Class Adm No

Candidate Name: _____

millennia institute

Promotional Examinations 2008

Pre-university 2

CHEMISTRY

HIGHER 1 8872/1

Monday 8th Sept 2008 50 minutes

Additional materials:
Answer paper
Data Booklet
1 piece of foolscap paper

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.
Write your name, index number and class on the answer sheet in the spaces provided and at the top of this page.

There are **thirty** questions in this paper. Answer **all** questions. For each question, there are four possible answers, **A, B, C** and **D**.
Choose the one you consider correct and record your choice in **soft pencil** on the separate answer sheet.

Read the instructions on the Answer Sheet very carefully.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

This question paper consists of 12 printed pages.

Section A: Multiple Choice Questions (30m)

For each question, there are 4 possible answers, **A**, **B**, **C** and **D**. Choose the **one** that you consider correct.

1. Which of the following contains 9.03×10^{21} of atoms?

   A 2.25 g of methane
   B 0.6375 g of ammonia
   C 336 cm^3 of argon gas at standard temperature and pressure
   D 3.60 dm^3 of fluorine gas at room temperature and pressure

2. On heating chromite, $FeCr_2O_4$ with sodium carbonate in air, the following reaction occurs:

   $4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$

   Which species is oxidised and which species is reduced in this process?

	Species oxidised	Species reduced
A	Chromium only	Carbonate ion only
B	Chromium only	Carbonate ion and oxygen
C	Chromium and iron	Oxygen only
D	Chromium and iron	Carbonate ion and oxygen

3. The successive ionization energies, in kJ mol^{-1}, of an unknown element **E** are given below.

   420 3100 4400 5900 8000 9600 11400 13300

   Which of the following statements about **E** is correct?

   A **E** is in group II of the Periodic Table.
   B The oxide of **E** is an amphoteric oxide.
   C The chloride of **E** hydrolyses in water to give an acidic pH.
   D Element **E** can conduct electricity in the solid and molten state.

4. Which electronic configuration is that of an atom of an element which is isoelectronic with H_2S?

A $1s^2\ 2s^2\ 2p^6\ 3s^2$
B $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$
C $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$
D $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

5. Which of the following pairs contains a compound held by ionic attractions and a compound held by permanent dipole-permanent dipole attractions?

A sodium chloride, tetrachloromethane
B strontium, bromoethane
C aluminium fluoride, phosphorus trichloride
D sodium ethanoate, beryllium hydride

6. How many σ and π bonds are there in linear C_2H_2 molecule?

A 2 σ and 2π **B** 2 σ and 3π
C 3 σ and 1π **D** 3 σ and 2π

7. Why is the boiling point of butanone (79.6^{o}C) higher than that of pentane (36.1^{o}C)?

A The relative molecular mass of butanone is higher than that of pentane molecule
B The butanone molecule has a larger surface area than that of a pentane molecule
C There are permanent dipole-permanent dipole forces between butanone molecules, but only van der Waals' forces between pentane molecules.
D There are hydrogen bonds between butanone molecules, but not between pentane molecules.

8. Given that the enthalpy change of neutralisation for the reaction given below is -114kJmol^{-1},

   $2NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$

   What is the most likely value for the enthalpy change of neutralization for the following reaction?

   $2Ba(OH)_2(aq) + 2HCl(aq) \rightarrow BaCl_2(aq) + 2H_2O(l)$

A -57 kJmol^{-1} **B** -76 kJmol^{-1}

C -114 kJmol^{-1} **D** -228 kJmol^{-1}

9. The radii of the ions P^{3-}, S^{2-} and Cl^- are 0.212nm, 0.184nm and 0.181nm respectively. Which of the following correctly explains why the radius decreases from P^{3-} to Cl^-?

A An increase in the total number of electrons and in the nuclear charge

B An increase in the total number of electrons and the nuclear charge remaining constant.

C A constant total number of electrons and an increase in the nuclear charge

D A decrease in the total number of electrons with nuclear charge remaining constant.

10. Which of the following changes **does not** take place in a period of elements with increasing atomic number?

A The atomic radius of the elements decreases.

B The oxides of the elements become less acidic.

C The electrical conductivity generally decreases.

D The electronegativity of the elements increases.

