



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

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**CHEMISTRY****0439/13**

Paper 1 Multiple Choice

**May/June 2012****45 Minutes**

Additional Materials:      Multiple Choice Answer Sheet  
   Soft clean eraser  
   Soft pencil (type B or HB is recommended)



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**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, Center number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.**Read the instructions on the Answer Sheet very carefully.**

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.


You may use a calculator.


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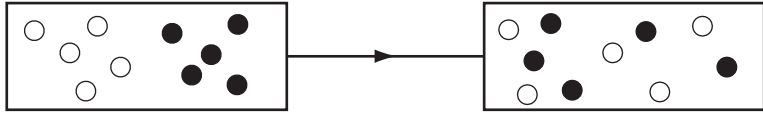
This document consists of **16** printed pages.

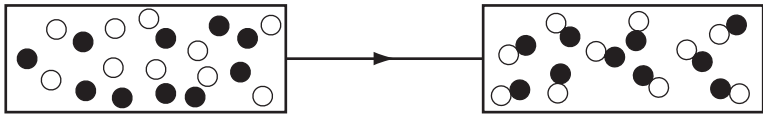
2

1 Which diagram shows the process of diffusion?

**A** 

**B** 

**C** 

**D** 

key  
 ○ } different atoms  
 ● }

2 A student investigates how the concentration of an acid affects the speed of reaction with a 0.5 g mass of magnesium at 30 °C.

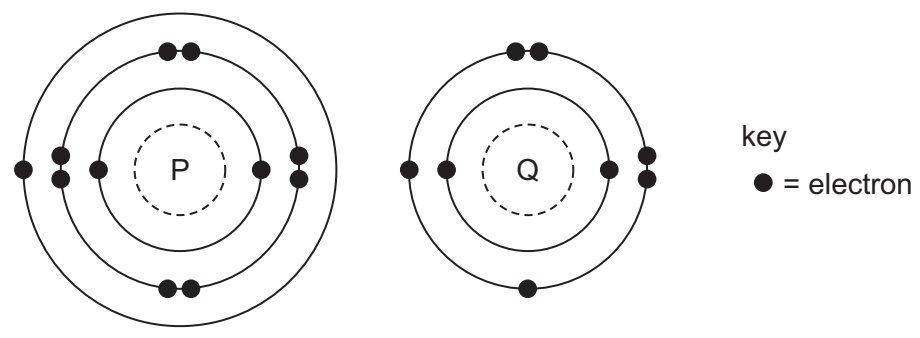
The student has a beaker, concentrated acid, water and the apparatus below.

- P a balance
- Q a clock
- R a graduated cylinder
- S a thermometer

Which pieces of apparatus does the student use?

- A** P, Q and R only
  - B** P, Q and S only
  - C** Q, R and S only
  - D** P, Q, R and S
- 3 Which method is most suitable to obtain zinc carbonate from a suspension of zinc carbonate in water?
- A** crystallization
  - B** distillation
  - C** evaporation
  - D** filtration

4 The electronic structures of atoms P and Q are shown.



P and Q react to form an ionic compound.

What is the formula of this compound?

- A  $PQ_2$       B  $P_2Q$       C  $P_2Q_6$       D  $P_6Q_2$

5 An element Y has the proton number 18.

The next element in the Periodic Table is an element Z.

Which statement is correct?

- A Element Z has one more electron in its outer shell than element Y.  
 B Element Z has one more electron shell than element Y.  
 C Element Z is in the same group of the Periodic Table as element Y.  
 D Element Z is in the same period of the Periodic Table as element Y.

6 Which atom has twice as many neutrons as protons?

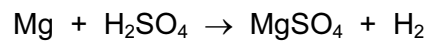
- A  $^1_1H$       B  $^2_1H$       C  $^3_1H$       D  $^4_2He$

7 Which is a simple covalent molecule?

	conducts electricity		volatile
	when solid	when molten	
A	✓	✓	x
B	✓	x	✓
C	x	✓	x
D	x	x	✓

