]

.....

.....

(ii) Based on your comparison in 5 (b) (i), what is the effect of temperature on the percentage of ammonia produced? [1M]

.....

(iii) One method of increasing the percentage of ammonia is by increasing the pressure. State **one** problem that may arise from this method. [1M]

.....

(iv) How many the problem in 5 (b) (iii) be overcome? [1M]

.....

(c) Ammonia from the Haber Process can be used to manufacture ammonium nitrate fertilizer, NH_4NO_3.
(i) State **one** other use of ammonium nitrate. [1M]

.....

(ii) Complete the chemical equation below for the preparation of ammonium nitrate fertilizer, NH_4NO_3.

..... + ... -- > NH_4NO_3

(iii) The apparatus below is used to make ammonium nitrate solution. Next to the arrow, draw a diagram of the setup of the apparatus used in the preparation of ammonium nitrate crystals. [2M]

[SPM03-03]

Diagram 3 shows the flow chart for the industrial manufacture of sulphuric acid and the production of fertilizer Z.

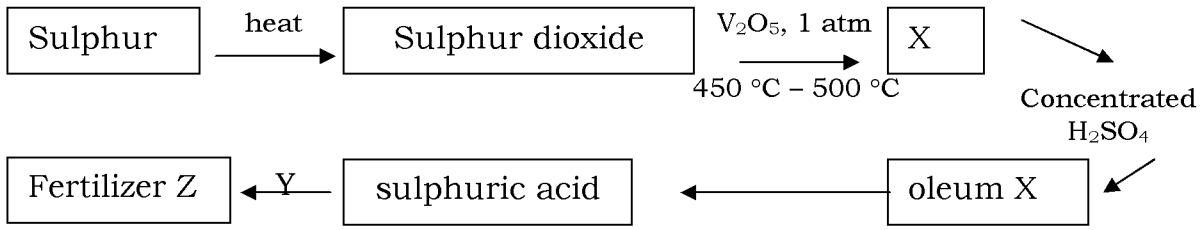


Diagram 3

Based on Diagram 3, answer the following questions.

(a) Name the process of manufacturing sulphuric acid. [1M]

.....

(b) Name the substance X. [1M]

.....

(c) Substance X could react directly with water to form sulphuric acid. Explain why this step is **not** carried out in the industrial process. [1M]

.....

(d) Write the chemical equation when oleum reacts with water to form sulphuric acid. [1M]

.....

(e) Name the substance Y and the fertilizer Z. [2M]

Substance Y: .....

Substance X: .....

The combustion of petrol in the engines of vehicles produces sulphur dioxide. This gas when dissolved in rain is corrosive.

(f) Write a chemical equation when sulphur dioxide reacts with water. [1M]

.....

[SBPtrial06-06]

Diagram 6 shows the diagram of formation of Salt A from the process X and Process Y.

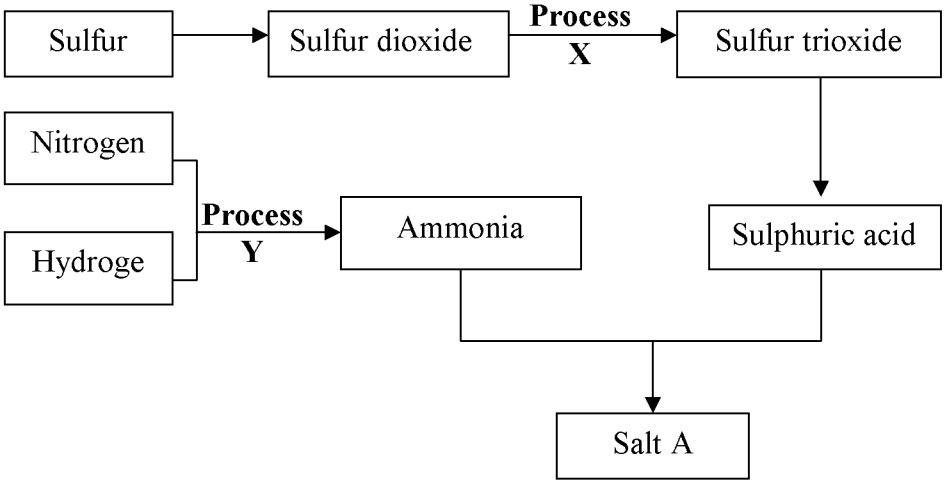


Diagram 6

(a) Name [2M]

(i) Process X : .....

