BAB 4: KEREAKTIFAN LOGAM
CHAPTER 4: REACTIVITY OF METALS

4.1 KEPELBAGAIAN MINERAL/ VARIETY OF MINERALS

A. Apakah mineral?/ What are minerals?

1. **Mineral** = bahan pepejal semulajadi dgn struktur kristal & komposisi kimia tertentu
Minerals = natural solid substances with definite crystalline structure and chemical composition

- ditemui dalam batuan dalam kerak Bumi
found in rocks in Earth's crust

- boleh jadi unsur atau sebatian/ can be elements or compounds

2. Unsur mineral/Mineral elements:
– emas, perak, berlian/ gold, silver, diamond

Emas/ gold	Perak/ silver	Berlian/ diamond
		

3. Sebatian mineral/ Mineral compounds:

Nama umum *Common name*	*Nama sistematik* *Systematic name*	*Gabungan unsur* *Element combination*
Hematit Hematite	Ferum (III) oksida Iron (III) oxide	Ferum, oksigen Iron, oxygen

Kasiterit Cassiterite	Timah (IV) oksida Tin (IV) oxide	Timah, oksigen Tin, oxygen
Bauksit Bauxite	Aluminium oksida Aluminium oxide	Aluminium, oksigen Aluminium, oxygen
Galena	Plumbum (II) sulfida Lead (II) sulphide	Plumbum, sulfur Lead, sulphur
Batu kapur/ kalsit Limestone/ calcite	Kalsium karbonat Calcium carbonate	Kalsium, oksigen, karbon (KOK) Calcium, oxygen, carbon (COC)

4. Fokus – **batu kapur**/ Focus – **limestone:**

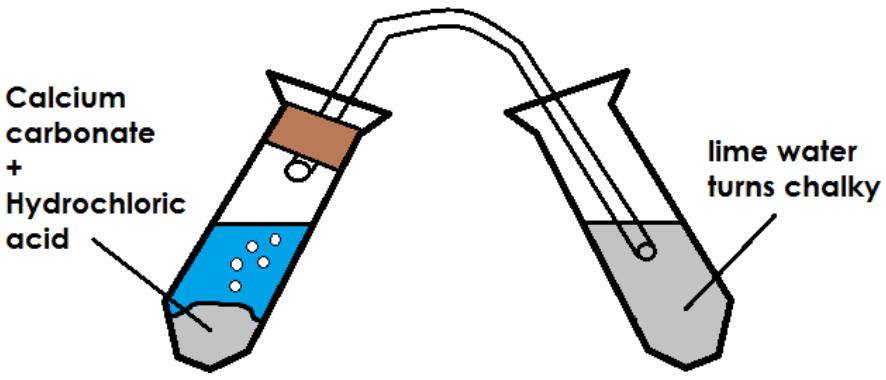
a. Unsur dalam batu kapur – **KOK (kalsium, oksigen, karbon)**
Elements in limestone – **COC (calcium, oxygen, carbon)**

b. Tindak balas melibatkan batu kapur/ Reactions involving limestone:

i. Tindak balas dgn asid:
Reaction when mixed with acid:

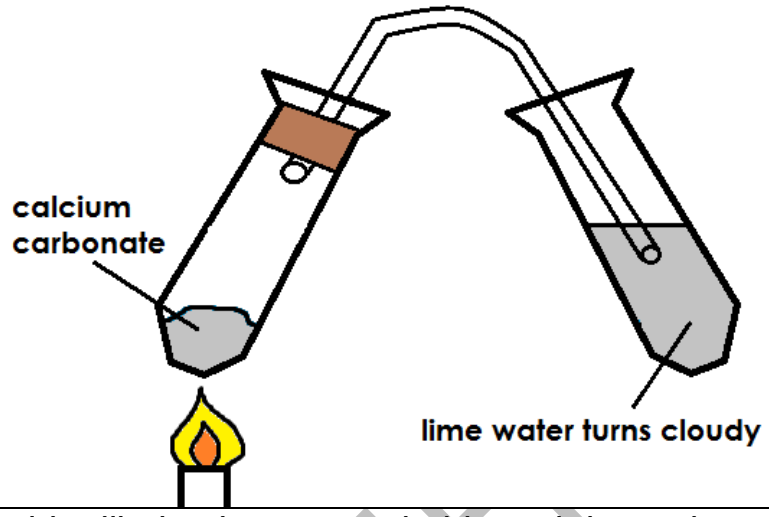
Kalsium karbonat + asid hidroklorik → kalsium klorida + air + karbon dioksida

Calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide



ii. Tindak baals apabila dipanaskan:
Reaction when heated:

Kalsium karbonat → kalsium oksida + karbon dioksida
Calcium carbonate → calcium oxide + carbon dioxide



**karbon dioksida dibebaskan menyebabkan air kapur bertukar keruh*
**carbon dioxide released turns the limewater cloudy*

c. Kegunaan batu kapur/ Uses of limestone:

i. Bahan binaan/ Building material 	ii. Bina jalan/ Road construction 
iii. Buat simen/ make cement 	iv. Meneutralkan asid dalam tanah/ neutralise acidic soil 

4.2 SIRI KEREAKTIFAN LOGAM/ REACTIVITY SERIES OF METALS

A. Siri Kereaktifan/ The Reactivity Series

1. Siri melibatkan 8 unsur/ series involves 8 elements **(MAC ZHILC)**

Mg **M**agnesium	Al **A**luminium	C **C**arbon	Zn **Z**inc	H **H**ydrogen	Fe **I**ron (Besi)	Pb **L**ead (Plumbum)	Cu **C**opper (Kuprum)

Semakin reaktif
(Tindak balas semakin cergas)

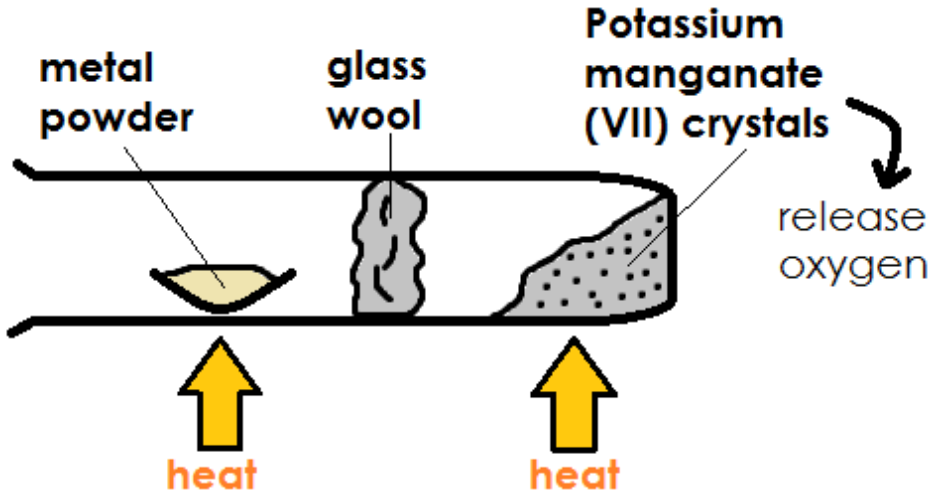
More reactive
(more vigorous reaction)

Semakin kurang reaktif
(Tindak balas kurang cergas)

Less reactive
(less vigorous)

Hipotesis: **semakin tinggi kedudukan dlm siri, semakin reaktif logam**
Hypothesis: **the higher the position in the series, the more reactive the metal**

2. Eksperimen – tindak balas logam dan oksigen:
Experiment – reaction of metal with oxygen:



Persamaan 1 Equation 1	Magnesium + Oksigen → Magnesium oksida Magnesium + Oxygen → Magnesium oxide
Pemerhatian 1 Observation 1	Magnesium terbakar **dgn terang** Magnesium burns **brightly**
Inferens 1 Inference 1	Magnesium adalah logam yg sgt reaktif Magnesium is a very reactive metal

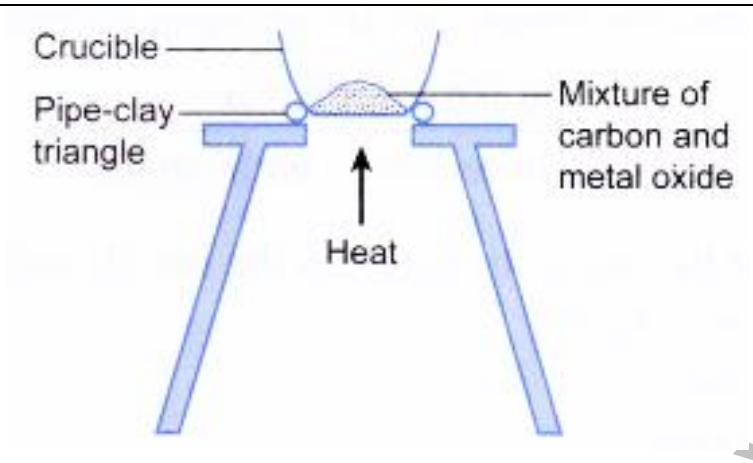
Persamaan 1 Equation 2	Kuprum + Oksigen → Kuprum oksida Copper + Oxygen → Copper oxide
Pemerhatian 2 Observation 2	Kuprum terbakar **dgn malap** Copper burns **dimly**
Inferens 2 Inference 2	Kuprum adalah logam kurang reaktif Copper is a less reactive metal

