M10/4/CHEMI/SPM/ENG/TZ2/XX+

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CHEMISTRY
STANDARD LEVEL
PAPER 1

Wednesday 12 May 2010 (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.
- The periodic table is provided for reference on page 2 of this examination paper.

The Periodic Table

1	2											3	4	5	6	7	0
1 **H** 1.01				Atomic Number **Element** 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)															

†	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. What is the coefficient of Fe_3O_4 when the following equation is balanced using the lowest whole numbers?

$$\_\_\ Al(s) + \_\_\ Fe_3O_4(s) \rightarrow \_\_\ Al_2O_3(s) + \_\_\ Fe(s)$$

A. 2

B. 3

C. 4

D. 5

2. What is the mass, in g, of one molecule of ethane, C_2H_6?

A. 3.0×10^{-23}

B. 5.0×10^{-23}

C. 30

D. 1.8×10^{25}

3. Which molecular formula is also an empirical formula?

A. PCl_3

B. C_2H_4

C. H_2O_2

D. $C_6H_{12}O_6$

4. Which of the following is consistent with Avogadro's law?

A. $\frac{P}{T}$ = constant (V, n constant)

B. $\frac{V}{T}$ = constant (P, n constant)

C. Vn = constant (P, T constant)

D. $\frac{V}{n}$ = constant (P, T constant)

5. A sample of element X contains 69 % of ^{63}X and 31 % of ^{65}X. What is the relative atomic mass of X in this sample?

A. 63.0

B. 63.6

C. 65.0

D. 69.0

6. How many electrons does the ion $^{31}_{15}P^{3-}$ contain?

A. 12

B. 15

C. 16

D. 18

7. What is the electron arrangement of the Mg^{2+} ion?

A. 2,2

B. 2,8

C. 2,8,2

D. 2,8,8

8. Which property **decreases** down group 7 in the periodic table?

A. Melting point

B. Electronegativity

C. Atomic radius

D. Ionic radius

9. Which oxides produce an acidic solution when added to water?

I. P_4O_{10}
II. MgO
III. SO_3

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

10. What is the formula of magnesium fluoride?

A. Mg_2F_3

B. Mg_2F

C. Mg_3F_2

D. MgF_2

11. What is the shape of the ammonia molecule, NH_3?

A. Trigonal planar

B. Trigonal pyramidal

C. Linear

D. V-shaped (bent)

12. Which molecule is polar?

A. CH_2Cl_2

B. BCl_3

C. Cl_2

D. CCl_4

13. Which substance can form intermolecular hydrogen bonds in the liquid state?

A. CH_3OCH_3

B. CH_3CH_2OH

C. CH_3CHO

D. $CH_3CH_2CH_3$

14. Which compound has a covalent macromolecular (giant covalent) structure?

A. $MgO(s)$

B. $Al_2O_3(s)$

C. $P_4O_{10}(s)$

D. $SiO_2(s)$

15. The standard enthalpy changes for the combustion of carbon and carbon monoxide are shown below.

$$C(s) + O_2(g) \rightarrow CO_2(g) \qquad \Delta H_c^{\ominus} = -394 \text{ kJ mol}^{-1}$$

$$CO(g) + \tfrac{1}{2}O_2(g) \rightarrow CO_2(g) \qquad \Delta H_c^{\ominus} = -283 \text{ kJ mol}^{-1}$$

What is the standard enthalpy change, in kJ, for the following reaction?

$$C(s) + \tfrac{1}{2}O_2(g) \rightarrow CO(g)$$

A. –677

B. –111

C. +111

D. +677

16. Which is correct about energy changes during bond breaking and bond formation?

	Bond breaking	Bond formation
A.	exothermic and ΔH positive	endothermic and ΔH negative
B.	exothermic and ΔH negative	endothermic and ΔH positive
C.	endothermic and ΔH positive	exothermic and ΔH negative
D.	endothermic and ΔH negative	exothermic and ΔH positive

17. Which processes are exothermic?

I. Ice melting
II. Neutralization
III. Combustion

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

18. Which unit could be used for the rate of a chemical reaction?

A. mol

B. mol dm^{-3}

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

D. dm^3

19. Which of the following can **increase** the rate of a chemical reaction?

I. Increasing the temperature

II. Adding a catalyst

III. Increasing the concentration of reactants

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

20. What is the equilibrium constant expression, K_c, for the following reaction?

$$N_2O_4(g) \rightleftharpoons 2NO_2(g)$$

A. $K_c = \frac{[NO_2]}{[N_2O_4]}$

B. $K_c = \frac{[NO_2]^2}{[N_2O_4]}$

C. $K_c = \frac{[NO_2]}{[N_2O_4]^2}$

D. $K_c = [NO_2][N_2O_4]^2$

21. Consider the endothermic reaction below.

$$5CO(g) + I_2O_5(g) \rightleftharpoons 5CO_2(g) + I_2(g)$$

According to Le Chatelier's principle, which change would result in an increase in the amount of CO_2?

A. Increasing the temperature

B. Decreasing the temperature

C. Increasing the pressure

D. Decreasing the pressure

22. Which species behave as Brønsted-Lowry acids in the following reversible reaction?

$$H_2PO_4^-(aq) + CN^-(aq) \rightleftharpoons HCN(aq) + HPO_4^{2-}(aq)$$

A. HCN and CN^-

B. HCN and HPO_4^{2-}

C. $H_2PO_4^-$ and HPO_4^{2-}

D. HCN and $H_2PO_4^-$

23. Which of the following are weak acids in aqueous solution?

I. CH_3COOH

II. H_2CO_3

III. HCl

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

24. In which species does sulfur have an oxidation number of 0?

A. SO_3

B. S_8

C. Na_2SO_4

D. H_2S

25. What is the reducing agent in the reaction below?

$$2MnO_4^-(aq) + Br^-(aq) + H_2O(l) \rightarrow 2MnO_2(s) + BrO_3^-(aq) + 2OH^-(aq)$$

A. Br^-

B. BrO_3^-

C. MnO_4^-

D. MnO_2

26. Which changes could take place at the positive electrode (cathode) in a voltaic cell?

I. $Zn^{2+}(aq)$ to $Zn(s)$

II. $Cl_2(g)$ to $Cl^-(aq)$

III. $Mg(s)$ to $Mg^{2+}(aq)$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

27. What is the structural formula of 2,3-dibromo-3-methylhexane?

A. $CH_3CHBrCHBrCH(CH_3)CH_2CH_3$

B. $CH_3CHBrCBr(CH_3)CH_2CH_2CH_3$

C. $CH_3CH_2CHBrCBr(CH_2CH_3)_2$

D. $CH_3CHBrCHBrCH(CH_2CH_3)_2$

28. What happens when a few drops of bromine water are added to excess hex-1-ene and the mixture is shaken?

I. The colour of the bromine water disappears.

II. The organic product formed does not contain any carbon-carbon double bonds.

III. 2-bromohexane is formed.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

29. What is the product of the following reaction?

$$CH_3CH(OH)CH_3 \xrightarrow{Cr_2O_7^{2-}/H^+}$$

A. CH_3COOH

B. CH_3COCH_3

C. CH_3CH_2COOH

D. $CH_3CH_2CH_3$

30. How many significant figures are there in 0.00370?

A. 2

B. 3

C. 5

D. 6