4

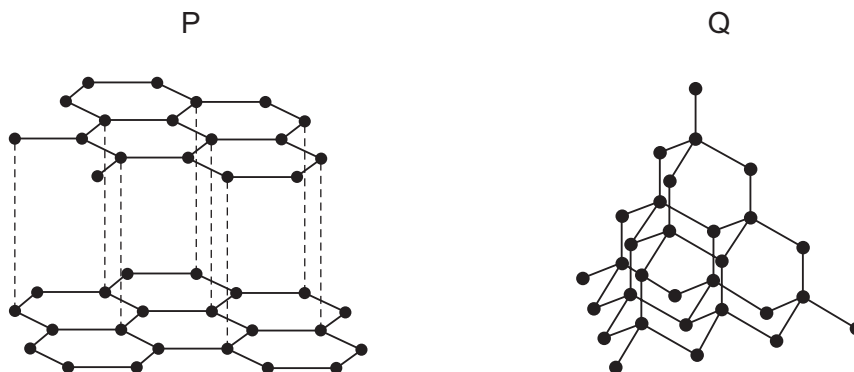
- 8 The equation for the reaction between magnesium and dilute sulfuric acid is shown.



$M_r$  of  $\text{MgSO}_4$  is 120

Which mass of magnesium sulfate will be formed if 12 g of magnesium are reacted with sulfuric acid?

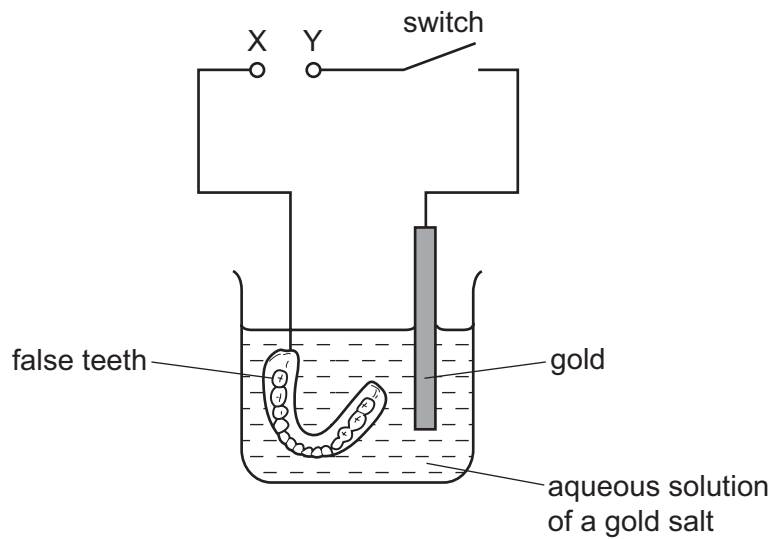
- A 5g                      B 10g                      C 60g                      D 120g
- 9 The diagrams show the structures of two forms, P and Q, of a solid element.



What are suitable uses of P and Q, based on their structures?

	use of solid P	use of solid Q
<b>A</b>	drilling	drilling
<b>B</b>	lubricating	drilling
<b>C</b>	drilling	lubricating
<b>D</b>	lubricating	lubricating

- 10 Winston Churchill, a British Prime Minister, had his false teeth electroplated with gold. The teeth were coated with a thin layer of carbon and were then placed in the apparatus shown.

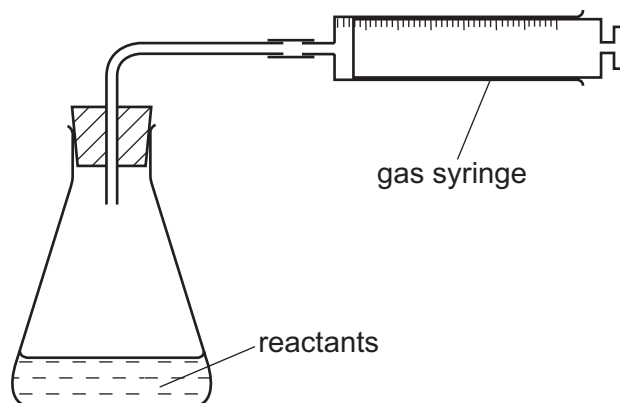


Which row is correct?

	terminal X is	the carbon powder could be
<b>A</b>	negative	diamond
<b>B</b>	negative	graphite
<b>C</b>	positive	diamond
<b>D</b>	positive	graphite