(ii) Process Y : .....

(b) (i) Write the chemical equation for the reaction to produce sulfur trioxide in process X. [1M]

.....

(ii) name the catakyst used in Process X. [1M]

.....

(c) (i) Write the chemical equation for the reaction to produce ammonia in process Y. [1M]

.....

(ii) State the optimum temperature and the pressure for the process Y. [1M]

.....

(d) (i) Name the salt A. [1M]

.....

(ii) Write the chemical formula of salt A. [1M]

.....

(iii) calculate the percent of nitogen in salt A. [1M]
[Relative atomic mass: H=1, N=14, O=16, S=32]

(e) State one using of sulphuric acid. [1M]

.....

[SPM09-01]

Diagram 1 shows the arrangement of atoms in two types of copper alloy.

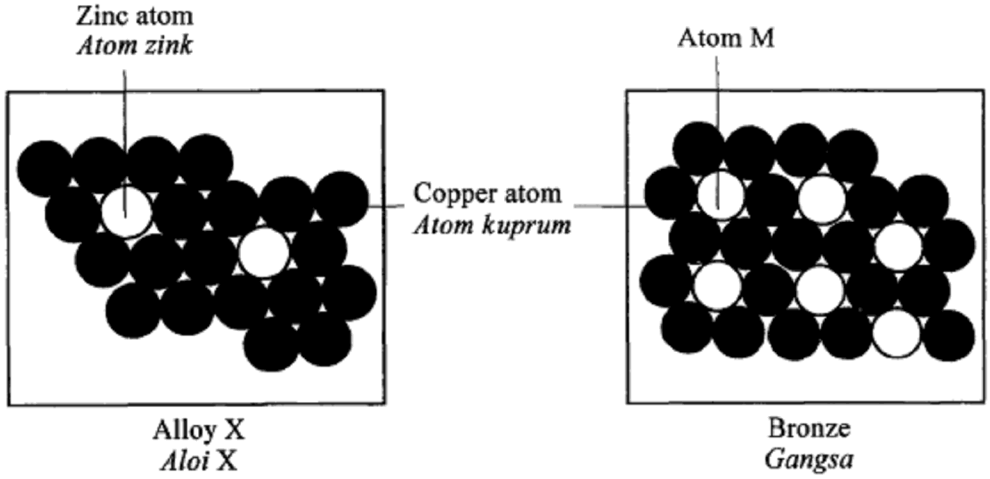


Diagram 1

(a) State the meaning of alloy. [1M]

.....

.....

(b) State the name of alloy X. [1M]

.....

(c) State the name of atom M. [1M]

.....

(d)(i) What is the different in terms of hardness between bronze and pure copper? [1M]

.....

(ii) Complete table 1 to show the difference in terms of size and arrangement of atoms in bronze and pure copper. [2M]

Difference	**Bronze**	**Pure copper**
Size of atoms		
Arrangement of atoms		

Table 1

(iii) Describe what happens to the atoms when a force is applied to a bronze and pure copper. [2M]

Bronze : .....

Pure copper:.....

(e) Pewter is also an example of an alloy. State one use of pewter. [1M]

.....

.....

[SBPtrial11-01]

Table 1 shows the particulars of four different types of manufacture substances in the industries.

Manufactured products	**Name of products**	**Components**
Alloy	Brass	copper and X
Glass	Lead glass	Y, sodium oxide and lead(II) oxide.
Composite material	Reinforced concrete	Concrete (cement, sand and small pebbles) and Z
Polymer	P	vinyl chloride

Table 1

(a) (i) State the name of element X in brass. [1M]

.....

(ii) Describe how the present of element X increases the hardness of brass. [2M]

.....

.....

