1 In an experiment, a student needs to measure 36.50 cm^3 of a solution.

Which apparatus would measure this volume most accurately?

A beaker

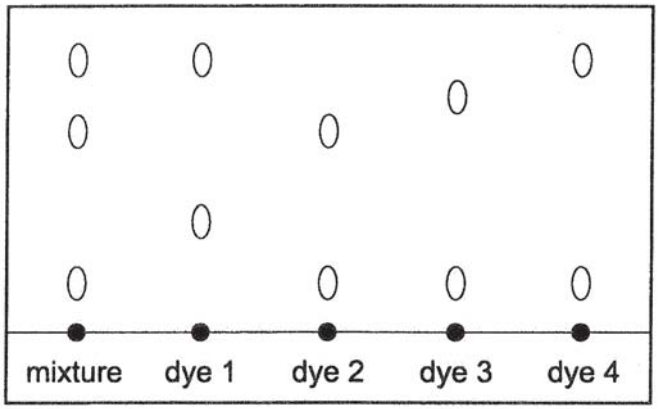
B burette

C measuring cylinder

D pipette

2 A mixture of coloured dyes is compared with other dyes using chromatography.

The chromatogram is shown below.



Which dye(s) is/are present in the mixture?

A 1 and 3

B 2 and 3

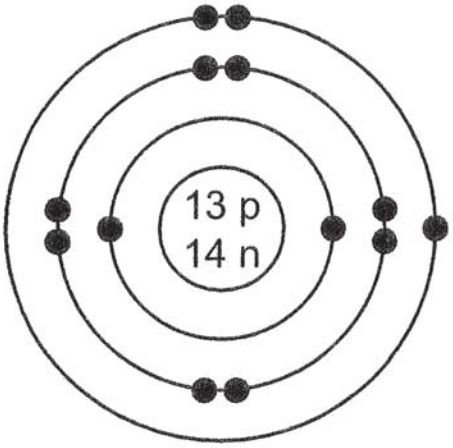
C 2 and 4

D 2 only

3 Which substance is a solid at 20 °C?

	melting point / °C	boiling point / °C
A	−117	78
B	−93	69
C	0	100
D	36	130

4 The diagram shows the structure of an atom of an element.



key
● = electron
n = neutron
p = proton

What is the nucleon number of this element?

A 13

B 14

C 27

D 40

5 Which change occurs when an atom forms a positive ion?

A It gains electrons.

B It gains protons.

C It loses electrons.

D It loses protons.

6 Which row describes the properties of a covalent molecule?

	boiling point	electrical conductivity
A	high	good
B	high	poor
C	low	good
D	low	poor

7 Relative atomic mass, A_r is defined by comparing the mass of one atom with the mass of another atom, Z.

What is Z?

A ^{12}C

B ^{1}H

C ^{24}Mg

D ^{16}O

8 The equation shows the reaction that occurs when ethanol burns in air.

$$C_2H_5OH + xO_2 \rightarrow yCO_2 + zH_2O$$

What are the values of *x*, *y* and *z* needed to balance the equation?

	x	*y*	*z*
A	2	2	2
B	2	2	3
C	2	3	3
D	3	2	3

9 Four different solutions, J, K, L and M are tested with Universal Indicator.

solution	J	K	L	M
colour with universal indicator	green	red	purple	orange

Which solution(s) is/ are acidic?

A J and M

B K and M

C K only

D L only

10 Milk is slightly acidic. When exposed to air, milk turns 'sour' as bacteria produce more acids.

What is the change in pH of the milk as it turns sour?

A 2.0 to 7.0

B 6.5 to 8.5

C 6.5 to 4.5

D 9.0 to 4.5

11 When aluminium and carbon burn in oxygen, oxides are formed.

Which row identifies the type of oxide that is formed by each one of them?

	aluminium oxide	carbon dioxide
A	amphoteric	acidic
B	amphoteric	basic
C	basic	acidic
D	basic	basic

12 Which equation, when completed, will show the production of a salt and hydrogen?

A $CuCO_3(s) + 2HCl(aq) \rightarrow$

B $2NaOH(aq) + H_2SO_4(aq) \rightarrow$

C $CuO(s) + H_2SO_4(aq) \rightarrow$

D $Mg(s) + 2HCl(aq) \rightarrow$

13 Sodium, silicon and argon are all in the same period of the Periodic Table.

Which statement about these elements is correct?

