INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL

N01/420/S(1) A

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													2 **He** 4.00
3 **Li** 6.94	4 **Be** 9.01			Atomic Mass								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. Which sample has the greatest mass?

A. 1.0 mol of H_2S

B. 1.0 mol of H_2O_2

C. 2.0 mol of OH^-

D. 2.0 mol of NH_4^+

2. A hydrocarbon contains 80 % by mass of carbon. What is its empirical formula?

A. CH

B. CH_2

C. CH_3

D. CH_4

3. Methanol can undergo complete combustion in air as shown below:

$$2CH_3OH + \_\_\_\_ O_2 \rightarrow \_\_\_\_ CO_2 + \_\_\_\_ H_2O$$

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

A. 1

B. 2

C. 3

D. 4

4. Calcium carbonate decomposes on heating as follows:

$$CaCO_3 \rightarrow CaO + CO_2$$

What mass (in grams) of CaO will be obtained by the complete decomposition of 50 g of $CaCO_3$?

A. 14

B. 25

C. 28

D. 40

5. Which solution contains the greatest amount (in moles) of solute?

A. $10.0\ cm^3$ of $0.500\ mol\ dm^{-3}$ KOH

B. $20.0\ cm^3$ of $0.400\ mol\ dm^{-3}$ KOH

C. $30.0\ cm^3$ of $0.300\ mol\ dm^{-3}$ KOH

D. $40.0\ cm^3$ of $0.200\ mol\ dm^{-3}$ KOH

6. Isotopes of an element have the same

A. number of protons and neutrons

B. number of protons and electrons

C. number of neutrons and electrons

D. atomic number and mass number

7. Which electron transition in the hydrogen atom releases the most energy?

A. $n = 2 \rightarrow n = 1$

B. $n = 3 \rightarrow n = 2$

C. $n = 4 \rightarrow n = 3$

D. $n = 5 \rightarrow n = 4$

8. Which of the properties of the alkali metals decrease(s) from Li to Cs?

I. atomic radius

II. melting point

III. electronegativity

A. I and II

B. II only

C. II and III

D. III only

9. Which pair of species react together when mixed in aqueous solution?

A. Br_2 and Cl^-

B. I_2 and Br^-

C. I_2 and Cl^-

D. Cl_2 and Br^-

10. Element *X* is in group 3 and element *Y* is in group 6 of the Periodic Table. Which is the most likely formula of the compound formed when *X* and *Y* react together?

A. XY

B. X_2Y_3

C. XY_2

D. X_3Y_2

11. Which molecule contains a multiple bond?

A. H_2

B. H_2O

C. C_2H_4

D. C_2H_6

12. Which is **not** present in CH_3OCH_3 in the liquid state?

A. Covalent bonding

B. Van der Waals' forces

C. Dipole-dipole attractions

D. Hydrogen bonding

13. Which statement is **not** true about metallic bonding?

A. It is present in mixtures of metals.

B. It results from the transfer of electrons from metals to non-metals.

C. It involves the delocalization of electrons.

D. It is electrostatic in nature.

14. Chlorine has a lower boiling point than bromine because chlorine and bromine have different

A. reactivities

B. bond enthalpies

C. bond polarities

D. molecular masses

15. A fixed mass of gas in a container of constant volume is heated. Which of the following does **not** increase?

A. The average kinetic energy of the gas particles

B. The pressure of the gas

C. The frequency of collisions between gas particles

D. The average distance between gas particles

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

A. They have positive ΔH values.

B. They release energy.

C. The products have a higher enthalpy than the reactants.

D. The products are less thermally stable than the reactants.

17. The enthalpy changes for two reactions involving hydrogen are as follows:

$$C(s) + 2H_2(g) \rightarrow CH_4(g) \qquad \Delta H = -75 \text{ kJ}$$
$$H_2(g) \rightarrow 2H(g) \qquad \Delta H = +436 \text{ kJ}$$

What is the enthalpy change (in kJ) for the reaction below?