(iii) Z is an example of another alloy that is used to manufacture reinforced concrete. What is Z? [1M]

.....

.....

(b) Substance Y is part of components in borosilicate glass.

(i) State the name of substance Y. [1M]

.....

(ii) Borosilicate glass is usually used as laboratory glassware. State one characteristic of borosilicate glass compare to the other types of glasses. [1M]

.....

(c) The chemical formula of monomer P is C_2H_3Cl.

(i) Draw the structural formula of monomer P. [1M]

(ii) State the name of compound P. [1M]

.....

(iii) State the name of process that change monomer to polymer. [1M]

.....

[SBPtrial07-04]

Table 4 shows the particulars of four different types of manufactured substances in industry.

Types	**Examples**	**Components**
Glass	Borosilicate	Silicon dioxide, sodium oxide, calcium oxide and X
Polymer	Z	Vinyl chloride
Alloy	Bronze	Copper and Y
Composite material	W	Concrete (cement, sand and small pebbles) and steel

(a) X is a part of the borosilicate glass. What is X? [1M]

.....

(b) (i) Identify Y. [1M]

.....

(ii) Bronze is harder than pure copper. Explain why. [2M]

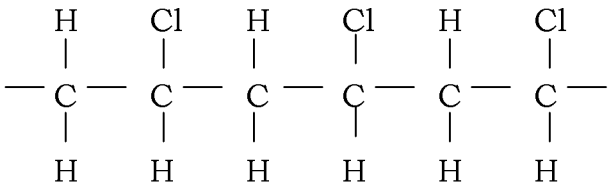
.....

.....

.....

.....

(c)The following diagram shows a part of molecular structure of a compound Z.



(i) Draw the structure of its monomer. [1M]

(ii) Compound Z is often used as a water pipe. State one advantage of this type of pipe as compared to metal pipes. [1M]

.....

(d) W can withstand high pressure and can support very heavy loads. What is W?

.....

(c) Ammonium fertilizers can be prepared by reactions between ammonia solution and acids.

(i) Write the chemical equation for the preparation of ammonium sulphate fertilizer. [1M]

.....

(ii) Urea, $CO(NH_2)_2$ is another example of ammonium fertilizers. Between urea and ammonium sulphate, which one is more suitable for the growth of plants? Prove it. [3M] [Relative atomic mass: H=1, C=12, N=14, O=16, S=32]

[MRSM03-05]

Table 2 shows a few examples of industrial products.

Alloy	***Composite material***	***Soap***
Brass and bronze	Concrete, reinforced plastic	Sodium palmitate

Table 2

(a) (i) What is an alloy? [1M]

.....

(ii) What is the composition of brass? [1M]

.....

(iii) Explain why bronze is stronger and tougher than pure copper. [2M]

.....

.....

.....

(b) (i) Most composite materials consist of two phases. State the two phases. [1M]

.....

(ii) What is the matrix used in reinforced plastics? [1M]

.....

(iii) Name a substance added in reinforced concrete used in construction of buildings. [1M]

.....

(c)(i) If one molecule of palmitic acids has 16 carbon atoms, write a chemical formula of sodium palmitate. [1M]

.....

(ii) The soap, sodium palmitate does not function effectively in acidic water. Explain. [2M]

.....

.....

.....

[SBPmidyearF507-06]

Figure 6 shows some common polymers.

- Polyethene
- Perspex
- Polymer Q
- PVC
- Protein

FIGURE 6

(a)What is meant by `polymer'? [1M]

.....

.....

(b) The polymerization of glucose produces polymer Q. Name polymer Q. [1M]

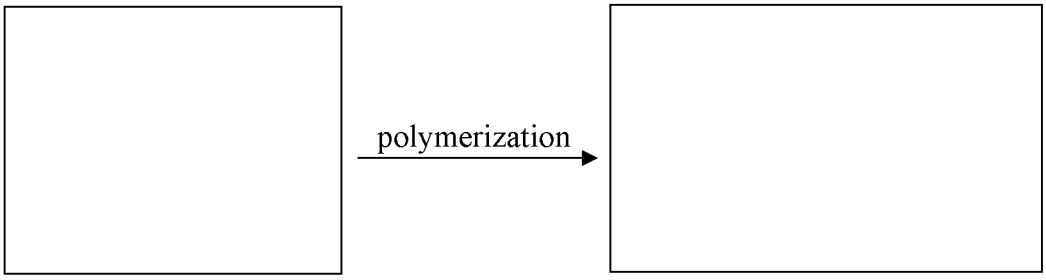
.....

