

CHEMISTRY STANDARD LEVEL PAPER 1

Thursday 10 May 2001 (afternoon)

45 minutes

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

Periodic Table 4 90 90					-	0			~		
Periodic Table Atomic Number 4 000 Atomic Number 4 000 Atomic Number 4 000 Atomic Number 4 000 Atomic Number 1					86 Rn (222)	54 Xe 131.3	36 Kr 83.8(18 Ar 39.95	10 Ne 20.18	2 He 4.00	
Periodic Table 4 Br 901 Atomic Number Atomic Number 5 6 7 8 8 8 7 8 8 8 7 8 8 8 7 8	103 Lr (260)	Lu 174.97	71		85 At (210)	53 I 126.90	35 Br 79.90	17 CI 35.45	9 F 19.00		
Periodic Table 4 Aomic Number Aomic Number 5 5 5 5 6 7 12 Aomic Number Aomic Number 12 13 14 15 12 24.31 Atomic Number 13 26.98 28.09 30.97 24.31 20 21 22 23 24.05 30.9 30.97 20 21 22 23 24.0 30.9 30.97 30.97 20.31 21 22 23 24.0 30.9 30.97 30.97 30.97 20.431 21 22 23 24.0 30.9 31.7 32 33.97 20.431 12 27 28.9 30.7 10.29 10.17 10.29 10.17 10.29 10.17 10.29 20.99 30.7 33 33 33 33 33 34 44 45 46 47 48 49 57 27.99 </th <td>102 No (259)</td> <td>Yb 173.04</td> <td>70</td> <td></td> <td>84 Po (210)</td> <td>52 Te 127.60</td> <td>34 Se 78.96</td> <td>16 S 32.06</td> <td>8 0 16.00</td> <td></td> <td></td>	102 No (259)	Yb 173.04	70		84 Po (210)	52 Te 127.60	34 Se 78.96	16 S 32.06	8 0 16.00		
Periodic Table Atomic Number $\frac{4}{901}$ Atomic Number $\frac{4}{901}$ Atomic Number $\frac{12}{901}$ Atomic Mass $\frac{12}{901}$ Atomic Mass $\frac{12}{12}$ $\frac{13}{12}$ $\frac{14}{14}$ $\frac{45}{15}$ $\frac{6}{10}$ $\frac{13}{13}$ $\frac{13}{137.41}$ $\frac{14}{138.91}$ $\frac{12}{12}$ $\frac{14}{14}$ $\frac{45}{10}$ $\frac{4}{16}$ $\frac{4}{15}$ $\frac{4}{16}$	101 Md (258)	Tm 168.93	69		83 Bi 208.98	51 Sb 121.75	33 As 74.92	15 P 30.97	7 N 14.01		
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Periodic Table 4 Be 9001 Atomic Number 12 Mg Atomic Number 24.31 Atomic Number 24.31 Atomic Mass 24.31 22 23 24 25 56 57 28 58.93 58.71 63.55 56.37 20 21 22 23 24 58.93 58.71 63.55 56.37 38 39 44.96 47.90 50.94 55.85 58.93 58.71 63.55 65.37 87.62 88.91 101.07 102.91 106.42 107.87 112.40 87.62 58.93 58.91 60.91 70 80 80 87.62 88.91 170.80 57.95 58.93 58.71 66.97 70 87.62 88.91 170.81 76 77	99 Es (254)	Ho 164.93	67		81 TI 204.37	49 In 114.82	31 Ga 69.72	13 Al 26.98	5 B 10.81		
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4 4	92 U 238.03	Nd 144.24	60	106 Sg (263)	74 W 183.85	42 Mo 95.94	24 Cr 52.00		c Mass	Number	lic Tal
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$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	90 Th 232.04	Ce 140.12	58	104 Rf (261)	72 Hf 178.49	40 Zr 91.22	22 Ti 47.90				
4 4 9.01 12 9.01 24.31 12 Mg 9.01 24.31 12 Mg 73 24.31 87.62 56 87.62 56 137.34 88 88 88 Ra (226)	**		÷	89 ‡ Ac (227)	57 † La 138.91	39 Y 88.91	21 Sc 44.96				
				88 Ra (226)	56 Ba 137.34	38 Sr 87.62	20 Ca 40.08	12 Mg 24.31	4 Be 9.01		
I I H H H 1.01 1.01 1.01 1.01 0.02 33 0.10 19 K 33 39.10 37 85.47 85 Cs 132.91 87 Fr Fr (223) (223)				87 Fr (223)	55 Cs 132.91	37 Rb 85.47	19 K 39.10	11 Na 22.99	3 Li 6.94	1 H 1.01	

