Student Number	
Theory Mark / 46	

Chemistry

2010 Half Yearly Year 11 Examination

Theory and Data Processing

General Instructions

- Reading time – 5 minutes
- Working time – 80 minutes
- Write using black or blue pen
- Write your Student Number at the top of this page and on the response sheet on page 9.
  A data sheet and a periodic table are provided at the back of the paper and may be removed for student convenience.

Theory

Total Marks – 46

Part A – 12 marks
Attempt Questions 1 – 12

Part B – 34 marks
Attempt Questions 13-23

Data Processing

Total Marks – 15 marks
Attempt Questions 1-3

Part A- Multiple Choice 12 marks
Attempt Questions 1-12
Allow about 15 minutes for this part

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

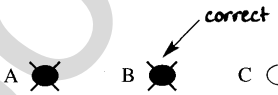
Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ● C ○ D ○

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ● B ⊗ C ○ D ○

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.



▸ **Mark your answers for Questions 1- 12 in the Answer Box on page 8**

1. A mixture of oil, salt, sawdust and water are to be separated into their individual components, each component being collected separately. What sequence of steps should be followed to do this separation and collection?

(A) decantation→ filtration → separating funnel → evaporation

(B) filtration → separating funnel → distillation

(C) fractional distillation →filtration → decantation

(D) filtration → separating funnel →evaporation

2. If the formula for sodium chlorotitanate is Na_2TiCl_6, what is the correct formula for zinc chlorotitanate?

(A) $ZnTiCl_6$

(B) Zn_2TiCl_6

(C) $Zn(TiCl_6)_2$

(D) $Zn_2(TiCl_6)_3$

3. Consider the following substances: calcium, neon, chlorine, oxygen and carbon dioxide. Which of the above substances exist as molecules in nature?

(A) all the substances

(B) chlorine, oxygen and carbon dioxide only

(C) neon, chlorine, oxygen and carbon dioxide only

(D) neon, chlorine and oxygen only

4. Sodium is not normally mined as sodium metal but is obtained by electrolyzing molten sodium chloride. What is the most likely reason for using this method of extraction?

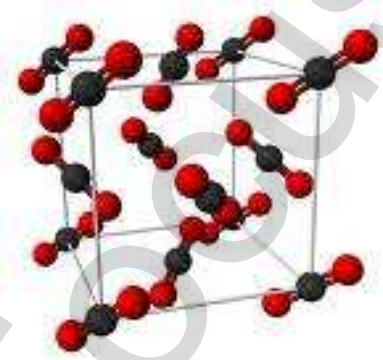
(A) it requires less energy to electrolyse molten sodium chloride than to dig up sodium metal from the ground.

(B) sodium is too reactive to handle while being mined

(C) sodium chloride is readily available than is sodium metal

(D) sodium is too reactive to exist in nature as a native element

5. The diagram below represents the structure of a solid chemical substance.



Which of the following is the solid most likely to be?

(A) silver

(B) carbon dioxide

(C) graphite

(D) sodium chloride

6. Which of the following is an empirical formula?

(A) N_2O_4

(B) NH_4NO_3

(C) Na_4O_2

(D) Na_2O

7. Which of the following descriptions best explains the electrical conductivity of metals?

(A) mobile ions transfer charge

(B) mobile valence electrons transfer charge

(C) mobile cations transfer charge

(D) mobile anions transfer charge

8. The uses of metals through history are categorised as follows:

Stone Age	Up to 3000 BC
Copper Age	3200 – 2300 BC
Bronze Age	2300 – 700 BC
Iron Age	700 BC – 1 AD
Modern Age	1 AD – present time

Which reason best accounts for this sequence?

(A) Bronze is harder than copper, is easily melted and is more malleable than copper.

(B) Iron can be extracted by heating copper ores with charcoal.

(C) The extraction of iron from its ores is easier than copper and aluminium.

(D) The extraction of metals depends upon the energy and extraction methods available at the time.

9. Consider the properties of the following substances M, Q, R and T.

Substance	MP (^{0}C)	Electrical conductivity	
		Solid state	Liquid state
M	-102	Nil	Nil
Q	1423	Nil	Conducts
R	3600	Nil	Nil
T	1535	Conducts	Conducts

Which of the following correctly identifies M, Q, R and T as covalent molecular, metallic, covalent network or ionic?