Kesimpulan – Magnesium adalah lebih reaktif berbanding kuprum
Conclusion – Magnesium is more reactive than copper

B. Kedudukan Karbon dalam Siri/ Position of Carbon in the Series

1. Eksperimen/ experiment:

Mg **M**agnesium	Al **A**luminium	C **C**arbon	Zn **Z**inc	H **H**ydrogen	Fe **I**ron	Pb **L**ead	Cu **C**opper
Tiada t/b No reaction			**Campuran terbakar dgn terang Mixture burns brightly**				



2. Persamaan/ Equation:

Aluminium oksida + Karbon → (tiada t/b) Aluminium oxide + Carbon → (no reaction)
Zink oksida + Karbon → Karbon dioksida + Zinc Zinc oxide + Carbon → Carbon dioxide + Zinc
Plumbum (II) oksida + Karbon → Karbon dioksida + Plumbum Lead (II) oxide + Carbon → Carbon dioxide + Lead

- Karbon boleh menyingkirkan oksigen drpd logam oksida jika karbon lebih reaktif drpd logam tersebut
- Carbon can remove oxygen from metal oxide if carbon is more reactive than the metal

3. Kesimpulan/ Conclusion:

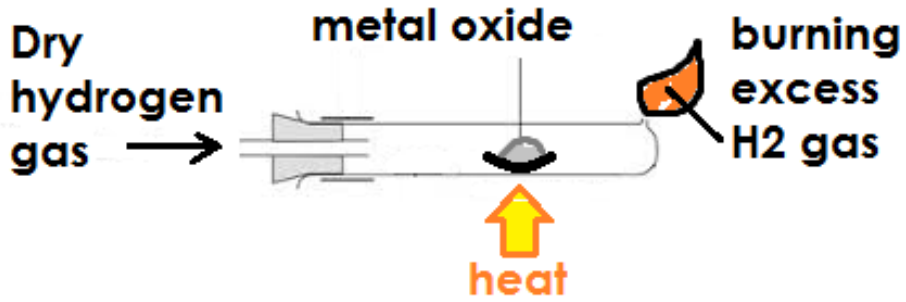
- Karbon boleh menyingkirkan oksigen drpd zink oksida kerana karbon lebih reaktif drpd zink
Carbon can remove oxygen from zinc oxide because carbon is more reactive than zinc

- Karbon tidak boleh menyingkirkan oksigen drpd aluminium oksida kerana karbon kurang reaktif drpd aluminium
Carbon cannot remove oxygen from aluminium oxide because carbon is less reactive than aluminium

C. Kedudukan Hidrogen dalam Siri/ Position of Hydrogen in the Series

2. Eksperimen/ experiment:

Mg **M**agnesium	Al **A**luminium	C **C**arbon	Zn **Z**inc	H **H**ydrogen	Fe **I**ron	Pb **L**ead	Cu **C**opper
Tiada t/b No reaction					**Logam oksida terbakar dgn terang/ Metal oxide burns brightly**		



2. Inferens/ Inferences:

- Hidrogen tidak menurunkan magnesium oksida
- Hidrogen menurunkan ferum (III) oksida kepada besi
- Hidrogen menurunkan plumbum (II) oksida kepada plumbum
- Hidrogen menurunkan kuprum (II) oksida kepada kuprum

- Hydrogen does not reduce magnesium oxide
- Hydrogen reduces iron (III) oxide to iron
- Hydrogen reduces lead (II) oxide to lead
- Hydrogen reduces copper (II) oxide to copper

3. Kesimpulan/ conclusion:

- Hidrogen kurang reaktif drpd magnesium
- Hidrogen lebih reaktif drpd besi, plumbum, & kuprum

- Hydrogen is less reactive than magnesium
- Hydrogen is more reactive than iron, lead, & copper