A They all have the same number of electron shells.

B They all have the same number of electrons in their atoms.

C They all have the same number of protons in their atoms.

D They all have the same number of electrons in their outer shell.

14 Chlorine and iodine are in Group VII in the Periodic Table.

How do the colours and melting points of chlorine and iodine compare?

	lighter colour	higher melting point
A	iodine	iodine
B	iodine	chlorine
C	chlorine	iodine
D	chlorine	chlorine

15 The diagram shows the position of elements L, M, Q, R and T in the Periodic Table.

These letters are not the chemical symbols of the elements.

Which statement about these elements is correct?

A L and M are halogens.

B L, M and Q are all metals.

C T exists as diatomic molecules.

D T is more reactive than R.

16 What is the property of **all** metals?

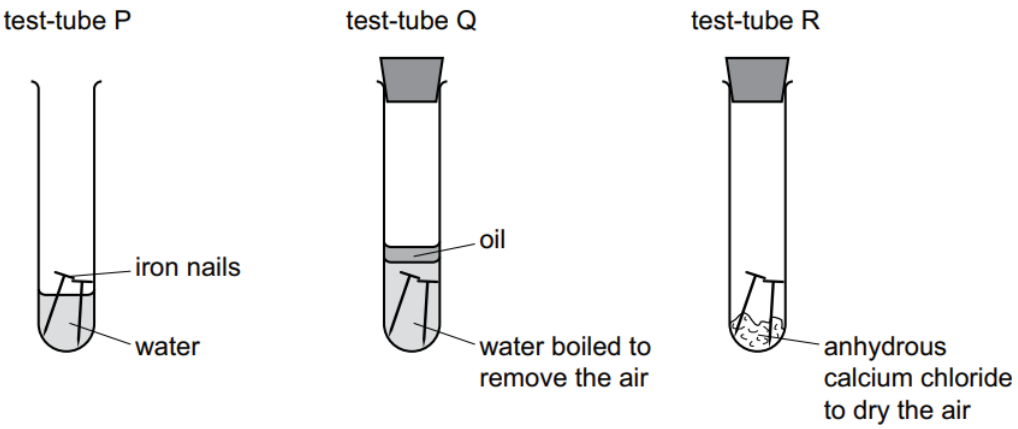
A conduct electricity

B hard

C low melting points

D reacts with water

17 The diagrams show experiments involving the rusting of iron.



In which test tubes will rusting **not** take place?

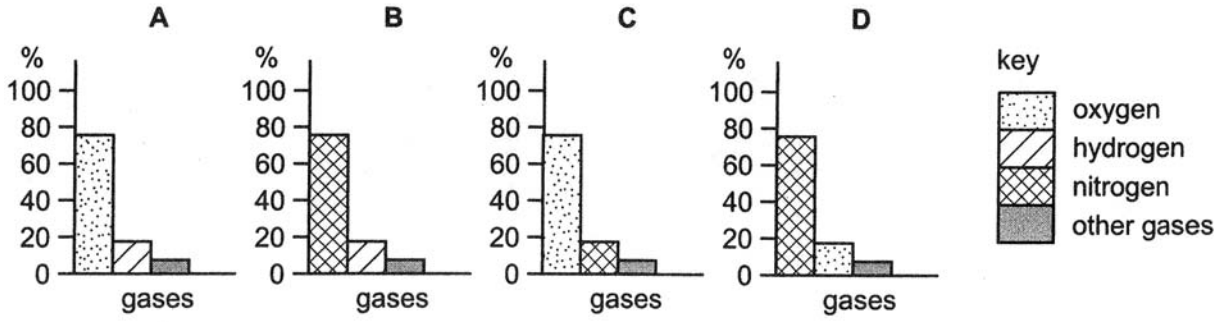
A P, Q and R

B P and Q only

C P and R only

D Q and R only

18 Which bar chart best represents the approximate composition by volume of air?



19 The table shows some unknown fractions obtained from the fractional distillation of petroleum, together with their uses.

fractions	uses
1	making chemicals
2	aircraft fuel
3	making polishes and waxes

Which row identifies fractions 1, 2 and 3?