	M	Q	R	T
A	network covalent	ionic	covalent molecular	metallic
B	covalent molecular	metallic	network covalent	ionic
C	network covalent	metallic	covalent molecular	ionic
D	covalent molecular	ionic	network covalent	metallic

10. Which statement describes the trend for metals in Groups 1 and 2 of the Periodic Table with respect to their chemical reactivity?

(A) Reactivity decreases up the group.

(B) Reactivity increases down the group.

(C) Group 1 metals are less reactive than Group 2 metals.

(D) There is no difference between the reactivity of the Group 1 and Group 2 metals.

11. Which substances may be combined to make the common alloy, bronze?

(A) copper and carbon

(B) Iron and brass

(C) Copper and tin

(D) Zinc and oxygen

12. What is the name of the product when solid lead is heated with air?

(A) Lead (II) oxide

(B) Lead (III) oxide

(C) Lead (II) hydroxide

(D) Hydrogen

This page left deliberately blank

Student number	

Part A: Answer grid for multiple choice questions.

1.	A O	B O	C O	D O
2.	A O	B O	C O	D O
3.	A O	B O	C O	D O
4.	A O	B O	C O	D O
5.	A O	B O	C O	D O
6.	A O	B O	C O	D O
7.	A O	B O	C O	D O
8.	A O	B O	C O	D O
9.	A O	B O	C O	D O
10.	A O	B O	C O	D O
11.	A O	B O	C O	D O
12.	A O	B O	C O	D O

Mark	

Part B. 34 marks
Attempt Questions 13 - 23
Allow about 40 minutes for this part
▸ ***Show all relevant working in questions involving calculations.***

Question 13 (2 marks)

Use the particle theory to explain the difference between nitrogen and nitrogen dioxide.

.....

.....

.....

.....

.....

.....

Question 14 (3 marks)

Use Lewis electron dot structures to show the formation of magnesium chloride from elemental magnesium and chlorine.

Question 15 (5 marks)

Shown below is a simplified periodic table showing only the main group elements (no transition elements). The group numbers are given on top of each corresponding group. Fictitious names for the elements are given.

I							**VIII**
Q	***II***	***III***	***IV***	***V***	***VI***	***VII***	*Fg*
Wf	*A*	*Bg*	*X*	*Av*	*Pj*	*Yk*	*De*
E	*Sk*	*Ns*	*Cq*	*Zx*	*Kj*	*Rt*	*Ws*
R	*D*	*M*	*Vu*	*So*	*Lh*	*Tm*	*Ak*
T	*Fn*	*Kc*	*Qc*	*Ah*	*Gw*	*Pm*	*Hy*
Y	*Hz*	*L*	*Ws*	*Fb*	*Eg*	*Mp*	*Ed*
Ua	*J*	*Z*	*Uv*				

(a) Write the electronic configuration of *Av* and the period to which it belongs.(2 marks)

Electronic configuration ……..... Period …….....

(b) Construct a formula for the compound formed from *Zx* and *Lh* (1 mark)

.....

(c) Describe a possible use for *Ns* based on a physical property and state this property. (2 marks)

.....

.....

Question 16 (4 marks)

Elemental iron is strongly magnetic but iron bonded in a compound is not. A student found a lump of a substance containing iron and iron oxide. He wanted to determine how much elemental iron was present in the sample. Suggest a step by step procedure to determine the percentage of iron in the sample by physical means only using equipment found in the school laboratory.

.....

.....

.....

.....

.....

.....

.....

.....

.....

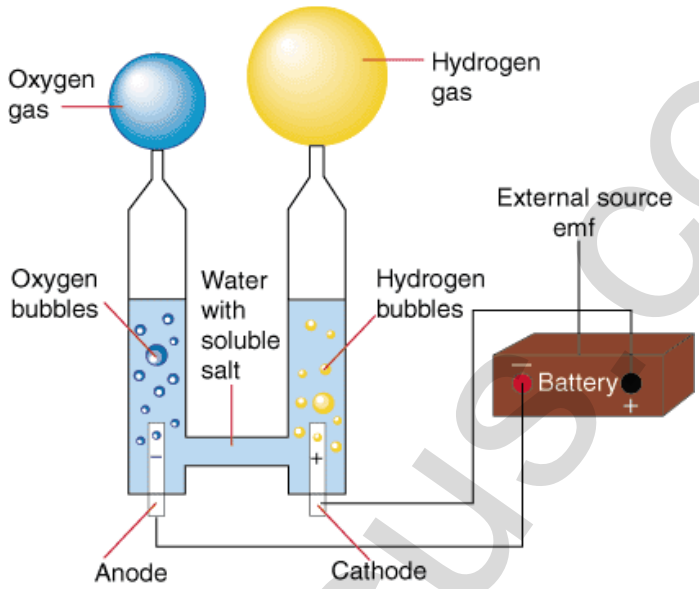
Question 17 (3 marks)

Complete the table by giving the names or formulae of the following substances.

