INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL

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

1 **H** 1.01				Atomic Number Atomic Mass													2 **He** 4.00
3 **Li** 6.94	4 **Be** 9.01											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 22.99	12 **Mg** 24.31											13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.06	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.90	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.71	29 **Cu** 63.55	30 **Zn** 65.37	31 **Ga** 69.72	32 **Ge** 72.59	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** 98.91	44 **Ru** 101.07	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.40	49 **In** 114.82	50 **Sn** 118.69	51 **Sb** 121.75	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.30
55 **Cs** 132.91	56 **Ba** 137.34	57 † **La** 138.91	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.85	75 **Re** 186.21	76 **Os** 190.21	77 **Ir** 192.22	78 **Pt** 195.09	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.37	82 **Pb** 207.19	83 **Bi** 208.98	84 **Po** (210)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 ‡ **Ac** (227)	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (262)	108 **Hs**	109 **Mt**									

†	58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** 146.92	62 **Sm** 150.35	63 **Eu** 151.96	64 **Gd** 157.25	65 **Tb** 158.92	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.93	70 **Yb** 173.04	71 **Lu** 174.97
‡	90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** (237)	94 **Pu** (242)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (254)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)

1. The number of moles in 500 g of water is approximately:

A. 28

B. 9000

C. 1×10^{25}

D. 3×10^{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_2

C. CH_4

D. C_2H_5

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

$$4NH_3 + \_\_\ O_2 \rightarrow \_\_\ NO + \_\_\ H_2O$$

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:

$$2KClO_3 \rightarrow 2KCl + 3O_2$$

How many moles of KCl would be produced?

A. 4.20

B. 6.30

C. 12.6

D. 18.9

5. 10.0 cm^3 of 0.200 $mol\,dm^{-3}$ $HNO_3(aq)$ are converted into $NaNO_3(aq)$. What volume (in cm^3) of 0.100 $mol\,dm^{-3}$ 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. CO_2

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 (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 $z\ ^{\circ}\mathrm{C}$. The specific heat capacity of water is $c\,\mathrm{J\,g^{-1}\,K^{-1}}$. 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:

$$\text{H—H} = 436\,,\ \text{Cl—Cl} = 242\,,\ \text{H—Cl} = 431$$

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?

$$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g}) \qquad \Delta H = -92\ \text{kJ}$$

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 $0.100\ \text{mol}\,\text{dm}^{-3}$. Which has the highest pH?

A. HCl

B. CH_3COOH

C. NaOH

D. NH_3

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. CH_4

B. C_2H_4

C. C_2H_6

D. C_3H_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. $CH_3COOCH_2CH_3$

B. $CH_3CH_2COOCH_2CH_3$

C. $CH_3CH_2COOCH_3$

D. CH_3COOCH_3

29. Which compound is optically active?

A. $CH_3COCH(CH_3)_2$

B. $(CH_3)_3CCHO$

C. $CH_3CH_2COCH_2CH_3$

D. $CH_3CH_2CH(CH_3)CHO$

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