4.3 PENGEKSTRAKAN LOGAM DRPD BIJIHNYA/ EXTRACTION OF METALS FROM THEIR ORES

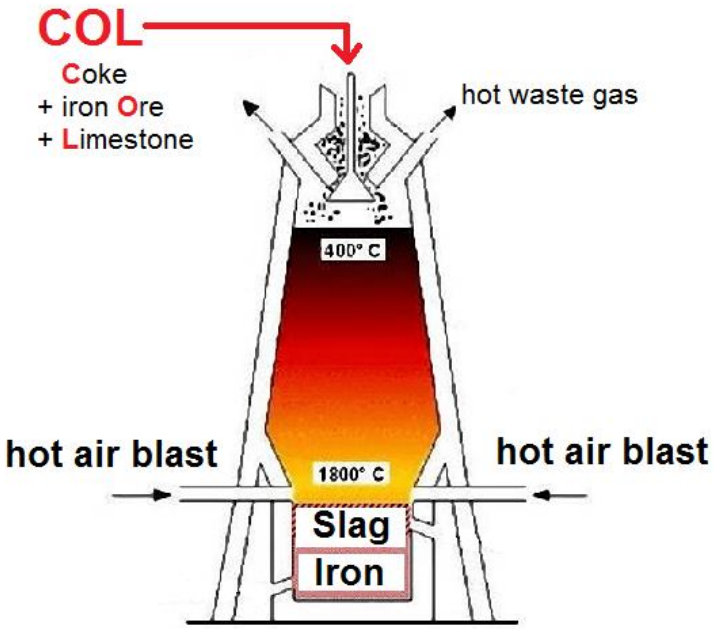
1. Bagaimana logam-logam diekstrak?/ How the metals are extracted?
Siri kereaktifan/ Reactivity series:

MORE REACTIVE

LESS REACTIVE

Semua atas karbon/ All above carbon	Guna **elektrolisis** Use **electrolysis**
Karbon/ Carbon	
Semua bawah karbon: zink, besi, timah, plumbum All below carbon: zinc, iron, tin, lead	Guna **relau bagas** - logam dipanaskan bersama karbon Use **blast furnace –** metals are heates with carbon
Kuprum & merkuri Copper & mercury	Dipanaskan secara terus Use direct heating
Perak & emas Silver & gold	Dijumpai dalam kerak Bumi Found in Earth's crust

2. Mengekstrak besi menggunakan relau bagas/
Extracting iron using blast furnace:



a. Persamaan/ Equation:

i. **Arang kok (karbon)** bertindak balas dgn oksigen
Coke (carbon) reacts with oxygen:

Karbon + oksigen → karbon dioksida + haba
Carbon + oxygen → carbon dioxide + heat

ii. Karbon dioksida bertindak balas dgn karbon:
Carbon dioxide reacts with carbon:

Karbon dioksida + karbon → karbon monoksida
Carbon dioxide + carbon → carbon monoxide

iii. Karbon & karbon monoksida menurunkan bijih besi kpd besi
Carbon and carbon monoxide reduces iron ore to iron:

(Bijih besi)
Ferum oksida + karbon → karbon dioksida + besi
(Iron ore)
Iron oxide + carbon → carbon dioxide + iron

(Bijih besi)
Ferum oksida + karbon monoksida → karbon dioksida + besi
(Iron ore)
Iron oxide + carbon monoxide → carbon dioxide + iron

Ferum oksida boleh jadi **ferum (II) oksida atau **ferum (III) oksida***
Iron oxide can be **iron (II) oxide or iron (III) oxide*

b. Bagaimana **selanga (kalsium silikat)** dihasilkan:
How **slag (calcium silicate)** is produced:

Batu kapur → kalsium oksida + karbon dioksida
Limestone → calcium oxide + carbon dioxide

↓

kalsium oksida + silikon dioksida → kalsium silikat
calcium oxide + silicon dioxide → calcium silicate

-silikon dioksida ialah bendasing
silicon dioxide is the impurities

- maka, fungsi batu kapur ialah utk menyingkirkan bendasing sbg selanga utk menghasilkan besi tulen
so, the function of limestone is to remove impurities as slag to produce pure iron

- selanga dpt digunakan sbg bahan utk bina bangunan & jalan
slag can be used to as materials for constructing buildings and roads

c. Hembusan udara panas dibekalkan utk mengekalkan suhu tinggi
- krn proses pengekstrakan ialah proses endotermik

Hot air blast is provided to keep temperature high
- because the extraction process is endothermic

3. Isu perlombongan/ Mining issues:

a. **Pencemaran** – udara, air, bunyi
Pollution – air, water, sound

b. **Pembaziran tenaga** – perlombongan guna banyak tenaga elektrik
Energy wastage – because mining uses too much electrical energy

c.**Kemusnahan tanah** – hakisan, penyahutanan, kebinasaan habitat
Land destruction – such as soil erosion, deforestation, habitat destruction