6

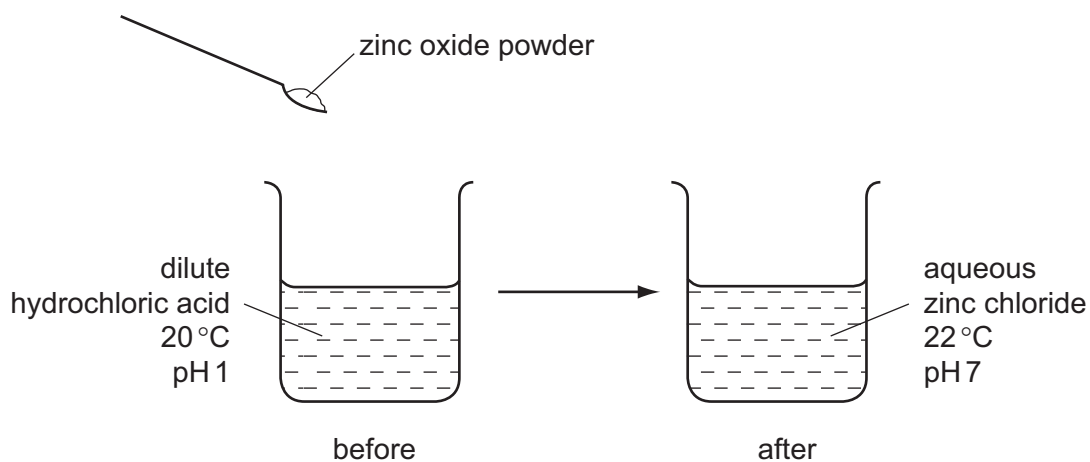
11 The apparatus shown is used to measure the speed of a reaction.



Which equation represents a reaction where the speed can be measured using this apparatus?

- A**  $\text{Mg(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$   
**B**  $\text{HCl(aq)} + \text{NaOH(aq)} \rightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)}$   
**C**  $\text{Fe(s)} + \text{CuSO}_4\text{(aq)} \rightarrow \text{Cu(s)} + \text{FeSO}_4\text{(aq)}$   
**D**  $2\text{Na(s)} + \text{Br}_2\text{(l)} \rightarrow 2\text{NaBr(s)}$

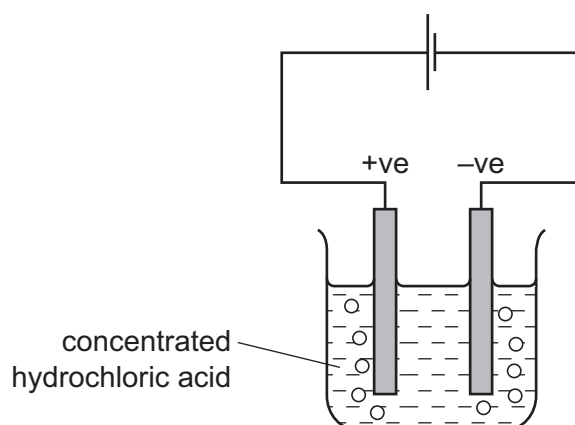
12 The diagram shows the reaction between zinc oxide and dilute hydrochloric acid.



Which terms describe the reaction?

	endothermic	neutralization
<b>A</b>	✓	✓
<b>B</b>	✓	x
<b>C</b>	x	✓
<b>D</b>	x	x

- 13 The diagram shows that two gases are formed when concentrated hydrochloric acid is electrolyzed using inert electrodes.



Which row correctly describes the colors of the gases at the electrodes?

	anode (+ve)	cathode (-ve)
<b>A</b>	colorless	colorless
<b>B</b>	colorless	yellow-green
<b>C</b>	yellow-green	colorless
<b>D</b>	yellow-green	yellow-green

- 14 A gas is escaping from a pipe in a chemical plant.

A chemist tests this gas and finds that it is alkaline.

What is this gas?

- A** ammonia
  - B** chlorine
  - C** hydrogen
  - D** sulfur dioxide
- 15 The element vanadium, V, forms several oxides.

In which change is oxidation taking place?

- A**  $\text{VO}_2 \rightarrow \text{V}_2\text{O}_3$
- B**  $\text{V}_2\text{O}_5 \rightarrow \text{VO}_2$
- C**  $\text{V}_2\text{O}_3 \rightarrow \text{VO}$
- D**  $\text{V}_2\text{O}_3 \rightarrow \text{V}_2\text{O}_5$

16 Dilute hydrochloric acid is added to a solid, S.

A flammable gas, G, is formed. Gas G is less dense than air.