- 1. The number of moles in 500 g of water is approximately:
 - A. 28
 - B. 9000
 - C. 1×10²⁵
 - D. 3×10²⁶
- 2. What is the empirical formula of a compound containing 85.7 % by mass of carbon and 14.3 % by mass of hydrogen?
 - A. CH
 - B. CH₂
 - C. CH₄
 - D. C_2H_5
- 3. One stage in the manufacture of nitric acid is the oxidation of ammonia as shown below:

 $4\mathrm{NH}_3 + _\mathrm{O}_2 \rightarrow _\mathrm{NO} + _\mathrm{H}_2\mathrm{O}$

What is the coefficient for O_2 when the equation is balanced?

- A. 3
- B. 4
- C. 5
- D. 6

4. In the decomposition of $KClO_3$, 6.30 mol of oxygen was produced:

$$2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$$

How many moles of KCl would be produced?

- A. 4.20
- B. 6.30
- C. 12.6
- D. 18.9
- 5. $10.0 \text{ cm}^3 \text{ of } 0.200 \text{ moldm}^{-3} \text{ HNO}_3(aq)$ are converted into NaNO₃(aq). What volume (in cm³) of 0.100 moldm⁻³ NaOH(aq) is needed for this?
 - A. 5.0
 - B. 10.0
 - C. 20.0
 - D. 30.0
- 6. Isotopes of an element have the same number of
 - A. protons and electrons.
 - B. protons and neutrons.
 - C. neutrons and electrons.
 - D. protons, neutrons and electrons.

- 7. Which species have electronic configurations 2.8.8, 2.8 and 2.8.1 respectively?
 - A. Ne, F, Na
 - B. K^+, F^-, Mg^{2+}
 - C. Ca^{2+} , F, Na⁺
 - D. Cl^{-}, F^{-}, Na
- 8. Elements in the same group of the Periodic Table have the same
 - A. number of protons.
 - B. ionisation energy.
 - C. reactivity.
 - D. number of outer electrons.
- **9.** The reason for the general increase in ionisation energy of the elements across period 3 of the Periodic Table is the increasing number of
 - A. outer electrons.
 - B. neutrons.
 - C. protons.
 - D. electron sub-levels occupied.
- 10. Which reaction between an alkali metal and a halogen is the most vigorous?
 - A. Lithium reacting with bromine
 - B. Sodium reacting with chlorine
 - C. Potassium reacting with bromine
 - D. Potassium reacting with chlorine

- 11. Which compound has the greatest ionic character?
 - A. MgS
 - B. HCl
 - C. CO₂
 - D. CaO
- **12.** Which molecule has the greatest polarity?
 - A. Fluorine
 - B. Hydrogen fluoride
 - C. Hydrogen chloride
 - D. Tetrafluoromethane
- **13.** Which is the best description of metallic bonding?
 - A. The attraction between oppositely charged ions
 - B. The attraction between protons and electrons
 - C. The attraction between positive ions and delocalised electrons
 - D. The attraction between nuclei and electron pairs
- 14. Which compound is the most soluble in water?
 - A. Methane
 - B. Propane
 - C. Propan-1-ol
 - D. Pentan-1-ol

	Volume	Temperature / K		
A.	Doubles	Halves		
B.	Doubles	Doubles		
C.	Halves	Halves		
D.	Halves	Remains constant		