	1	2	3
A	lubricating oil	diesel oil	paraffin
B	diesel oil	lubricating oil	naphtha
C	naphtha	paraffin	lubricating oil
D	paraffin	naphtha	diesel oil

20 Which row shows the general formula for alkenes and the effect of alkenes on aqueous bromine?

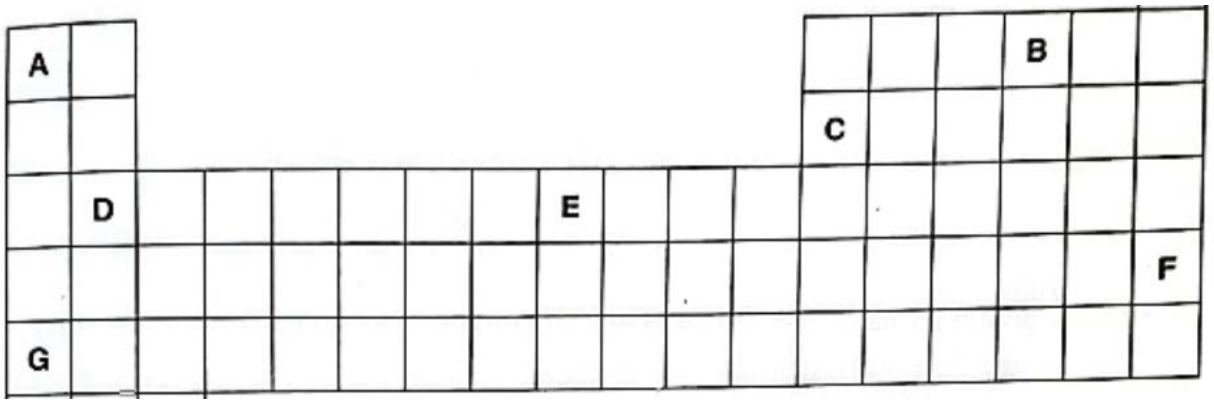
	general formula	effect on aqueous bromine
A	C_nH_{2n}	decolourised
B	C_nH_{2n}	no visible change
C	C_nH_{2n+2}	decolourised
D	C_nH_{2n+2}	no visible change

END OF PAPER 3

Section A

Answer **all** the questions in the spaces provided.

1 The diagram shows part of the Periodic Table of the Elements.



Use the letters A to G in the diagram to answer the following questions.

(a) Which two elements are in the same Group? ……and …… [1]

(b) Which is the least reactive element? ……. [1]

[Total : 2]

2 Some gases pollute the atmosphere.

(a) State one major source for each of the gaseous pollutants in the table.

gas	source
carbon monoxide	
sulfur dioxide	

[2]

(b) Name one other gas that is an atmospheric pollutant.

…….. [1]

[Total : 3]

3 The table below shows the mass of ions present in a 100 cm^3 sample of alkaline water.

ion	formula of ion	mass of ion in 100 cm^3 sample of water / mg
calcium	Ca^{2+}	125
chloride	Cl^-	120
magnesium	Mg^{2+}	12
phosphate	PO_4^{3-}	95
potassium	K^+	140
hydroxide	OH^-	160
sodium	Na^+	58
sulfate	SO_4^{2-}	30

(a) Write the chemical formula of the compound when sodium ion combines with hydroxide ion.

…… [1]

(b) Draw a 'dot and cross' diagram to show the bonding in calcium chloride.

Show only the outer shell electrons.

[2]

(c) Which ion present in alkaline water causes the water to be alkaline?

…… [1]

(d) Describe the observation when a piece of damp red litmus paper is placed into the alkaline water.

…… [1]

[Total: 5]

4 **(a)** Calculate the relative formula mass, M_r of magnesium sulfate, $MgSO_4$.