What are S and G?

	solid S	gas G
<b>A</b>	copper	hydrogen
<b>B</b>	copper carbonate	carbon dioxide
<b>C</b>	zinc	hydrogen
<b>D</b>	zinc carbonate	carbon dioxide

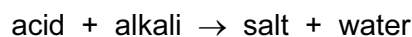
17 The results of three tests on a solution of compound X are shown in the table.

test	result
aqueous sodium hydroxide added	white precipitate formed, soluble in excess
aqueous ammonia added	white precipitate formed, insoluble in excess
acidified silver nitrate added	white precipitate formed

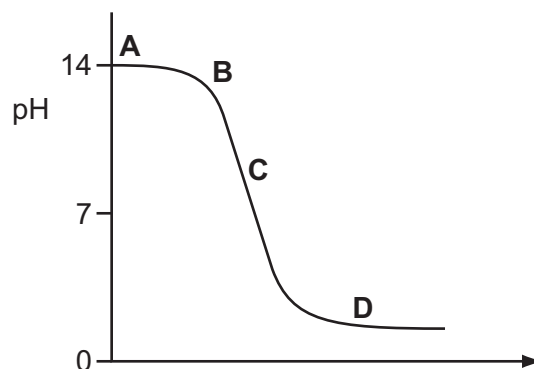
What is compound X?

- A** aluminum bromide
- B** aluminum chloride
- C** zinc bromide
- D** zinc chloride

18 The graph shows how the pH changes as an acid is added to an alkali.



Which letter represents the area of the graph where both acid and salt are present?





- 19 Which properties of the element titanium, Ti, can be predicted from its position in Table?

	can be used as a catalyst	conducts electricity when solid	has low density	forms colored compounds
<b>A</b>	✓	✓	x	✓
<b>B</b>	✓	✓	✓	x
<b>C</b>	✓	x	✓	✓
<b>D</b>	x	✓	✓	✓

- 20 The diagram shows a section of the Periodic Table.

Which element is described below?

'A colorless, unreactive gas that is denser than air.'

			<b>A</b>
	<b>B</b>		
		<b>C</b>	
			<b>D</b>

- 21 Element X is below iodine in the Periodic Table.

Which row correctly shows the physical state of element X at room temperature and its reactivity compared with that of iodine?

	physical state of element X at room temperature	reactivity compared with that of iodine
<b>A</b>	gas	less reactive
<b>B</b>	solid	less reactive
<b>C</b>	gas	more reactive
<b>D</b>	solid	more reactive

22 Which property is shown by **all** metals?

- A They are extracted from their ores by heating with carbon.
- B They conduct electricity.
- C They form acidic oxides.
- D They react with hydrochloric acid to form hydrogen.

23 Five elements have proton numbers 10, 12, 14, 16 and 18.

What are the proton numbers of the three elements that form oxides?

- A 10, 12 and 14
- B 10, 14 and 18
- C 12, 14 and 16
- D 14, 16 and 18

24 Metal X reacts violently with water.

Metal Y reacts slowly with steam.

Metal Z does not react with dilute hydrochloric acid.

What is the correct order of reactivity of these metals, most reactive first?

- A  $X \rightarrow Y \rightarrow Z$
- B  $X \rightarrow Z \rightarrow Y$
- C  $Z \rightarrow X \rightarrow Y$
- D  $Z \rightarrow Y \rightarrow X$

25 Which statement about the extraction of iron from its ore is correct?

- A Iron is more difficult to extract than zinc.
- B Iron is more difficult to extract than copper.
- C Iron is easy to extract because it is a transition metal.
- D Iron cannot be extracted by reduction with carbon.

26 Which statement about the uses of metals is correct?

- A Aluminum is used in the manufacture of aircraft as it has a high density.
- B Aluminum is used to make food containers as it conducts electricity.
- C Stainless steel for cutlery is made by adding other elements to iron.
- D Stainless steel is used to make chemical reactors as it corrodes readily.

27 Fertilizers need to supply crops with three main elements.

Which compound contains all three of these elements?

- A  $\text{H}_3\text{PO}_4$       B  $\text{KNO}_3$       C  $\text{NH}_4\text{K}_2\text{PO}_4$       D  $\text{NH}_4\text{NO}_3$

28 Some uses of water are listed.

- 1 for drinking
- 2 in chemical reactions
- 3 in swimming pools
- 4 in washing

For which uses is it necessary to chlorinate the water?