Name	*Formula*
Ammonium sulfate	
Aluminium carbonate	
Nitrogen dioxide	
	KNO_3
	Na_2O
	CuS

Question 18 (3 marks)

Consider the diagram for the electrolysis of water.



Identify the electrolysis of water as a physical or chemical process and give reasons for answer.

.....

.....

.....

.....

.....

.....

Question 19 (4 marks)

During your practical work you performed a first- hand investigation to show the decomposition of a carbonate by heat.

(a) Give a balanced chemical equation for the decomposition reaction of a carbonate. (1 mark)

.....

(b) Outline two observations that indicated that a reaction had taken place. (2 marks)

.....

.....

.....

(c) Outline one test you performed to determine the nature of one of the products formed. (2 marks)

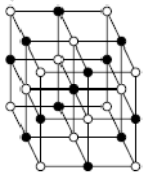
.....

.....

.....

Question 20 (5 marks)

The arrangement of potassium ions and fluoride ions in potassium fluoride is represented in the following diagram. The arrangement extends in three dimensions to represent a crystal.



KEY
● = K^+
○ = F^-

(a) Would it be possible for magnesium fluoride to have the same structure as potassium fluoride? Give a reason for your answer. (1 mark)

.....

.....

(b) In terms of the bonds involved, explain why potassium fluoride has a much higher melting point (857^0C) than carbon tetra fluoride (-184^0C). (2 marks)

.....

.....

.....

(c) Explain why aqueous potassium fluoride is a good conductor of electricity while solid potassium fluoride is not. (2 marks)

.....

.....

.....

.....

Question 21 (2 marks)

Calcium reacts vigorously with dilute sulfuric acid at room temperature.

Write half-equations to describe the electron transfer associated with this reaction. (2 marks)

.....

.....

Question 22 (1 mark)

Potassium reacts violently with water at room temperature.

Write balanced formulae equation to describe the reaction between potassium and water at room temperature. (1 mark)

.....

Question 23 (2 marks)

The observations made by a group of students when adding several common metals to water, steam (water gas) and an acid are presented in the table. The metals are represented fictitiously by the symbols, W, X, Y and Z. The metals are listed in no particular order.

	W	X	Y	Z
Dilute HCl (aq)	N	small amount of bubbling, metal slowly disappears	large amount of bubbling, no metal remains	large amount of bubbling, no metal remains
H_2O (l) at 25^oC	N	N	bubbles, no metal remains	N
H_2O (g) (steam)	N	N	no metal remains	no metal remains

Note. N = no observable reaction.

(a) In the space below list the metals in order from most active to least active. (1 mark)

Most active → Least active

Metal list: ....

(b) Describe the relationship between the relative reactivity of these metals and their first ionisation energy. (1 mark)

.....

.....

End of Theory Test – Continue with the Data Processing……

Student Number	
Mark / 15	

Chemistry

2009 Half Yearly Year 11 Examination

Data Processing

General Instructions

- Write using black or blue pen
- Draw diagrams using pencil
- Data source material is included in this task