(c) Name the monomer of [2M]

(i) protein : .....

(ii) polyethene : .....

(d) Draw the structural formula for the polymerization of the monomers of polyethene. [2M]



(e) State one example of a natural polymer other than those in the list in Figure 6. [1M]

.....

(f) What is the main source of polyethene, perspex and PVC? [1M]

.....

(g) Explain how PVC causes the environmental problem. [1M]

.....

.....

(h) State one use of perspex in our daily life. [1M]

.....

Essay {Paper02}

[SPM04-09]

(a) Diagram 3.1 shows the waste product from a factory which affects the quality of the environment.

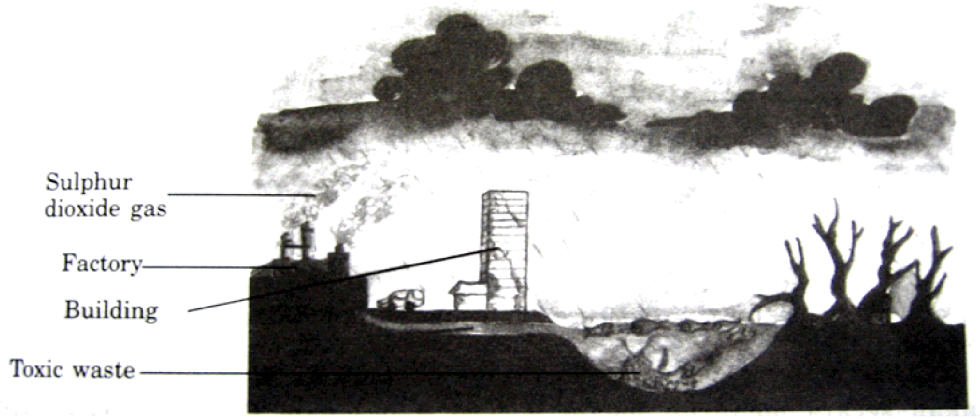


Diagram 3.2

Based on Diagram 3.2, describe how the waste products affect the quality of the environment.

Your description should include the following aspects:
- Source
- Process
- Effect

(c)

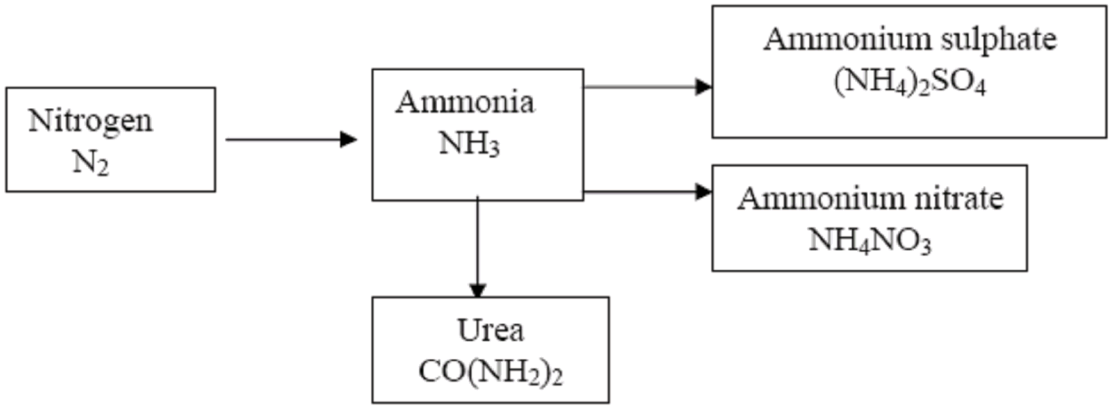
Sarah could easily bend her bangle which is made of pure metal but she could not bend her mother's bangle which is made of alloy.