[relative atomic masses, A_r: Mg, 24; S, 32; O, 16]

Show your working.

relative formula mass = ……. [1]

(b) Magnesium sulfate can be made by reacting magnesium metal with dilute sulfuric acid. This is the chemical equation for the reaction.

$$Mg(s) + H_2SO_4(aq) \rightarrow MgSO_4(aq) + H_2(g)$$

(i) What does (aq) tell you about magnesium sulfate?

…… [1]

(ii) State an apparatus that could be used to collect and measure the volume of hydrogen gas.

…… [1]

(iii) Calculate the number of moles in 6 g of magnesium.

[relative atomic masses, A_r: Mg, 24]

Show your working.

number of moles of magnesium = …… mol [1]

[Total:4]

Section B

Answer any **two** questions from this section in the spaces provided.

5 **(a)** **(i)** Besides the iron ore, name **two** other starting materials that are added to the blast furnace in the extraction of iron.

…… and …… [2]

(ii) In the blast furnace, carbon monoxide reacts with iron ore to produce molten iron.

Complete and balance the following equation

Fe_2O_3 + CO → …… + …….. [1]

(b) The table shows the results of tests performed on metals **R**, **S**, **T** and **U**.

Key ✓ reaction x no reaction	metal	reaction with water	reaction with steam	reaction with dilute hydrochloric acid
	R	x	✓	✓
	S	x	x	✓
	T	✓	✓	✓
	U	x	x	x

(i) Which metal (**R**, **S**, **T** or **U**) could be copper? …… [1]

(ii) Which metal (**R**, **S**, **T** or **U)** could be zinc? …… [1]

(c) State **two** advantages of recycling metals.

1. ……

……

2. ……

…… [2]

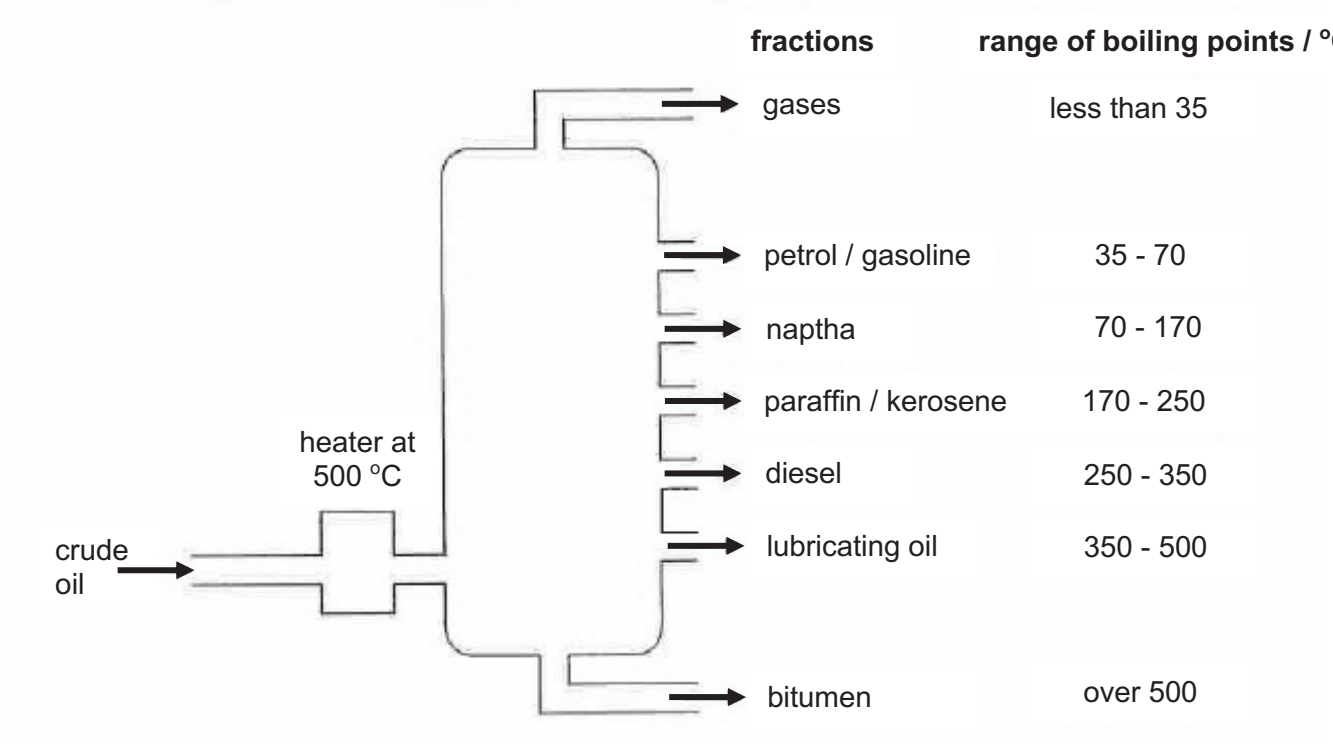
(d) When an aluminium drink can is dropped onto the ground from a height, the aluminium can becomes dented.

