INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL

CHEMISTRY
STANDARD LEVEL
PAPER 1

Tuesday 13 November 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. $$PbS(s) + O_2(g) \rightarrow PbO(s) + SO_2(g)$$

The reaction of lead(II) sulfide with oxygen is represented by the unbalanced equation above. What is the sum of the coefficients in the **balanced** equation?

A. 4

B. 5

C. 8

D. 9

2. 8.0 g of a pure compound contains 3.2 g of sulfur and 4.8 g of oxygen. What is its empirical formula?

A. SO

B. SO_2

C. SO_3

D. S_2O_3

3. How many carbon atoms are present in 0.10 mol of ethanoic acid, CH_3COOH ?

A. 6.0×10^{22}

B. 1.2×10^{23}

C. 6.0×10^{23}

D. 1.2×10^{24}

4.

$$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$$

Powdered zinc reacts with Cu^{2+} ions according to the equation above. What will be the result of adding 3.25 g of Zn to 100 cm^3 of 0.25 $mol\,dm^{-3}$ $CuSO_4$ solution?

A. All the Cu^{2+} ions react and some solid zinc remains.

B. All the Cu^{2+} ions react and no solid zinc remains.

C. All the solid zinc reacts and Cu^{2+} ions remain.

D. Neither solid zinc nor Cu^{2+} ions remain.

5. Which sample contains the greatest number of ions?

A. 25 cm^3 of 0.40 $mol\,dm^{-3}$ NaCl

B. 50 cm^3 of 0.20 $mol\,dm^{-3}$ $MgCl_2$

C. 100 cm^3 of 0.10 $mol\,dm^{-3}$ KNO_3

D. 200 cm^3 of 0.05 $mol\,dm^{-3}$ $CuSO_4$

6. Consider the composition of the particles **W**, **X**, **Y**, **Z** below. Which two particles are isotopes of the same element?

Particle	**Number of protons**	**Number of neutrons**	**Number of electrons**
W	11	12	10
X	12	12	12
Y	12	13	12
Z	13	14	10

A. W and X

B. X and Y

C. Y and Z

D. W and Z

7. What is the electron configuration of an atom of element 20?

A. 8.8.4

B. 4.8.8

C. 2.8.10

D. 2.8.8.2

8. Which combination will produce a reaction?

A. $Cl_2(aq) + 2I^-(aq)$

B. $Br_2(aq) + 2Cl^-(aq)$

C. $I_2(aq) + 2Br^-(aq)$

D. $I_2(aq) + 2Cl^-(aq)$

9. When the species Br, Br^+ and Br^- are arranged in order of increasing size (smallest first), what is the correct order?

A. $Br < Br^+ < Br^-$

B. $Br < Br^- < Br^+$

C. $Br^+ < Br < Br^-$

D. $Br^- < Br < Br^+$

10. When sodium oxide and sulfur dioxide are added to separate test tubes containing water, the solutions will be, respectively,

A. acidic and acidic.

B. acidic and basic.

C. basic and basic.

D. basic and acidic.

11. The compound formed between magnesium and oxygen is primarily

A. ionic with a formula of MgO.

B. ionic with a formula of MgO_2.

C. covalent with a formula of MgO.

D. covalent with a formula of MgO_2.

12. Which substance is the most polar?

A. CH_4

B. CF_4

C. CH_2F_2

D. CH_2Cl_2

13. The geometry and bond angle of the sulfite ion (SO_3^{2-}) are best described as

A. pyramidal, 107°.

B. tetrahedral, 109°.

C. bent, 104°.

D. trigonal planar, 120°.

14. As the size of the halogen molecules, X_2, increases down the group, their boiling points

A. decrease due to decreasing electronegativity.

B. decrease due to decreasing bond energies.

C. increase due to increasing permanent dipole–dipole attraction.

D. increase due to increasing van der Waals' forces.

15. When the pressure is increased at constant temperature, the particles in a gas will

A. become smaller.

B. become larger.

C. move faster.

D. be closer together.

16. When solid ammonium nitrate dissolves in water, the temperature decreases. Which statement about the dissolving of ammonium nitrate in water is correct?

