



**CHEMISTRY**  
**STANDARD LEVEL**  
**PAPER 1**

Thursday 10 May 2001 (afternoon)

45 minutes

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**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**

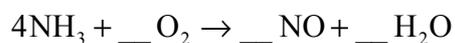
		Atomic Number										2																	
		Atomic Mass																											
1 <b>H</b> 1.01												5 <b>B</b> 10.81	6 <b>C</b> 12.01	7 <b>N</b> 14.01	8 <b>O</b> 16.00	9 <b>F</b> 19.00	10 <b>Ne</b> 20.18												
3 <b>Li</b> 6.94	4 <b>Be</b> 9.01											13 <b>Al</b> 26.98	14 <b>Si</b> 28.09	15 <b>P</b> 30.97	16 <b>S</b> 32.06	17 <b>Cl</b> 35.45	18 <b>Ar</b> 39.95												
11 <b>Na</b> 22.99	12 <b>Mg</b> 24.31											19 <b>K</b> 39.10	20 <b>Ca</b> 40.08	21 <b>Sc</b> 44.96	22 <b>Ti</b> 47.90	23 <b>V</b> 50.94	24 <b>Cr</b> 52.00	25 <b>Mn</b> 54.94	26 <b>Fe</b> 55.85	27 <b>Co</b> 58.93	28 <b>Ni</b> 58.71	29 <b>Cu</b> 63.55	30 <b>Zn</b> 65.37	31 <b>Ga</b> 69.72	32 <b>Ge</b> 72.59	33 <b>As</b> 74.92	34 <b>Se</b> 78.96	35 <b>Br</b> 79.90	36 <b>Kr</b> 83.80
37 <b>Rb</b> 85.47	38 <b>Sr</b> 87.62	39 <b>Y</b> 88.91	40 <b>Zr</b> 91.22	41 <b>Nb</b> 92.91	42 <b>Mo</b> 95.94	43 <b>Tc</b> 98.91	44 <b>Ru</b> 101.07	45 <b>Rh</b> 102.91	46 <b>Pd</b> 106.42	47 <b>Ag</b> 107.87	48 <b>Cd</b> 112.40	49 <b>In</b> 114.82	50 <b>Sn</b> 118.69	51 <b>Sb</b> 121.75	52 <b>Te</b> 127.60	53 <b>I</b> 126.90	54 <b>Xe</b> 131.30												
55 <b>Cs</b> 132.91	56 <b>Ba</b> 137.34	57 † <b>La</b> 138.91	72 <b>Hf</b> 178.49	73 <b>Ta</b> 180.95	74 <b>W</b> 183.85	75 <b>Re</b> 186.21	76 <b>Os</b> 190.21	77 <b>Ir</b> 192.22	78 <b>Pt</b> 195.09	79 <b>Au</b> 196.97	80 <b>Hg</b> 200.59	81 <b>Tl</b> 204.37	82 <b>Pb</b> 207.19	83 <b>Bi</b> 208.98	84 <b>Po</b> (210)	85 <b>At</b> (210)	86 <b>Rn</b> (222)												
87 <b>Fr</b> (223)	88 <b>Ra</b> (226)	89 ‡ <b>Ac</b> (227)	104 <b>Rf</b> (261)	105 <b>Db</b> (262)	106 <b>Sg</b> (263)	107 <b>Bh</b> (262)	108 <b>Hs</b> (262)	109 <b>Mt</b> (262)																					
			58 <b>Ce</b> 140.12	59 <b>Pr</b> 140.91	60 <b>Nd</b> 144.24	61 <b>Pm</b> 146.92	62 <b>Sm</b> 150.35	63 <b>Eu</b> 151.96	64 <b>Gd</b> 157.25	65 <b>Tb</b> 158.92	66 <b>Dy</b> 162.50	67 <b>Ho</b> 164.93	68 <b>Er</b> 167.26	69 <b>Tm</b> 168.93	70 <b>Yb</b> 173.04	71 <b>Lu</b> 174.97													
			90 <b>Th</b> 232.04	91 <b>Pa</b> 231.04	92 <b>U</b> 238.03	93 <b>Np</b> (237)	94 <b>Pu</b> (242)	95 <b>Am</b> (243)	96 <b>Cm</b> (247)	97 <b>Bk</b> (247)	98 <b>Cf</b> (251)	99 <b>Es</b> (254)	100 <b>Fm</b> (257)	101 <b>Md</b> (258)	102 <b>No</b> (259)	103 <b>Lr</b> (260)													