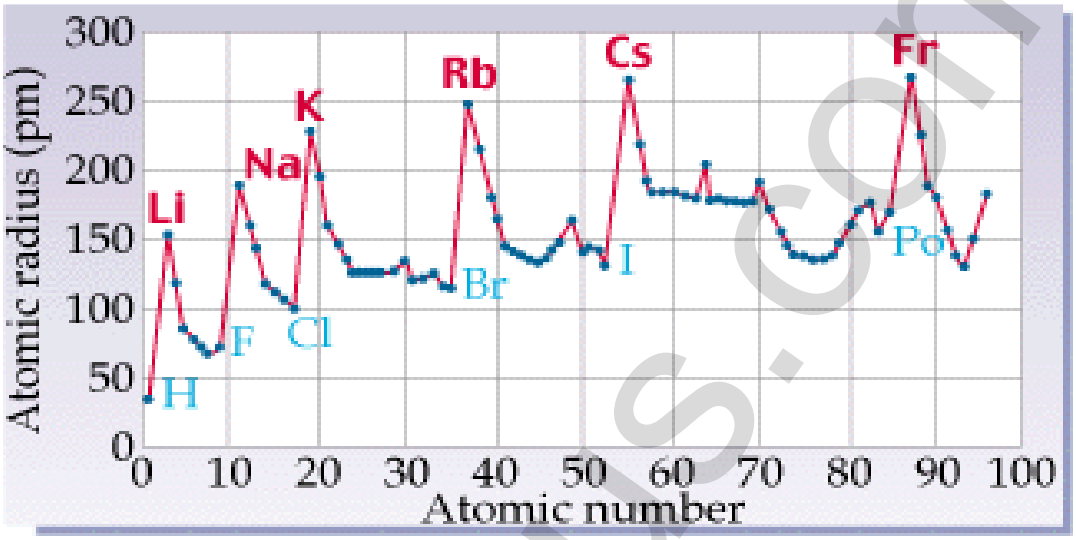
Data Processing

Total Marks – 15

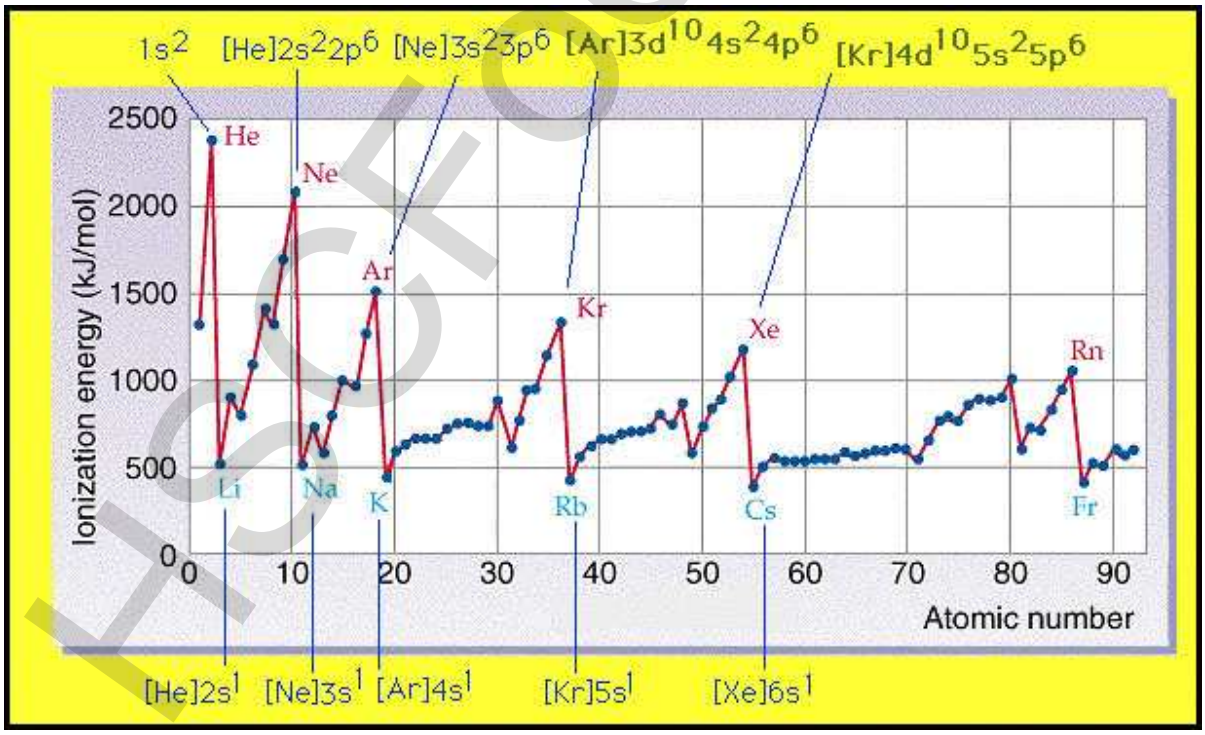
Allow about 25 minutes for this part

Question 1 (4 marks)
Use graph A and graph B below to answer Question 1.