15. Which change will have the greatest effect on the pressure of a fixed mass of an ideal gas?

- 16. Which statement about exothermic reactions is **not** correct?
 - A. They release energy
 - B. The enthalpy change (ΔH) is negative
 - C. The products have a greater enthalpy than the reactants
 - D. The products are more stable than the reactants
- 17. In an experiment to measure the heat change when a small amount of sodium hydroxide is dissolved in water, x g of sodium hydroxide was dissolved in y g of water, giving a temperature rise of $z \, ^{\circ}C$. The specific heat capacity of water is $c J g^{-1} K^{-1}$. Which expression should be used to calculate the heat change (in J)?
 - A. *cxyz*
 - B. cxy
 - C. cyz
 - D. cxz

18. Some average bond enthalpies (in $kJ mol^{-1}$) are as follows:

$$H-H = 436$$
, $Cl-Cl = 242$, $H-Cl = 431$

What is the enthalpy change (in kJ) for the decomposition of hydrogen chloride?

 $2\text{HCl} \rightarrow \text{H}_2 + \text{Cl}_2$

- A. -184
- B. +184
- C. +247
- D. –247
- **19.** The reaction between nitrogen and oxygen in the atmosphere under normal conditions is extremely slow. Which statement best explains this?
 - A. The concentration of oxygen is much lower than that of nitrogen
 - B. The molar mass of nitrogen is less than that of oxygen
 - C. The frequency of collisions between nitrogen and oxygen molecules is lower than that between nitrogen molecules themselves
 - D. Very few nitrogen and oxygen molecules have sufficient energy to react
- 20. Which change will shift the position of equilibrium to the right in this reaction?

 $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -92 \text{ kJ}$

- A. Increasing the temperature
- B. Decreasing the pressure
- C. Adding a catalyst
- D. Removing ammonia from the equilibrium mixture

- **21.** Which statement describes the Brønsted–Lowry behaviour of H_2O molecules in aqueous solutions?
 - A. They cannot act as either acids or bases
 - B. They can act as acids but not bases
 - C. They can act as acids or bases when reacting with each other
 - D. They can act as acids when reacting with HCl molecules
- **22.** Aqueous solutions of each of the following have a concentration of 0.100 moldm⁻³. Which has the highest pH?
 - A. HCl
 - B. CH₃COOH
 - C. NaOH
 - D. NH₃
- **23.** Which statement about the MnO_4^- ion is correct?
 - A. An acidified solution of MnO_4^- oxidises fluoride ions
 - B. The oxidation number of manganese in MnO_4^- is +5
 - C. An acidified solution of MnO_4^- oxidises bromide ions
 - D. The oxidation number of oxygen in MnO_4^- is +2
- 24. During the electrolysis of a molten salt, which statement is not correct?
 - A. The ions only move when a current flows
 - B. Positive ions are attracted to the negative electrode
 - C. Positive ions gain electrons at the negative electrode
 - D. Negative ions lose electrons at the positive electrode

- 25. Which compound is **not** a member of the same homologous series?
 - A. CH₄
 - B. C_2H_4
 - $C_{\cdot} C_{2}H_{6}$
 - $D_{\cdot} C_{3}H_{8}$
- 26. Which are the most likely products of the incomplete combustion of a hydrocarbon?
 - A. Carbon dioxide and water
 - B. Carbon dioxide and hydrogen
 - C. Carbon monoxide and water
 - D. Carbon monoxide and hydrogen
- 27. The compound CH_3CH_2OH is reacted with excess acidified potassium dichromate(VI) solution. What is the name of the functional group of the final organic product formed?
 - A. Alkanal
 - B. Alkanone
 - C. Alkanoic acid
 - D. Alkanol
- **28.** Which product is formed from the reaction between CH_3COOH and CH_3CH_2OH ?
 - A. CH₃COOCH₂CH₃
 - B. CH₃CH₂COOCH₂CH₃
 - C. CH₃CH₂COOCH₃
 - D. CH₃COOCH₃

- **29.** Which compound is optically active?
 - A. $CH_3COCH(CH_3)_2$
 - B. (CH₃)₃CCHO
 - C. CH₃CH₂COCH₂CH₃
 - D. CH₃CH₂CH(CH₃)CHO
- **30.** In which pair do both types of compound take part in hydrogen bonding?
 - A. Alkanals and esters
 - B. Bromoalkanes and alkanals
 - C. Alkanes and alkenes
 - D. Alkanols and amines