†

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1. The number of moles in 500 g of water is approximately:
- A. 28
  - B. 9000
  - C.  $1 \times 10^{25}$
  - D.  $3 \times 10^{26}$
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. CH<sub>2</sub>
  - C. CH<sub>4</sub>
  - D. C<sub>2</sub>H<sub>5</sub>

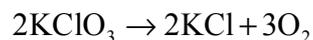
3. One stage in the manufacture of nitric acid is the oxidation of ammonia as shown below:



What is the coefficient for O<sub>2</sub> when the equation is balanced?

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

4. In the decomposition of  $\text{KClO}_3$ , 6.30 mol of oxygen was produced:



How many moles of  $\text{KCl}$  would be produced?

- A. 4.20
- B. 6.30
- C. 12.6
- D. 18.9
5.  $10.0 \text{ cm}^3$  of  $0.200 \text{ mol dm}^{-3}$   $\text{HNO}_3(\text{aq})$  are converted into  $\text{NaNO}_3(\text{aq})$ . What volume (in  $\text{cm}^3$ ) of  $0.100 \text{ mol dm}^{-3}$   $\text{NaOH}(\text{aq})$  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. CO<sub>2</sub>
  - 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

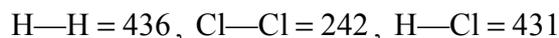
15. Which change will have the greatest effect on the pressure of a fixed mass of an ideal gas?

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

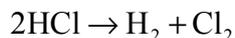
16. Which statement about exothermic reactions is **not** correct?

- A. They release energy
- B. The enthalpy change ( $\Delta H$ ) 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  $z$  °C. The specific heat capacity of water is  $c \text{ J g}^{-1} \text{ K}^{-1}$ . Which expression should be used to calculate the heat change (in J)?
- A.  $xyz$
- B.  $xy$
- C.  $cyz$
- D.  $cxz$

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



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



- 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?



- 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  $\text{H}_2\text{O}$  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  $\text{HCl}$  molecules
22. Aqueous solutions of each of the following have a concentration of  $0.100 \text{ mol dm}^{-3}$ . Which has the highest pH?
- A.  $\text{HCl}$
  - B.  $\text{CH}_3\text{COOH}$
  - C.  $\text{NaOH}$
  - D.  $\text{NH}_3$
23. Which statement about the  $\text{MnO}_4^-$  ion is correct?
- A. An acidified solution of  $\text{MnO}_4^-$  oxidises fluoride ions
  - B. The oxidation number of manganese in  $\text{MnO}_4^-$  is +5
  - C. An acidified solution of  $\text{MnO}_4^-$  oxidises bromide ions
  - D. The oxidation number of oxygen in  $\text{MnO}_4^-$  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.  $\text{CH}_4$
  - B.  $\text{C}_2\text{H}_4$
  - C.  $\text{C}_2\text{H}_6$
  - D.  $\text{C}_3\text{H}_8$
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  $\text{CH}_3\text{CH}_2\text{OH}$  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  $\text{CH}_3\text{COOH}$  and  $\text{CH}_3\text{CH}_2\text{OH}$ ?
- A.  $\text{CH}_3\text{COOCH}_2\text{CH}_3$
  - B.  $\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_3$
  - C.  $\text{CH}_3\text{CH}_2\text{COOCH}_3$
  - D.  $\text{CH}_3\text{COOCH}_3$

29. Which compound is optically active?

- A.  $\text{CH}_3\text{COCH}(\text{CH}_3)_2$
- B.  $(\text{CH}_3)_3\text{CCHO}$
- C.  $\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_3$
- D.  $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CHO}$

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
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