By using one suitable example, describe a laboratory experiment to show the hardness of the alloy compared to its pure metal.
Explain the difference in hardness of the metal and its alloy in terms of atomic arrangement. [10M]

----------oooOO aĎaŽ OOooo----------

[MRSM05-08c]

(c) The flow chart in Diagram 3 shows how the production of four compounds derived from nitrogen that can be used as fertilizers.



(i) State **two** reasons why ammonia is not suitable to be used directly as fertilizer.[2M]

(ii) Compare the nitrogen content in ammonium sulphate, ammonium nitrate and urea. [3M]
[Relative atomic mass: N=14, H=1, O=16, C=12, S=32]

(iii) Farmers neutralise the acidity of their agricultural soil by adding the alkaline calcium hydroxide. Why do calcium hydroxide and ammonium fertiliser are not suitable to be added to the soil at the same time? [2M]

(iv) Explain briefly how to confirm the presence of ammonium ions in a solution of ammonium fertilizer. [3M]

----------**oooOO aĎaŽ OOooo**----------

[SPM11-08c]

(c). Diagram 8.3 shows substance X produced in the Contact Process used to manufacture detergent. This process also produces pollutant Y.

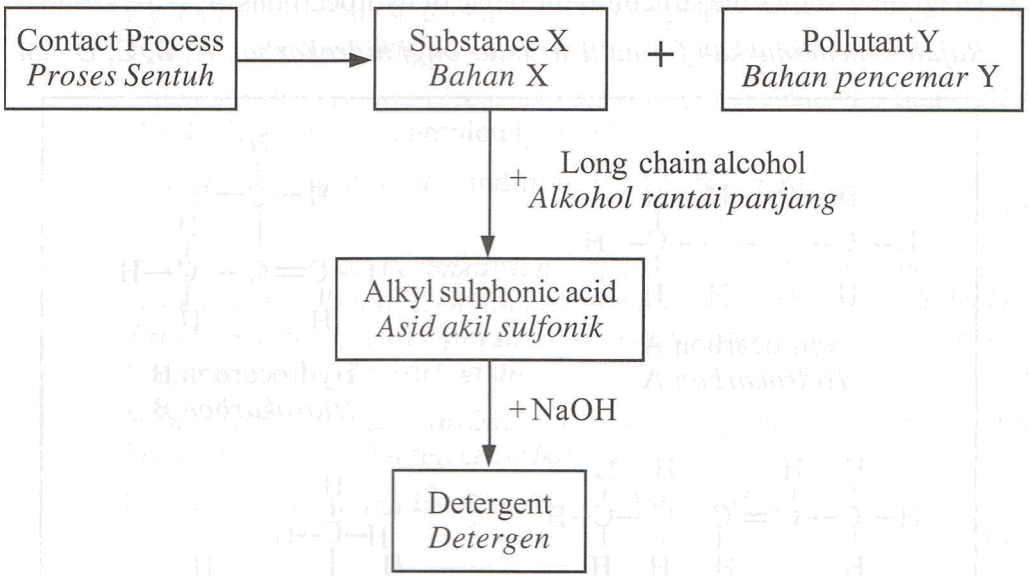


Diagram 8.3

(i). State the names of substance X and pollutant Y. [2M]

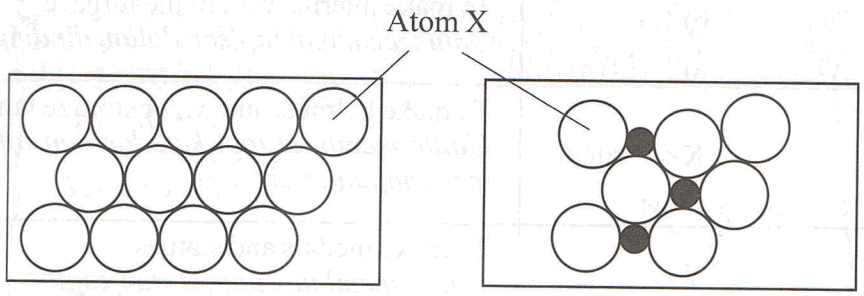
(ii) Describe how pollutant Y can cause environmental pollution. [3M]

(iii). State three effects of pollution caused by pollutant Y. [3M]

----------**oooOO aĎaŽ OOooo**----------

[SPM11-07a]

(a) Diagram 7 shows the arrangement of atoms in two types of materials, A and B. Material B is more suitable than material A to make railway tracks.