- A 1 and 2      B 1 and 3      C 2 and 4      D 3 and 4

29 Which is a use of oxygen?

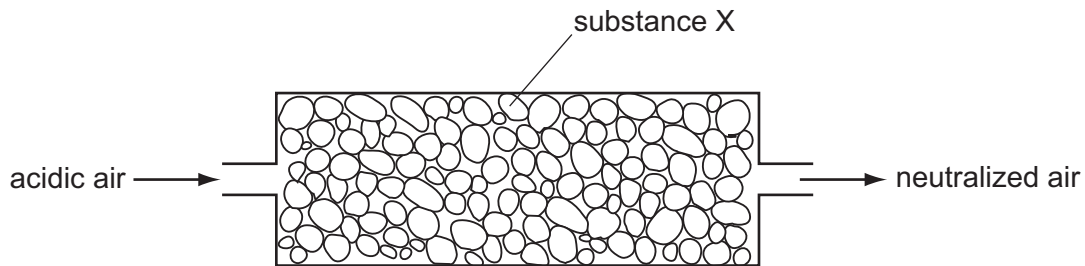
- A filling balloons  
B filling light bulbs  
C food preservation  
D making steel

30 Coal is a fossil fuel.

Which gas is **not** formed when coal burns?

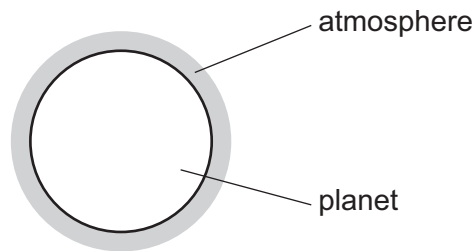
- A carbon dioxide  
B carbon monoxide  
C methane  
D sulfur dioxide

- 31 Air containing an acidic impurity was neutralized by passing it through a column of substance X.



What is substance X?

- A calcium oxide
  - B sand
  - C sodium chloride
  - D concentrated sulfuric acid
- 32 A new planet has been discovered and its atmosphere has been analyzed.



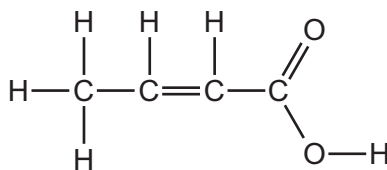
The table shows the composition of the atmosphere.

gas	percentage by volume
carbon dioxide	4
nitrogen	72
oxygen	24

Which gases are present in the atmosphere of the planet in a higher percentage than they are in the Earth's atmosphere?

- A carbon dioxide and oxygen
- B carbon dioxide only
- C nitrogen and oxygen
- D nitrogen only

33 The structure of a compound is shown.



Which functional groups are present in this compound?

	alcohol	alkene	carboxylic acid
<b>A</b>	✓	✓	✓
<b>B</b>	✓	x	x
<b>C</b>	x	✓	✓
<b>D</b>	x	x	✓

34 Gas X is a waste gas from digestion in animals.

Gas Y is formed when gas X is burned with a small amount of oxygen.

Gas Z is formed when gas X is burned with an excess of oxygen.

What are X, Y and Z?

	X	Y	Z
<b>A</b>	carbon dioxide	methane	carbon monoxide
<b>B</b>	carbon monoxide	methane	carbon dioxide
<b>C</b>	methane	carbon dioxide	carbon monoxide
<b>D</b>	methane	carbon monoxide	carbon dioxide

35 Which fraction from the fractional distillation of petroleum does **not** match its correct use?

	fraction	use
<b>A</b>	fuel oil	domestic heating
<b>B</b>	kerosene	jet fuel
<b>C</b>	naphtha	making roads
<b>D</b>	refinery gas	for heating and cooking