$$CH_4(g) \rightarrow C(s) + 4H(g)$$

A. –947

B. +361

C. +511

D. +947

18. Which reaction has an enthalpy change equal to four times the bond enthalpy of the C–H bond?

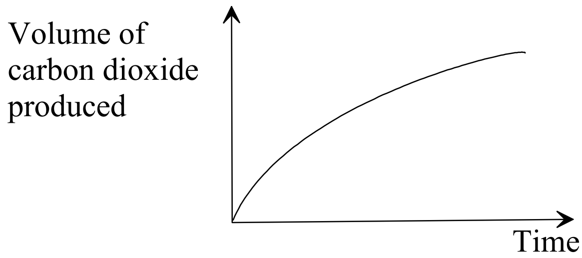
A. $CH_4(g) \rightarrow C(s) + 2H_2(g)$

B. $CH_4(g) \rightarrow C(g) + 2H_2(g)$

C. $CH_4(g) \rightarrow C(s) + 4H(g)$

D. $CH_4(g) \rightarrow C(g) + 4H(g)$

19. The following graph was plotted from the results of an experiment to find the rate of reaction between solid calcium carbonate and aqueous hydrochloric acid.



It can be deduced from the graph that

A. the rate of the reaction increases with time.

B. the concentration of the acid decreases with time.

C. the reaction is reversible.

D. the reaction is exothermic.

20. Which of the following are always true for a chemical reaction at equilibrium?

I. The forward and reverse reaction rates are equal.

II. The amounts of reactants and products are equal.

III. The concentrations of products and reactants do not change.

A. I and II

B. I and III

C. II and III

D. I, II and III

21. Which of the following changes will shift the position of equilibrium of this reaction in the forward direction?

$$N_2(g) + O_2(g) \rightleftharpoons 2\,NO(g) \qquad \Delta H = +181\,kJ$$

I. Increasing the pressure

II. Adding a catalyst

III. Increasing the temperature

A. I only

B. II only

C. III only

D. I and III

22. Which of the following would **definitely** show that a liquid was acidic?

A. Sodium carbonate dissolves in it.

B. Addition of calcium produces bubbles of gas.

C. Addition of solid sodium hydroxide causes a temperature increase.

D. Addition of calcium carbonate produces bubbles of gas.

23. Which reaction is an example of Brønsted-Lowry acid-base behaviour?

A. $Mg + 2H^+ \rightarrow Mg^{2+} + H_2$

B. $2Na + H_2 \rightarrow 2NaH$

C. $H_3O^+ + OH^- \rightarrow 2H_2O$

D. $Ca + 2H_2O \rightarrow Ca^{2+} + 2OH^- + H_2$

24. Which methods could be used to distinguish between aqueous solutions of a strong acid and a weak acid, both of concentration 0.10 mol dm^{-3} ?

I. Finding the volume of 0.10 mol dm^{-3} NaOH needed to neutralise 10 cm^3 of each solution

II. Measuring the pH value of each solution

III. Observing what happens when magnesium is added to each solution

A. I and II

B. II and III

C. I and III

D. I, II and III

25. In which reaction does an element undergo a change in oxidation number?

A. $ZnSO_4 + 2NaOH \rightarrow Zn(OH)_2 + Na_2SO_4$

B. $NaOH + HCl \rightarrow NaCl + H_2O$

C. $2K_2CrO_4 + H_2SO_4 \rightarrow K_2Cr_2O_7 + K_2SO_4 + H_2O$

D. $2CuSO_4 + 4KI \rightarrow 2CuI + I_2 + 2K_2SO_4$

26. Which statement is true for the electrolysis of molten sodium chloride?

A. Sodium ions form atoms at the positive electrode.

B. Chloride ions form molecules at the positive electrode.

C. Sodium chloride molecules form ions to replace those discharged at the electrodes.

D. Oxidation takes place at the negative electrode.

27. Three metals *X*, *Y* and *Z* react as follows:

$$Y + XSO_4 \rightarrow YSO_4 + X$$
$$X + ZSO_4 \rightarrow XSO_4 + Z$$

Which of the following shows the metals *X*, *Y* and *Z* in **decreasing** order of reactivity?

A. *X*, *Y*, *Z*

B. *Z*, *Y*, *X*

C. *Y*, *Z*, *X*

D. *Y*, *X*, *Z*

28. Which features are common to compounds in a homologous series?

I. They have the same general formula

II. They have the same physical properties

III. They have similar chemical properties

A. I and II

B. II and III

C. I and III

D. I, II and III

29. Which of the following is **not** pentane or one of its isomers?

A. $CH_3(CH_2)_3CH_3$

B. $(CH_3)_2CCHCH_3$

C. $(CH_3)_2CHCH_2CH_3$

D. $(CH_3)_4C$

30. Which compound can **not** be formed from ethene in a one-step process?

A. CH_3CH_2Br

B. CH_2BrCH_2Br

C. CH_3CH_2OH

D. $CH_3CH_2NH_2$