

Mubashir Sulehri 03224307040

> Lahore Grammar School Roots International School Lahore Learning Campus Bloomfield Hall School

A sample of a compound of iron is analysed. The sample contains 0.547 g of potassium, 0.195 g of iron, 0.252 g of carbon and 0.294 g of nitrogen.
Calculate the empirical formula of this compound.

Answer[3]

Complete the following table giving the name or the formula of each compound as appropriate.

	Chemical name	Chemical formula
(a)	potassium chloride	
(b)		SO ₂
(c)		Mg(NO ₃) ₂
(d)	methanol	
(e)		FeBr ₂
(f)	aluminium sulphate	

3 Calculate the mass of magnesium in 150g of magnesium carbonate MgCO₃.

Name of compound	Formula of compound	Formula of cation	Formula of anion
magnesium chloride	MgCl ₂	Mg ²⁺	C1 ⁻
lead(II) nitrate		Pb ²⁺	
aluminium sulphate		Al ³⁺	SO4 ²⁻
manganese(III) oxide	Mn ₂ O ₃		O ²⁻
calcium phosphate	Ca ₃ (PO ₄) ₂		

This question refers to the three organic compounds labelled A, B and C below.

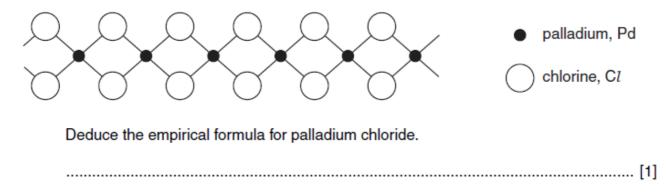
Compound A	Compound B	Compound C						
СН₃СН=СНСООН	CH ₃ CH ₂ CH ₂ COOH	СН ₃ СН=СНСН ₂ ОН						

(a) Which one of the compounds has a relative molecular mass of 86?

.....

6 Calculate the mass of water in 100 g of Cupper sulphate crystal CuSO₄.5H₂O

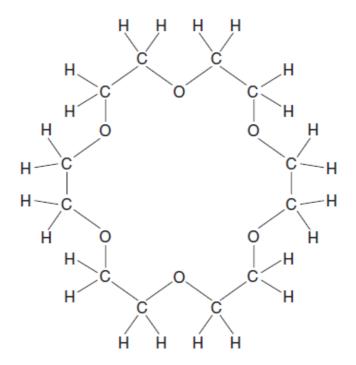
7 (c) Part of the structure of palladium chloride is shown below.



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- ⁸ Sodium can react with compounds called crown ethers.
 - (a) A typical crown ether is shown below.



Write the empirical formula for this crown ether.

.....[1]

9 When hydrogen and iodine are heated in a sealed container an equilibrium is reached with the product, hydrogen iodide.

At 400 °C the equilibrium mixture contains 0.4000 grams of hydrogen, 0.07560 grams of iodine and 1.344 grams of hydrogen iodide.

Calculate the percentage of iodine molecules, I2, by mass in this equilibrium mixture.

Another compound of bromine and fluorine is bromine(V) fluoride, BrF₅. 10 Calculate the percentage of bromine by mass in bromine(V) fluoride.

[2]

11 Carbon monoxide reacts with chromium to form chromium carbonyl. The structure of chromium carbonyl is shown below.

Write the empirical formula for chromium carbonyl.

.....[1]

.C

12 The table shows the energy released when one gram of an alkane or an alkene is completely burned.

molecular formula	Energy released per gram / kJ
CH ₄	55.6
C ₂ H ₄	50.3
C ₄ H ₈	42.5
C ₄ H ₁₀	49.6
C ₂₀ H ₄₂	47.2

A sample of a hydrocarbon contains 0.240 g of carbon and 0.050 g of hydrogen.

- (i) Calculate the empirical formula of this hydrocarbon.
- (ii) The hydrocarbon is one of the compounds in the table. Which one?

[3]

¹³ A 40.5 g sample of a chloride of sulfur contains 21.3 g of chlorine.

(i) Deduce the empirical formula of this chloride of sulfur.

empirical formula[3]

(ii) The relative molecular mass of this chloride is 135.

Deduce the molecular formula of this chloride.

molecular formula[1]

- 14 Potassium nitrate, potassium sulfate and potassium phosphate are used in fertilisers.
 - (a) Calculate the percentage by mass of potassium in potassium sulfate, K_2SO_4 .

..... % by mass [2]

- 15 A sample containing 64.5 g of a chloride of germanium contains 42.6 g of chlorine.
 - (i) Deduce the empirical formula of this chloride.

empirical formula[3] (ii) This chloride of germanium has a boiling point of 87 °C. Predict the structure and bonding of this chloride.