A. It is endothermic with ΔH greater than zero.

B. It is endothermic with ΔH less than zero.

C. It is exothermic with ΔH less than zero.

D. It is exothermic with ΔH greater than zero.

17. When 0.01 mol of solid NaOH is added to 100 cm^3 of 1.0 $mol\,dm^{-3}$ HCl, the temperature increases by ΔT_1. What will be the temperature change, ΔT_2, for a second experiment in which the amount of NaOH and the volume of 1.0 $mol\,dm^{-3}$ HCl are each doubled?

A. $\Delta T_2 = \Delta T_1$

B. $\Delta T_2 = \frac{1}{2}\Delta T_1$

C. $\Delta T_2 = 2\Delta T_1$

D. $\Delta T_2 = 4\Delta T_1$

18.

$$O_2(g) \rightarrow 2O(g) \qquad \Delta H = 498 \text{ kJ}$$
$$3O_2(g) \rightarrow 2O_3(g) \qquad \Delta H = 284 \text{ kJ}$$

Using the information above, what is ΔH for the following equation in kJ?

$$O_3(g) \rightarrow 3O(g)$$

A. 214

B. 356

C. 463

D. 605

19. What are the units for the rate of a reaction?

A. mol dm^{-3}

B. s^{-1}

C. $\text{mol dm}^{-3}\,\text{s}^{-1}$

D. $\text{dm}^{3}\,\text{mol}^{-1}\,\text{s}^{-1}$

20.

$$Sn(s) + 2Fe^{3+}(aq) \rightarrow Sn^{2+}(aq) + 2Fe^{2+}(aq)$$

Tin metal reacts with aqueous Fe^{3+} ions according to the equation above. Which of the following factors will increase the rate of this reaction?

I. Increasing the Fe^{3+} ion concentration

II. Decreasing the size of the tin pieces

A. I only

B. II only

C. Both I and II

D. Neither I nor II

21. $$NH_3(g) + H_2O(l) \rightleftharpoons NH_4^+(aq) + OH^-(aq) \qquad \Delta H > 0$$

Which change increases the amount of NH_4^+ ions in the above reaction?

A. decreasing the temperature

B. decreasing the pressure

C. removing water

D. adding an acid

22. Which statement(s) is(are) correct about the effect of adding a catalyst to a system at equilibrium?

I. The rate of the forward reaction increases.

II. The rate of the reverse reaction increases.

III. The yield of the products increases.

A. I only

B. III only

C. I and II only

D. I, II and III

23. A Brønsted-Lowry base is defined as a substance which

A. accepts H^+ ions.

B. produces OH^- ions.

C. conducts electricity.

D. donates protons.

24. Which statement best describes the difference between solutions of strong and weak acids of equal concentration?

A. Weak acid solutions have lower pH values than strong acids.

B. Weak acid solutions react more slowly with sodium carbonate than strong acids.

C. Weak acid solutions require fewer moles of base for neutralisation than strong acids.

D. Weak acid solutions do not react with magnesium while strong acids do.

25. What is the oxidation number of phosphorus in NaH_2PO_4?

A. +3

B. −3

C. +5

D. −5

26. Which product is formed at the cathode (negative electrode) when molten $MgCl_2$ is electrolysed?

A. Mg^{2+}

B. Cl^-

C. Mg

D. Cl_2

27. $$CH_3OH + CH_3CH_2COOH \rightarrow CH_3CH_2COOCH_3 + H_2O$$

The forward reaction represented by the equation above is

A. addition.

B. esterification.

C. hydrolysis.

D. neutralisation.

28. Which of the following statements about single and double bonds between two carbon atoms is (are) correct?

I. Double bonds are stronger than single bonds.

II. Double bonds are more reactive than single bonds.

A. I only

B. II only

C. Both I and II

D. Neither I nor II

29. Which of the following is an amine?

A. $CH_3CH_2NH_2$

B. CH_3CONH_2

C. $-[CH_2CONHCH_2CO]_n-$

D. $CH_3CH_2C \equiv N$

30. The boiling points for several bromoalkanes are given below.

CH_3Br (4 °C) CH_2Br_2 (97 °C) $CHBr_3$ (150 °C)

The increase in boiling points is best attributed to changes in the strengths of

A. covalent bonds.

B. permanent dipole–dipole interactions.

C. hydrogen bonds.

D. van der Waals' forces.