Material A Material B

Diagram 7

(i). State the types of material A and material B. [2M]

(ii). Explain, in terms of arrangement of atoms, why material B is more suitable to make railway tracks. [4M]

(b) Table 7 shows five different manufactured substances in industry, V, W, X. Y and Z, and their uses.

Manufactured substances in industry	**Uses**
V	To make glass cookware and boiling tubes
W	To make internal wall of the furnace
X	To make helmets and water storage tanks
Y	To make medals and statues
Z	To make the body of aeroplanes

Table 7

Based on Table 7, state the names of V, W, X, Y and Z.
Give the specific properties of each of the substances to support your answers. [10M]

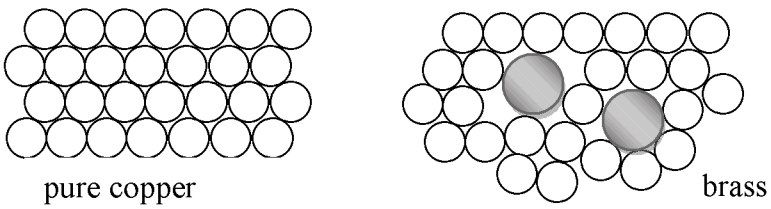
(c). Explain how synthetic polymers can cause environmental pollution. [4M]

----------oooOO aĎaŽ OOooo----------

[SBPdiag08-10]

(a) Describe an experiment to prepare a dry zinc nitrate.
Your answers should include the equations involved. [10M]

(b) Diagram 10 shows the arrangement of atoms in pure copper and brass.



pure copper brass

(i) What is the meaning of alloy? [1M]

(ii) State the **three** aims of alloying. [3M]

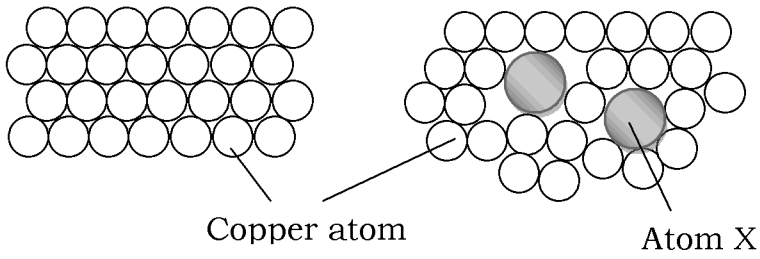
(iii) Brass is harder than pure copper. Explain.[6M]

----------oooOO aĎaŽ OOooo----------

[SBPtrial08-07a,b]

(a) Aeroplane is made from an alloy of aluminium.
What is the name of this alloy? Explain why the low density aluminium is not suitable for building aeroplane. [3M]

(b) Bronze is an alloy of copper. Diagram 7.1 shows the arrangement of atoms in pure copper and bronze.



(i) Name the atom X. [1M]

(ii) Explain why bronze is harder than pure copper. [6M]