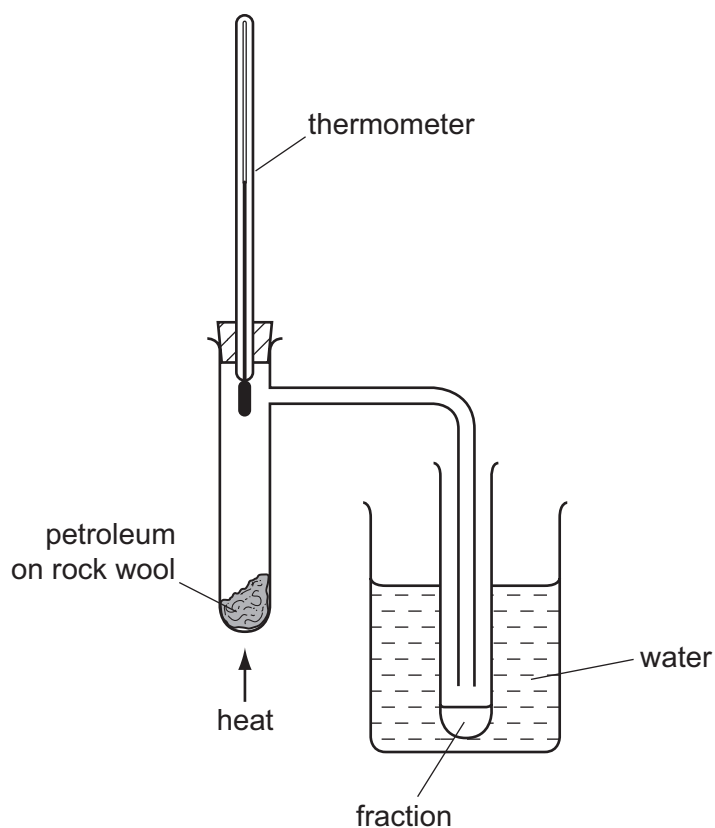
36 When a long chain hydrocarbon is cracked, the following products are produced.

- 1  $C_3H_8$
- 2  $C_2H_4$
- 3  $C_3H_6$
- 4  $C_2H_6$

Which products would decolorize bromine water?

- A** 1 and 4      **B** 2 and 3      **C** 2 only      **D** 3 only

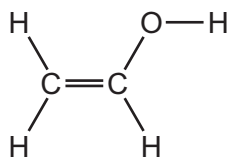
37 The diagram shows apparatus used to separate petroleum into four fractions.



Which fraction contains the smallest hydrocarbon molecules?

fraction	boiling point range / °C
<b>A</b>	up to 70
<b>B</b>	70 to 120
<b>C</b>	120 to 170
<b>D</b>	over 170

38 PVA is a polymer. The monomer has the structure shown.



To which homologous series does this compound belong?

	alcohols	alkenes
<b>A</b>	✓	✓
<b>B</b>	✓	x
<b>C</b>	x	✓
<b>D</b>	x	x

39 Ethanol is an important chemical produced by the .....1..... of .....2..... .

Which words correctly complete gaps 1 and 2?

	1	2
<b>A</b>	combustion	ethane
<b>B</b>	combustion	glucose
<b>C</b>	fermentation	ethane
<b>D</b>	fermentation	glucose

40 Which equation represents incomplete combustion of ethane?

- A**  $C_2H_6 + O_2 \rightarrow 2CO + 3H_2$
- B**  $C_2H_6 + 2O_2 \rightarrow 2CO_2 + 3H_2$
- C**  $2C_2H_6 + 5O_2 \rightarrow 4CO + 6H_2O$
- D**  $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