Which physical property of aluminium metal does this show?

…… [1]

[Total : 8]

6 The diagram shows the apparatus used to separate the fractions from crude oil.



(a) What is the name given to this process?

……... [1]

(b) What physical property of all the fractions makes this separation process possible?

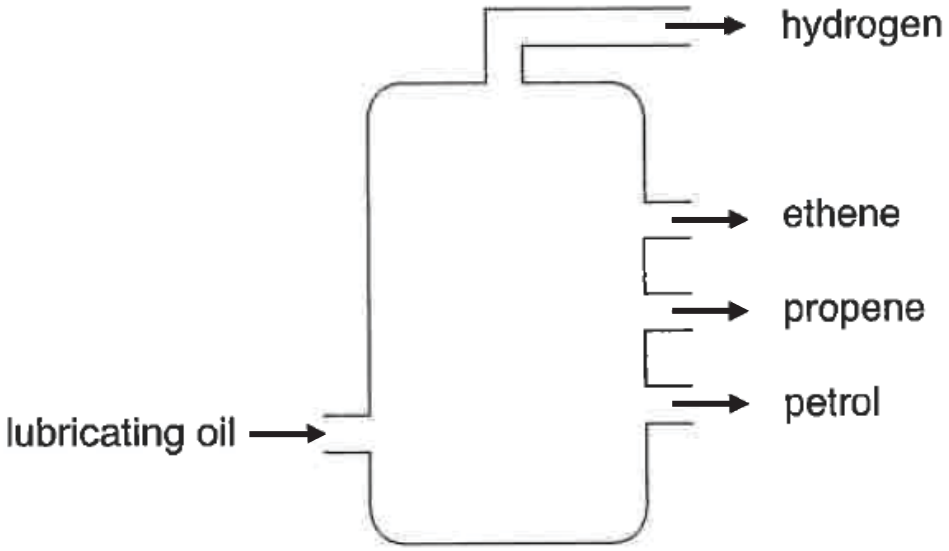
……... [1]

(c) Decane is a chemical obtained from crude oil. It has a boiling point of 174 °C.

In which fraction would you find decane?

……... [1]

(d) The lubricating oil fraction is passed through a 'cracker' to produce the chemical substances shown below.



(i) What is meant by *cracking*?

……. [1]

(ii) Under what condition(s) do/does cracking occur?

……. [2]

(iii) Explain why cracking is important in the oil industry.

……

……. [1]

(iv) Ethene is an unsaturated hydrocarbon with the formula C_2H_4.

Draw the structural formula for one molecule of ethene.

[1]