Graph A – Atomic Radius vs Atomic Number



Graph B – First Ionisation energy of Elements



Compare and contrast four significant features of Graph A and Graph B above. (4 marks)

……

……

……

……

……

……

Continued over the page

Question 2 (7 marks)Use the diagram below and the table on page 21 to answer the following questions.

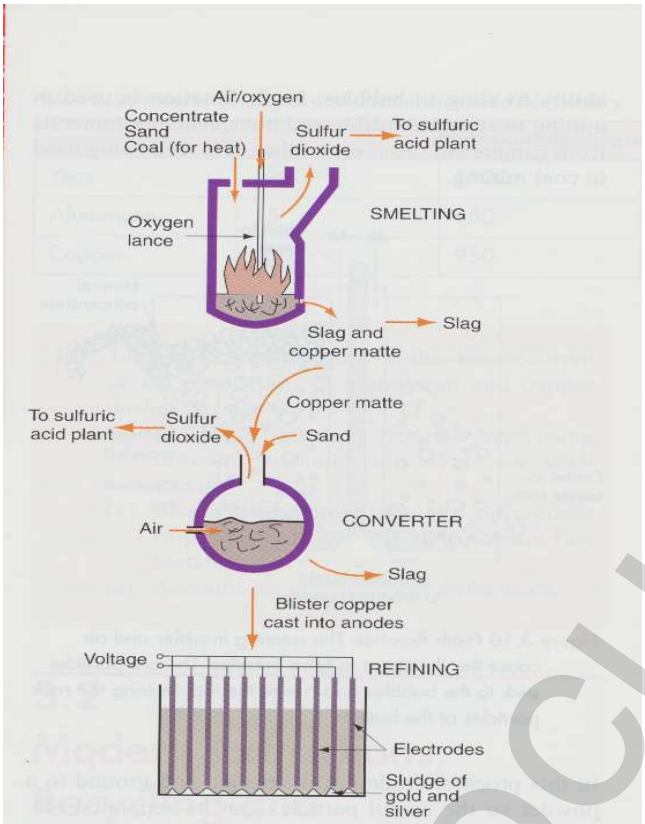


Figure 3.11 Producing copper In the Isasmelt process, copper ore is first smelted in a modern furnace before being sent to the converter

The main copper ores contain chalcopyrites ($CuFeS_2$) .
After a series of physical separation processes, the copper mineral must be treated chemically to extract copper from the compounds present in the ores. A common method used in the chemical separation process involves mixing the mineral concentrate($CuFeS_2$) with sand(SiO_2) and coal and placing into a furnace. Oxygen is added and the intense heat causes the ore to be smelted.

The chemical equations below show the reactions which occur :

$$2CuFeS_{2(s)} + 4O_{2(g)} \rightarrow Cu_2S_{(l)} + 2FeO_{(s)} + 3SO_{2(g)}$$

$$FeO_{(s)} + SiO_{2(s)} \rightarrow FeSiO_{3(l)}$$

The copper(I) sulfide is heated in a converter with oxygen blown through to extract the copper from the copper(I) sulfide. Sand is added to remove the remaining iron oxide.

The chemical equations for these reactions in the converter are shown below :

$Cu_2S_{(s)} + O_{2(g)} \dashrightarrow 2Cu_{(l)} + SO_{2(g)}$

$FeO_{(s)} + SiO_{2(s)} \rightarrow FeSiO_{3(l)}$

The overall reaction is :

$2CuFeS_{2(s)} + 5O_{2(g)} \dashrightarrow 2Cu_{(s)} + 2FeO_{(s)} + 4SO_{2(g)}$

(a) At various stages of the production of copper from its ore, the percentages of the elements present change as shown in the Table below :

Percentage of elements present

Stage	Copper %	Iron %	Sulfur %	Sand %
Concentrate (copper)	25	33	32	3
Slag	0.6	36	0.1	34
Blister copper	98	0.1	0.2	0
Pure copper	99.99	0	0	0

i. Identify the process used to convert concentrate (copper) to blister copper. (1 mark)

……

ii. Identify the process used to convert blister copper to pure copper. (1 mark)

……..