### DATA SHEET The Periodic Table of the Elements

Group		II	III	IV	V	VI	VII	0
I		1 H Hydrogen 1						4 He Helium 2
3	7	9 Li Lithium 4	5 B Boron 5	6 C Carbon 6	7 N Nitrogen 7	8 O Oxygen 8	9 F Fluorine 9	10 Ne Neon 10
11	23	12 Mg Magnesium 12	13 Al Aluminum 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulfur 16	17 Cl Chlorine 17	18 Ar Argon 18
19	39	40 Ca Calcium 20	41 K Potassium 19	42 Sc Scandium 21	43 Ti Titanium 22	44 V Vanadium 23	45 Cr Chromium 24	46 Mn Manganese 25
37	85	86 Sr Strontium 38	87 Rb Rubidium 37	88 Y Yttrium 39	89 Zr Zirconium 40	90 Nb Niobium 41	91 Mo Molybdenum 42	92 Tc Technetium 43
55	133	134 Ba Barium 56	135 Cs Caesium 55	136 La Lanthanum 57	137 Ce Cerium 58	138 Pr Praseodymium 59	139 Nd Neodymium 60	140 Pm Promethium 61
87	226	227 Ra Radium 88	228 Fr Francium 87	229 Ac Actinium 89	230 Th Thorium 90	231 Pa Protactinium 91	232 U Uranium 92	233 Np Neptunium 93
81	204	205 Tl Thallium 81	206 Pb Lead 82	207 Bi Bismuth 83	208 Po Polonium 84	209 At Astatine 85	210 Rn Radon 86	211
80	201	202 Hg Mercury 80	203 Tl Thallium 81	204 Pb Lead 82	205 Bi Bismuth 83	206 Po Polonium 84	207 At Astatine 85	208 Rn Radon 86
79	197	198 Au Gold 79	199 Hg Mercury 80	200 Tl Thallium 81	201 Pb Lead 82	202 Bi Bismuth 83	203 Po Polonium 84	204 At Astatine 85
47	108	109 Ag Silver 47	110 Cd Cadmium 48	111 In Indium 49	112 Sn Tin 50	113 Pb Lead 82	114 Bi Bismuth 83	115 Po Polonium 84
29	64	65 Cu Copper 29	66 Zn Zinc 30	67 Ga Gallium 31	68 Ge Germanium 32	69 As Arsenic 33	70 Se Selenium 34	71 Br Bromine 35
28	59	60 Ni Nickel 28	61 Co Cobalt 27	62 Fe Iron 26	63 Mn Manganese 25	64 Cr Chromium 24	65 V Vanadium 23	66 Ti Titanium 22
46	106	107 Pd Palladium 46	108 Ag Silver 47	109 Cd Cadmium 48	110 In Indium 49	111 Sn Tin 50	112 Sb Antimony 51	113 Te Tellurium 52
78	195	196 Pt Platinum 78	197 Au Gold 79	198 Hg Mercury 80	199 Tl Thallium 81	200 Pb Lead 82	201 Bi Bismuth 83	202 Po Polonium 84
77	192	193 Ir Iridium 77	194 Os Osmium 76	195 Pt Platinum 78	196 Au Gold 79	197 Hg Mercury 80	198 Tl Thallium 81	199 Pb Lead 82
45	103	104 Rh Rhodium 45	105 Pd Palladium 46	106 Ag Silver 47	107 Cd Cadmium 48	108 In Indium 49	109 Sn Tin 50	110 Sb Antimony 51
27	59	60 Co Cobalt 27	61 Ni Nickel 28	62 Cu Copper 29	63 Zn Zinc 30	64 Ga Gallium 31	65 Ge Germanium 32	66 As Arsenic 33
73	181	182 Ta Tantalum 73	183 Hf Hafnium 72	184 Ta Tantalum 73	185 W Tungsten 74	186 Re Rhenium 75	187 Os Osmium 76	188 Ir Iridium 77
74	184	185 W Tungsten 74	186 Re Rhenium 75	187 Os Osmium 76	188 Ir Iridium 77	189 Pt Platinum 78	190 Au Gold 79	191 Hg Mercury 80
91	91	92 Zr Zirconium 40	93 Nb Niobium 41	94 Mo Molybdenum 42	95 Tc Technetium 43	96 Ru Ruthenium 44	97 Rh Rhodium 45	98 Pd Palladium 46
72	178	179 Hf Hafnium 72	180 Ta Tantalum 73	181 W Tungsten 74	182 Re Rhenium 75	183 Os Osmium 76	184 Ir Iridium 77	185 Pt Platinum 78
89	226	227 Ac Actinium 89	228 Fr Francium 87	229 Ac Actinium 89	230 Th Thorium 90	231 Pa Protactinium 91	232 U Uranium 92	233 Np Neptunium 93

\*58-71 Lanthanoid series

†90-103 Actinoid series

a = relative atomic mass

X = atomic symbol

b = proton (atomic) number

Key

a	X	b
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169	167	165	162	159	157	152	150	144	141	140
170	68	67	66	65	64	63	62	60	59	58
Yb Ytterbium	Er Erbium	Ho Holmium	Dy Dysprosium	Tb Terbium	Gd Gadolinium	Eu Europium	Sm Samarium	Nd Neodymium	Pr Praseodymium	Ce Cerium
171	102	99	98	97	96	95	94	92	91	90
Lu Lutetium	No Nobelium	Es Einsteinium	Cf Californium	Bk Berkelium	Cm Curium	Am Americium	Pu Plutonium	U Uranium	Pa Protactinium	Th Thorium

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).

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