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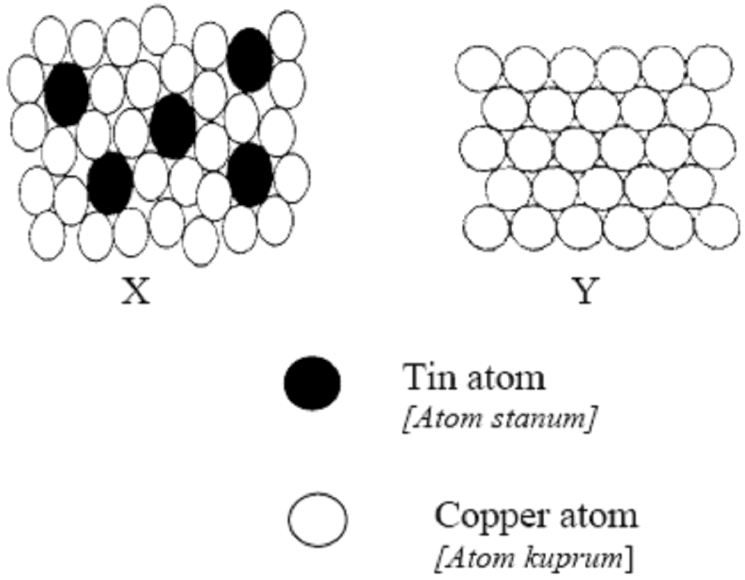
[MRSM07-10b]

(b) Diagram 10.2 shows the arrangement of atoms of two substances, X and Y in solid state.



Based on Diagram 10.2, differentiate the arrangement of atoms and the properties of substance X and Y.[7M]

[SBPtrial09-07]

(a) (i) What is meant by alloy? [2M]

(ii) List two aims of alloying. [3M]

(b) Diagram 7 shows the apparatus set-up to investigate the hardness of copper and bronze.

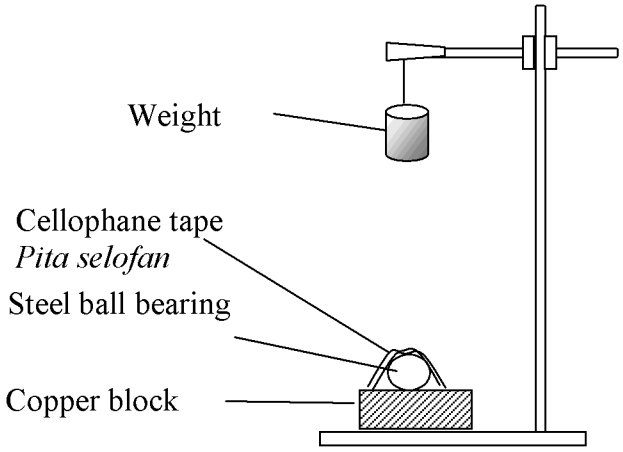


Diagram 7

A steel ball bearing is taped onto the copper block using cellophane tape. A weight of 1 kilogram is dropped at a height of 50 cm to hit the ball bearing. The diameter of the dent made on the copper block is measured. The experiment is repeated by replacing copper block with bronze block. Table 7 shows the results of the experiment.

Type of block	**Diameter of dent (cm)**
Copper	0.5
Bronze	0.2

Table 7

(i) Based on the results of the experiment, compare the hardness between copper and bronze. [1M]

(ii) Explain the difference in hardness between copper and bronze. [5M]

(iii) Draw a labelled diagram to show the arrangement of atoms in copper and bronze. [3M]

(c) Sulphuric acid, H_2SO_4 is manufactured in industry through Contact Process. This process consists of the following stages:

Stage 1	Molten sulphur is burnt in dry air to produce sulphur dioxide. $S + O_2 \text{ --> } SO_2$
Stage 2	Sulphur dioxide and excess oxygen gas are passed over vanadium (V) oxide catalyst at 450°C to produce sulphur trioxide. $2SO_2 + O_2 \rightleftharpoons 2SO_3$
Stage 3	Sulphur trioxide $\xrightarrow{\text{Step } I}$ Oleum $\xrightarrow{\text{Step } II}$ Dilute sulphuric acid

(i) Describe Step I and Step II in Stage 3. [2M]
(ii) Write the chemical equation for Step I and Step II in (c)(i). [2M]

(iii) 48 g of sulphur is burnt completely in oxygen gas in Stage 1.
Calculate the maximum volume of sulphur dioxide gas produced. [2M]
[Relative atomic mass: S=32, O=16; molar volume of any gas is 24 dm^3 mol^{-1} at room temperature and pressure]

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[MRSM08-08a,b,c]

(a) Diagram 8 shows the structural formula of chloroethene or vinyl chloride.