Cara mengawal isu/ How to handle issues:

a. **Kitar semula logam** – utk kurangkan permintaan perlombongan
Recycle metals – to reduce the demand for mining

b. **Guna teknologi hijau (penapis)** – utk kurangkan pencemaran
Use green technologies (filters) – to reduce pollution

c. **Guna mesin lebih baik** – kurangkan pencemaran & pembaziran
Use better machineries – to reduce pollution and energy usage

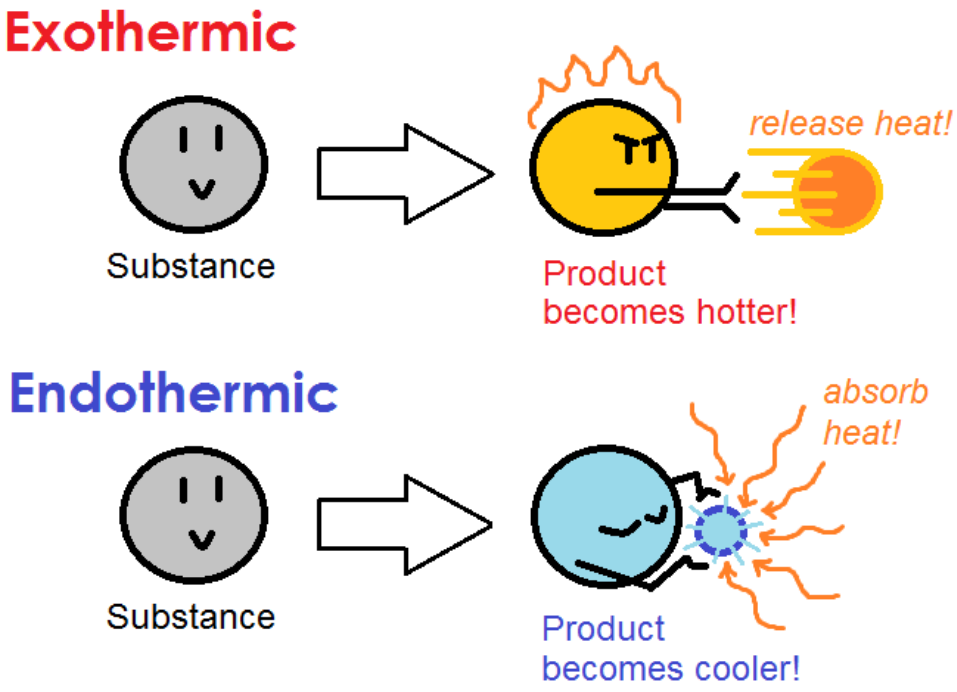
d. **Kuatkuasa undang2 & pengurusan lebih baik** – kurangkan kerosakan tanah
Law enforcement and better management – to reduce land destruction

BAB 5: TERMOKIMIA
CHAPTER 5: THERMOCHEMISTRY

1. **Termokimia** = t/b kimia yg melibatkan perubahan haba
- 2 jenis: **endotermik** & **eksotermik**

Thermochemistry = chemical reactions involving heat change
- 2 types: **endothermic** and **exothermic** reactions

A. ENDOTHERMIC AND EXOTHERMIC REACTIONS

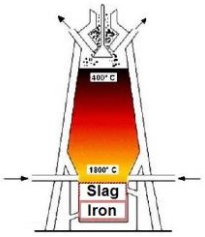


ENDOTERMIK ENDOTHERMIC	EKSOTERMIK EXOTHERMIC
Haba diserap drpd persekitaran Heat is absorbed from the surrounding	Heat dibebaskan ke persekitaran Heat is released into the surrounding
Menyebabkan suhu menurun Result in drop of temperature	Menyebabkan suhu meningkat Result in rise in temperature

Contoh/ Examples:	Contoh/ Examples:
- melarutkan **ammonium nitrat** dalam air - membuat kek - pengekstrakan bijih besi dlm relau bagas - fotosintesis - dissolving **ammonium nitrate** in water - cake baking - iron ore extraction in blast furnace - photosynthesis	- melarutkan **kalsium klorida** dalam air - pembakaran & letupan - peneutralan asid & alkali - respirasi - dissolving **calcium chloride** in water - burning and explosion - neutralisation of acid and alkali - respiration

Rajah contoh/ Diagram of examples:

Endotermik/ Endothermic:

Ammonium nitrate in cold pack	Cake baking	Metal ore extraction	Photosynthesis
			

Eksotermik/ Exothermic:

Calcium chloride in hot pack	Burning/ explosion	Neutralisation	Respiration