(b) Distinguish between concentrate (copper) and blister copper using information given in the table above. (2 marks)

……

……

(c) Calculate the mass of copper metal that could be extracted from 50 kg of concentrate (copper). (3 marks)

……..

……

……

Question 3 (4 marks)

Use the flow chart diagram below, showing the Extraction of Aluminium, to answer the following questions.

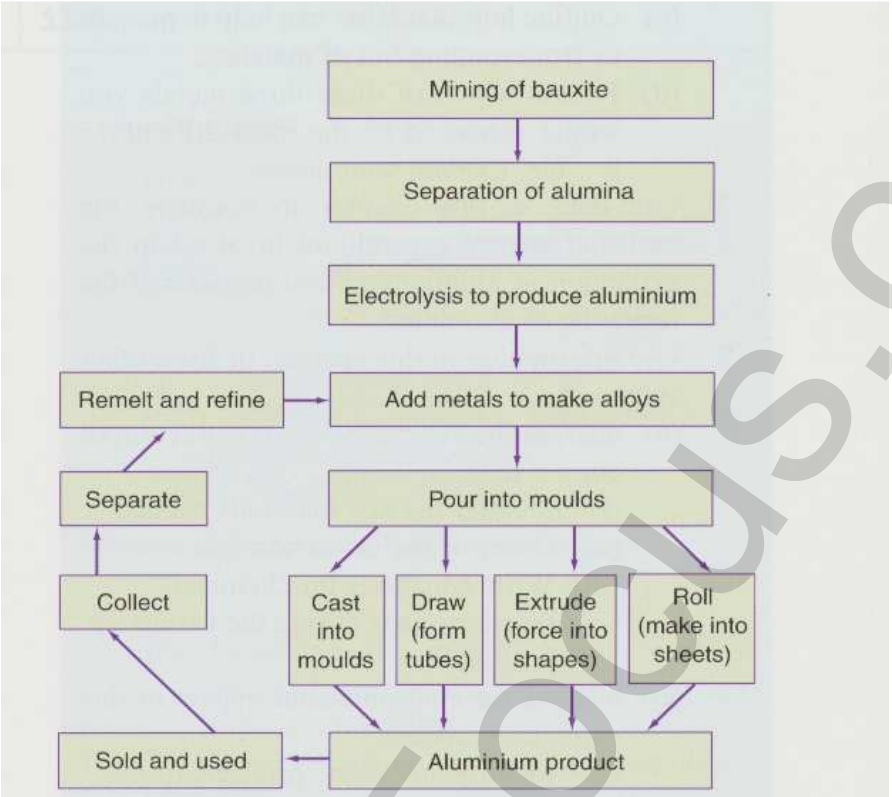
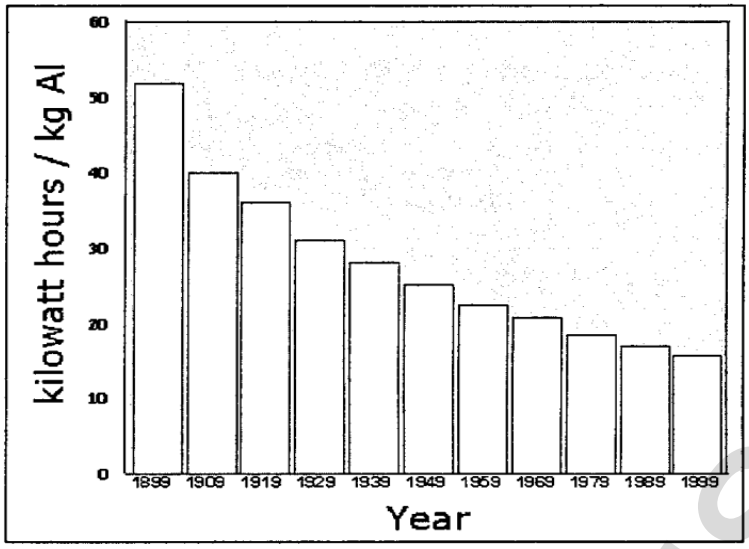


Figure 3.18 Aluminium cycle Using and reusing aluminium

Energy Usage for the Production of Aluminium over time



(a) Identify the trend in energy usage in the production of Aluminium, shown in the graph above. (1 mark)

……..

(b) Account for the trend in energy usage using information in the diagram above. (3 marks)

……..

……..

……..

……..

……..

End of Data Processing
End of Test