

**A Level Chemistry B (Salters)**  
**H433/02** Scientific literacy in chemistry

**Question Set 6**

- 1 'Morton's salt'™ contains a mixture of sodium chloride with magnesium carbonate. It is advertised using the slogan 'When it rains it pours' indicating that the table salt is free-flowing in humid weather.

Magnesium carbonate is hygroscopic (absorbs water) and forms hydrated salts, eg  $\text{MgCO}_3 \cdot 3\text{H}_2\text{O}$ , but does not dissolve. This stops the sodium chloride absorbing water.

- (a) (i) Some data for the dissolving of  $\text{NaCl}$  is given below.

Enthalpy change	Value / $\text{kJ mol}^{-1}$
$\Delta_{\text{LE}} H \text{NaCl}$	-780
$\Delta_{\text{hyd}} H \text{Na}^+$	-402
$\Delta_{\text{hyd}} H \text{Cl}^-$	-374

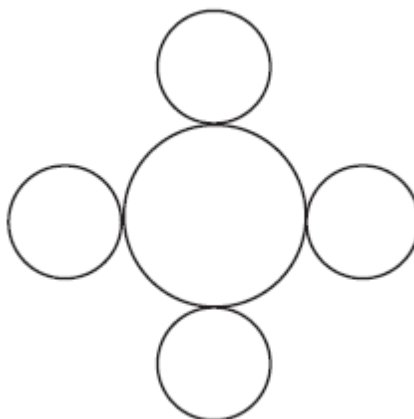
Calculate a value for the enthalpy change of solution of  $\text{NaCl}$ .

enthalpy change of solution of  $\text{NaCl} =$

[1]

- (ii) The diagram below shows the pattern of ions in **one face** of a  $\text{NaCl}$  lattice.

Extend the diagram to show the repeating pattern by adding **three** more suitable ions. Label one  $\text{Na}^+$  ion and one  $\text{Cl}^-$  on the diagram.



[2]

- (b) Some students heat a sample of  $\text{MgCO}_3 \cdot 3\text{H}_2\text{O}$  to try to make  $\text{MgCO}_3$ . Calculate the percentage loss in mass they will obtain if they succeed.

percentage loss in mass = \_\_\_\_\_ % [2]

- (c) The students continue to heat the  $\text{MgCO}_3$  formed and realise that the compound is decomposing, giving off  $\text{CO}_2$  gas.

The students want to obtain  $200 \text{ cm}^3$   $\text{CO}_2$  at 290 K and 99 kPa.  
What mass of  $\text{MgCO}_3$  should they heat?

mass of  $\text{MgCO}_3$  = \_\_\_\_\_ g [3]

- (d) (i) Magnesium has a higher first ionisation enthalpy than calcium.

Write an equation for the reaction for the first ionisation enthalpy of magnesium.

Include state symbols.

[1]

- (ii) Explain why magnesium has a higher first ionisation enthalpy than calcium. [2]

- (e) (i) Some students are given a mixture of magnesium carbonate with another Group 2 carbonate. They dissolve the mixture in an acid. They test the solution of salts formed as shown in the table below.

Test	Result
Flame test	Green flame
Add dilute nitric acid followed by silver nitrate solution	White precipitate

Name the acid that the students used to dissolve the mixture of carbonates. [1]

- (ii) Name the other Group 2 carbonate that was mixed with the magnesium carbonate. [1]

**Total Marks for Question Set 6: 13**

# Resource Materials

Question Set No: 6

## The Periodic Table of the Elements

(1)	(2)	Key atomic number Symbol name relative atomic mass										(3)	(4)	(5)	(6)	(7)	(0)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H hydrogen 1.0	2 He helium 4.0	3 Li lithium 6.9	4 Be beryllium 9.0	5 B boron 10.8	6 C carbon 12.0	7 N nitrogen 14.0	8 O oxygen 16.0	9 F fluorine 19.0	10 Ne neon 20.2	11 Na sodium 23.0	12 Mg magnesium 24.3	13 Al aluminium 27.0	14 Si silicon 28.1	15 P phosphorus 31.0	16 S sulfur 32.1	17 Cl chlorine 35.5	18 Ar argon 39.9
19 K potassium 39.1	20 Ca calcium 40.1	21 Sc scandium 45.0	22 Ti titanium 47.9	23 V vanadium 50.9	24 Cr chromium 52.0	25 Mn manganese 54.9	26 Fe iron 55.8	27 Co cobalt 58.9	28 Ni nickel 58.7	29 Cu copper 63.5	30 Zn zinc 65.4	31 Ga gallium 69.7	32 Ge germanium 72.6	33 As arsenic 74.9	34 Se selenium 79.0	35 Br bromine 79.9	36 Kr krypton 83.8
37 Rb rubidium 85.5	38 Sr strontium 87.6	39 Y yttrium 88.9	40 Zr zirconium 91.2	41 Nb niobium 92.9	42 Mo molybdenum 95.9	43 Tc technetium	44 Ru ruthenium 101.1	45 Rh rhodium 102.9	46 Pd palladium 106.4	47 Ag silver 107.9	48 Cd cadmium 112.4	49 In indium 114.8	50 Sn tin 118.7	51 Sb antimony 121.8	52 Te tellurium 127.6	53 I iodine 126.9	54 Xe xenon 131.3
55 Cs caesium 132.9	56 Ba barium 137.3	57-71 lanthanoids	72 Hf hafnium 178.5	73 Ta tantalum 180.9	74 W tungsten 183.8	75 Re rhenium 186.2	76 Os osmium 190.2	77 Ir iridium 192.2	78 Pt platinum 195.1	79 Au gold 197.0	80 Hg mercury 200.6	81 Tl thallium 204.4	82 Pb lead 207.2	83 Bi bismuth 209.0	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				
57 La lanthanum 138.9	58 Ce cerium 140.1	59 Pr praseodymium 140.9	60 Nd neodymium 144.2	61 Pm promethium 144.9	62 Sm samarium 150.4	63 Eu europium 152.0	64 Gd gadolinium 157.2	65 Tb terbium 158.9	66 Dy dysprosium 162.5	67 Ho holmium 164.9	68 Er erbium 167.3	69 Tm thulium 168.9	70 Yb ytterbium 173.0	71 Lu lutetium 175.0	101 Md mendelevium	102 No nobelium	103 Lr lawrencium

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