11. Which oxide will not dissolve in aqueous sodium hydroxide?

A Al_2O_3 **B** MgO

C SO_2 **D** SiO_2

12. The following reaction is endothermic.

$$\text{Reactants} \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} \text{Products} \qquad \Delta H > 0$$

Which of the following represents the changes when the equilibrium mixture is cooled?

	k_1	k_{-1}	K_c
A	increases	increases	increases
B	decreases	decreases	decreases
C	increases	decreases	increases
D	decreases	increases	decreases

13. If the reaction

P + Q → R + S

is described as being zero order with respect to **P**, which of the following statements best describes **P**?

A **P** is a catalyst in the above reaction.

B The concentration of **P** does not change during the reaction.

C There are no **P** molecules which possess sufficient energy to react.

D The rate of reaction is independent of the concentration of **P**.

14. The reaction of a compound **RS** is shown below.

$$\mathbf{RS}\ (g) \rightarrow \mathbf{R}\ (g) + \mathbf{S}\ (g)$$

The rate equation for the reaction is rate = k [**RS**] and the half-life of the reactant is found to be 192.5 s.

If the initial concentration of **RS** is 2.0×10^{-2} mol dm^{-3}, what will be the concentration of **RS** after 385 seconds?

A 1.0×10^{-2} mol dm^{-3}

B 5.0×10^{-3} mol dm^{-3}

C 2.5×10^{-3} mol dm^{-3}

D 2.0×10^{-3} mol dm^{-3}

15. 1 mole of solid I_2 was added to 50 cm^3 of 3 mol dm^{-3} KI. Equilibrium was reached. The reaction mixture was then rapidly cooled and aqueous $AgNO_3$ was added until no further precipitation occurred. The mass of precipitate was 11.75 g. Calculate the value of K_c for the reaction.

$$I_2(s) + I^-(aq) \rightleftharpoons I_3^-(aq)$$

A 2.22 **B** 2.00

C 0.15 **D** 0.11

16. Aqueous sodium chlorate(I), NaOCl, is used to keep swimming pool water free of harmful bacteria. It is the HOCl molecules formed when NaOCl reacts with water to that kill bacteria.

$$OCl^-(aq) + H_2O \rightleftharpoons OH^-(aq) + HOCl(aq)$$

The OCl^- ion is broken down by ultra-violet light from the sun.

$$OCl^-(aq) + \text{uv light} \rightarrow Cl^-(aq) + \tfrac{1}{2} O_2(g)$$

What could be done to maintain the highest concentration of HOCl(aq)?

A Acidify the pool water **B** Add a solution of chloride ions
C Add a solution of hydroxide ions **D** Bubble air through the water

17. Consider the equilibrium system

$$Fe_3O_4(s) + CO(g) \rightleftharpoons CO_2(g) + 3\ FeO(s)$$

It is an endothermic reaction at room temperature. Which of the following changes is **incorrect** ?

A Reducing CO_2 causes the position of equilibrium to shift to the right.
B Reducing CO causes the position of equilibrium to shift to the left.
C Adding Fe_3O_4 causes the position of equilibrium to shift to the right.
D Decreasing the temperature causes the position of equilibrium to shift to the left.

18. Acidosis is a condition caused by strenuous exercise in which the pH of human blood falls from the normal value of 7.4 and death may occur should pH drops to 6.8

By how many times is the H^+ ion concentration in blood at pH 6.8 greater than that at pH 7.4?

A 1.1 **B** 2.0 **C** 4.0 **D** 60.0

19. In which of the following equations does the H_2O ion act as a bronsted base?

A $CH_3COOH_{(aq)} + H_2O_{(l)} \rightleftharpoons CH_3COO^-_{(aq)} + H_3O^+_{(aq)}$

B $CO_3^{2-}{}_{(aq)} + H_2O_{(l)} \rightleftharpoons HCO_3^-{}_{(aq)} + OH^-_{(aq)}$

C $HS^-_{(aq)} + H_2O_{(l)} \rightleftharpoons H_2S_{(aq)} + OH^-_{(aq)}$

D $HSO_3^-{}_{(aq)} + H_2O_{(l)} \rightleftharpoons H_2SO_{3(aq)} + OH^-_{(aq)}$

20. Sulphur dioxide dissolves in water to form a weak dibasic acid, H_2SO_3, which forms the following equilibria:

$H_2SO_3\,(aq) \rightleftharpoons H^+(aq) + HSO_3^-(aq) \qquad K_{a1} = 1.5 \times 10^{-2}\ mol\ dm^{-3}$

$HSO_3^-(aq) \rightleftharpoons H^+(aq) + SO_3^{2-}(aq) \qquad K_{a2} = 1.5 \times 10^{-7}\ mol\ dm^{-3}$

Which of the following species are arranged in order of increasing concentration at equilibrium?