.....[2]

- 16 Concentrated aqueous ammonia is used to make fertilisers such as ammonium phosphate, $(NH_4)_3PO_4$.
 - (a) Calculate the percentage by mass of nitrogen in ammonium phosphate.

..... % by mass [2]

17 Balance the following equations , also write state sybols, in each case.

٠	Na +	H₂O →	NaOH +	H ₂	
٠	C10H16+	$Cl_2 \rightarrow$	C +	HCI	
٠	C ₂ H ₄ O ₂ +	$O_2 \rightarrow$	CO ₂ +	H_2O	
•	H ₂ SO ₄ +	$B(OH)_3 \rightarrow$	B ₂ (SO	4)3 +	H_2O

18 Write the Ionic Equations of the following reactions

		IIIN	2	He	helium 4	10	Ne	neon 20	18	Ar	argon 40	36	Ъ	krypton 84	54	Xe	xenon 131	86	Rn	radon -										
		١١٨				6	ш	fluorine 19	17	Cl	chlorine 35.5	35	Ъ	bromine 80	53	Ι	iodine 127	85	At	astatine -					71	Lu	lutetium 175	103	Ļ	lawrencium
		N				8	0	oxygen 16	16	S	sulfur 32	34	Se	selenium 79	52	Те	tellurium 128	84	Ро	polonium –	116	۲<	livermorium -		70	γb	ytterbium 173	102	No	nobelium
		>				7	z	nitrogen 14	15	٩	phosphorus 31	33	As	arsenic 75	51	Sb	antimony 122	83	ï	bismuth 209					69	Tm	thulium 169	101	Мd	mendelevium
		\geq				9	ပ	carbon 12	14	S.	silicon 28	32	Ge	germanium 73	50	Sn	tin 119	82	Pb	lead 207	114	Fl	flerovium -		68	ш	erbium 167	100	ЕB	fermium
		≡				5	ш	boron 11	13	Al	aluminium 27	31	Ga	gallium 70	49	In	indium 115	81	Τl	thallium 204					67	Р	holmium 165	66	Es	einsteinium
												30	Zn	zinc 65	48	Cd	cadmium 112	80	Hg				0		66	2	dysprosium 163	98	ç	californium
												29	Cu	copper 64	47	Ag	silver 108	79	Au	gold 197	111	Rg	roentgenium -		65	Tb	terbium 159	97	剐	berkelium
	Group											28	ïZ	nickel 59	46	Pd	palladium 106	78	£	platinum 195	110	Ds	darmstadtium -		64	Ъд	gadolinium 157	96	Cm	curium
	Gro											27	ပိ	cobalt 59	45	Rh	rhodium 103	17	Ir	iridium 192	109	Mt	meitnerium -		63	Еu	europium 152	95	Am	americium
			-	т	hydrogen 1							26	Fe	iron 56	44	Ru	ruthenium 101	76	Os	osmium 190	108	Hs	hassium -				samarium 150	94	Pu	plutonium
						-			_			25	Mn	manganese 55	43	Ц	technetium -	75	Re	rhenium 186	107	Bh	bohrium I		61	Рт	promethium –	93	Np	neptunium
							bol	ass				24	ъ	chromium 52	42	Мо	molybdenum 96	74	\geq	tungsten 184	106	Sg	seaborgium -		60		neodymium 144	92	⊃	uranium 220
					Key	atomic number	atomic symbol	name relative atomic mass				23	>	vanadium 51	41	qN	niobium 93	73	Та	tantalum 181	105	Db	dubnium –		59	ሻ	praseodymium 141	91	Ра	protactinium 231
							ato	rel				22	Ħ	titanium 48	40	Zr	zirconium 91	72	Hf	hafnium 178	104	Rf	rutherfordium -		58	Ce	cerium 140	06	Th	thorium 232
												21	Sc	scandium 45	39	≻	yttrium 89	57-71	lanthanoids		89-103	actinoids			57	La	lanthanum 139	89	Ac	actinium
		Π				4	Be	beryllium 9	12	Mg	magnesium 24	20	Ca	calcium 40	38	Ś	strontium 88	56	Ba	barium 137	88	Ra	radium –			ids			6	
		_				m	:	lithium 7	7	Na	sodium 23	19	Y	potassium 39	37	Rb	rubidium 85	55	Cs	caesium 133	87	Ļ	francium -			lanthanoids			actinoids	
ч		010													EO	70/		/ 1/4	0											

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The Periodic Table of Elements

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

CHEMICAL FORMULA AND EQUATIONS

9

uranium 238

protactiniu 231

90 Th ^{thorium} 232