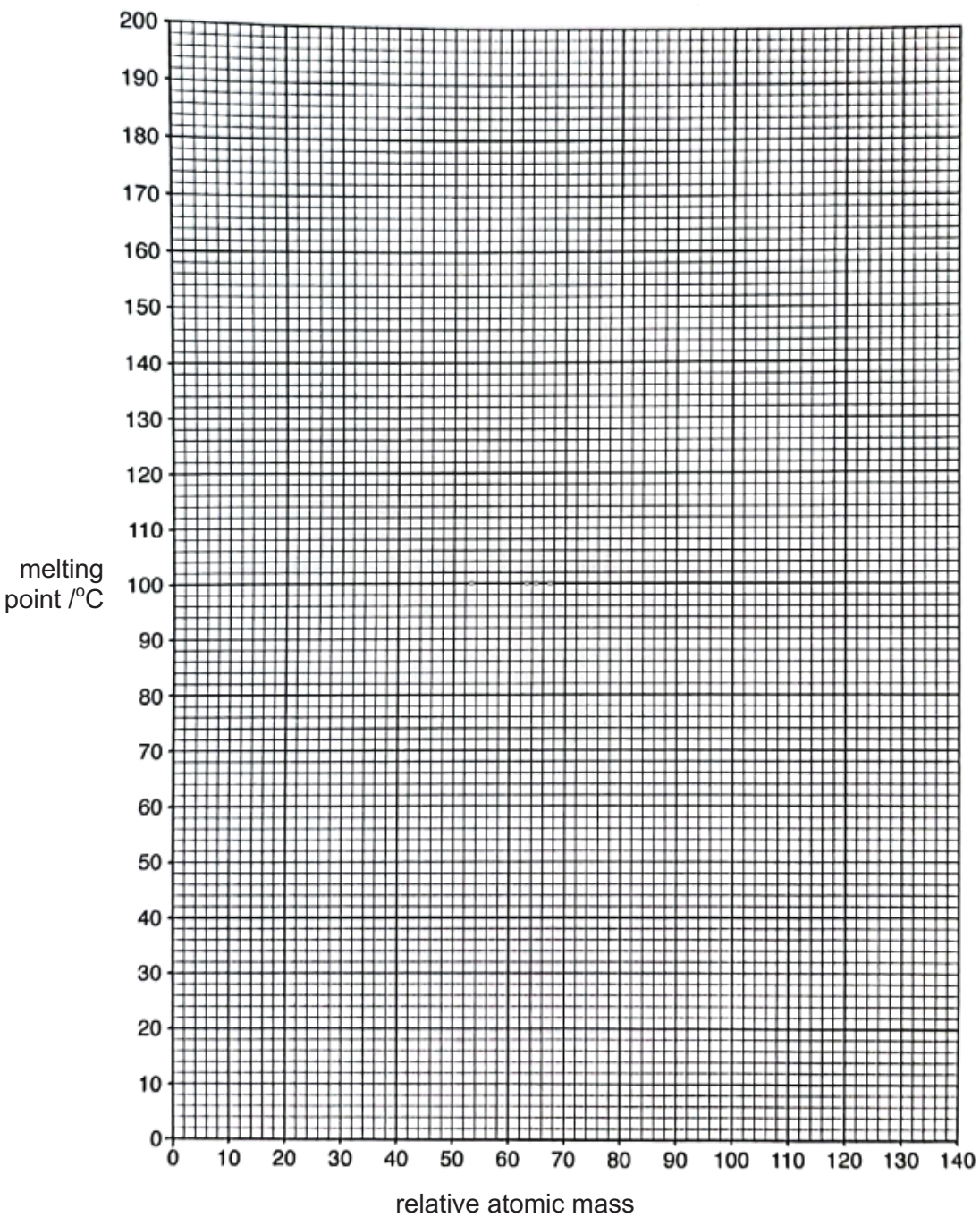
[Total: 8]

7 **(a)** The table shows the relative atomic masses, A_r and the melting points of some Group I metals.

metal	relative atomic masses, A_r	melting point/ ^oC
lithium	7	181
sodium	23	98
potassium	39	
rubidium	85	39
caesium	133	28

(i) Plot a graph of melting point against relative atomic mass, marking each point with a cross (x). [1]

(ii) Draw a curved line of best fit, using all your plotted points. [1]



(iii) Use your graph to predict the melting point of potassium.

melting point of potassium = …… ^{o}C [1]

(iv) Explain why all these elements are placed in Group I of the Periodic Table.

……..…….

……..…… [1]

(b) **(i)** Describe one observation made when sodium is added to water.

…..……..…….

…..……..……. [1]

(ii) Write a balanced chemical equation for the reaction of sodium with water.

……. [2]

(iii) Arrange the Group I metals lithium, sodium and potassium in order of increasing chemical reactivity.

least reactive ……..….

……..

most reactive …….. [1]

[Total : 8]

END OF PAPER 4

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		**Key** proton (atomic) number atomic symbol name relative atomic mass									5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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

For Answer please email :

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to share with you.