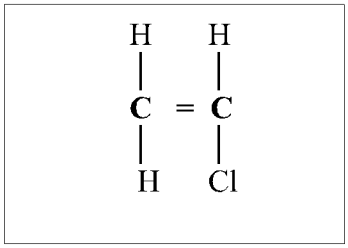

Diagram 8

(i) Vinyl chloride can undergo polymerization. Suggest a name for the polymer formed and write a chemical equation for the reaction.[2M]

(ii) Discuss the following statement: [3M]

The usage of synthetic polymer causes environmental pollution.

(b) Ammonia and sulphuric acid are two important chemicals produced in chemical industries.
Ammonia gas reacts with aqueous sulphuric acid to form a nitrogenous fertilizer as shown in the equation.

$$2NH_3 + H_2SO_4 \text{ -- > } (NH_4)_2SO_4$$

Calculate the mass of ammonium sulphate produced when an excess ammonia gas is passed into 100 cm^3 of 2.0 mol dm^{-3} of aqueous sulphuric acid solution.
[Molar mass of ammonium sulphate = 132 g mol^{-1}][3M]
(c) "Pure aluminium rod is malleable while duralumin which is made of 95% aluminium and 5% copper is not".
Explain how the difference in the composition contributes to the difference in properties of aluminium and duralumin.[5M]

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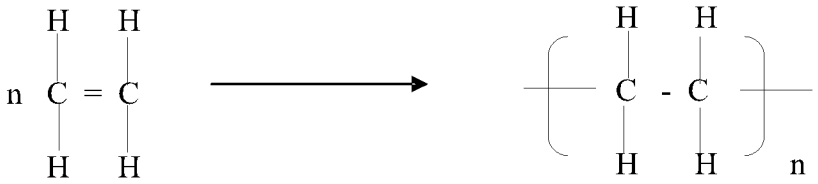
[MRSM05-08b]

(b) Polythene and polypropene are synthetic polymers widely used in daily life. The following chemical equation shows the polymerisation of ethene to polyethene



(i) Write the chemical equation for the polymerisation of propene to polyethene.[1M]

(ii) Explain the usage of synthetic polymer substances that can contribute towards the problems of environmental pollution.[3M]

(iii) Suggest **two** ways how the problems in b(ii) could be reduced. [2M]

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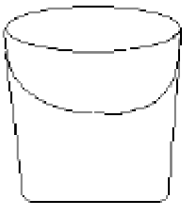
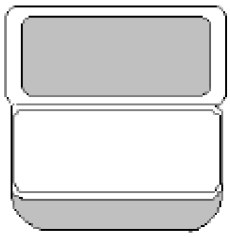
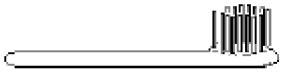
[MRSM06-08d]

(d) Diagram 8.3 shows the usage of several synthetic polymers in daily life's.

		
Polytena	polystyrene	nylon

Explain the sources and the effects of pollution due to the widely usage of synthetic polymers. [5M]

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[MRSM11-08a]
(*a*) The major component of glass is silica while in ceramic is silicate.
Compare and contrast the properties of glass and ceramic. [4M]

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Essay {Paper03]

[SPM05-03]

Choose one of the following tasks:

Tasks 1
The copper wire in an electric cable can be easily bent by hand, a one-cent coin made of an alloy of copper with tin and zinc cannot be bent easily.

Referring to the situation above, plan a laboratory experiment to investigate the effect of alloy formation on the hardness of a metal.

Your planning must include the following items: [17M]

(a) Statements of the problem
(b) All the variables
(c) Lists of substances and apparatus
(d) Produce
(e) Tabulation of data

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[SPM03-03]

If the body a car is made of iron, it would easily rust. This is because the iron surface is exposed to air and water. It is also easily dented in an accident. Thus, to reduce these problems the body of the car is made of steel.

Referring to the above situation, design a laboratory experiment to compare iron and steel based on one of the following properties:

Hardness or rust resistance

In designing your experiment it must include the following items: [17M]

(a) Problem statement
(b) Hypothesis
(c) Lists of substances and apparatus
(d) Procedure
(e) Tabulation of data

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