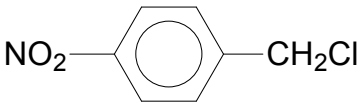
A $[H_2SO_3]$, $[HSO_3^-]$, $[SO_3^{2-}]$

B $[H_2SO_3]$, $[SO_3^{2-}]$, $[HSO_3^-]$

C $[HSO_3^-]$, $[SO_3^{2-}]$, $[H_2SO_3]$

D $[SO_3^{2-}]$, $[HSO_3^-]$, $[H_2SO_3]$

21. Which type of reaction cannot take place with the compound



?

A Electrophilic addition **B** Electrophilic substitution

C Free radical substitution **D** Nucleophilic substitution

22. How many isomers (both structural and cis-trans) are there for dibromopropene?

A 3 **B** 5 **C** 6 **D** 7

23. When heated strongly, a hydrocarbon gives ethene, propane and but-1-ene in the mole ratio 5 : 1 : 1.

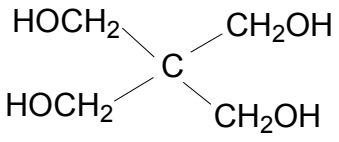
Which of the following is the molecular formula of the hydrocarbon?

A $C_{17}H_{36}$ **B** $C_{17}H_{34}$ **C** $C_{19}H_{20}$ **D** $C_{19}H_{40}$

24. Which statement correctly describes what happens when one mole of ethane is mixed with six moles of bromine in the dark at room temperature.

A There is no reaction
B CH_3CH_2Br and HBr are formed
C CH_3CBr_3 and HBr are formed
D CBr_3CBr_3 and HBr are formed

25. Pentaerythritol is an intermediate formed in the manufacture of paint. It has a structure shown below.



Pentaerythritol

Which of the following can be deduced from its structure?

A It is a tertiary alcohol
B It is soluble in water
C It gives yellow crystals when heated with aqueous NaOH and iodine
D It is dehydrated to an alkene by concentrated sulphuric acid.

For questions 26-30, the responses A to D should be selected on the basis of

A	B	C	D
1,2 and 3 are correct	1 and 2 only are correct	2 and 3 only are correct	1 only is correct

26. Which of the following conversions show an oxidation of bromine?

1 $Br_2 \rightarrow BrO^-$ (√)

2 $Br_2 \rightarrow BrF$ (√)

3 $Br_2 \rightarrow BrI$

27. In which of the following compounds are the bond angles in Molecule I **greater** than in Molecule II?

	Molecule I	Molecule II
1	H_2O	H_2S
2	NH_4^+	NH_3
3	CO_3^{2-}	NO_3^-

28. Which set of solutions below gives a buffer solution when they are mixed?

1 25 cm^3 of 0.10 mol dm^{-3} CH_3COOH and 25 cm^3 of 0.10 mol dm^{-3} CH_3COONa

2 25 cm^3 of 0.10 mol dm^{-3} CH_3COOH and 10 cm^3 of 0.10 mol dm^{-3} NaOH

3 25 cm^3 of 0.10 mol dm^{-3} CH_3COOH and 30 cm^3 of 0.10 mol dm^{-3} NaOH

29. In a lake, an excess of the pesticide *Aqua*(used to spray crops), decomposes into harmless products according to the rate equation :

rate = k[*Aqua*]

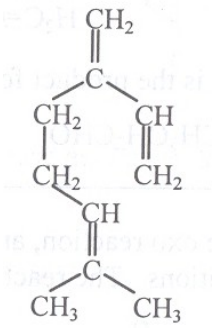
Which of the following are **correct** statements about this reaction?

1 A change in temperature of the lake will later the rate constant, k. (√)

2 It is a first order reaction (√)

3 The half-life of *Aqua* depends on its concentration in the lake.

30. A chemical defence secreted by a species of termite has the structure shown below.



The structure of this compound is determined by treating it with acidified hot concentrated manganate(VII) ions.

Which compounds are formed in this reaction?

1 CO_2

2 CH_3COCH_3

3 $HOOCCO(CH_2)_2COOH$

- END OF PAPER -