**Beaconhouse Defence Campus**

**Chemistry AS 9701**

**April 2020**

**Assessment I**

**30 MCQs Time: 50 min**

**Name:** …………………………………  **Teacher’s name:** ……………………………..

**Instructions:**

* Answer all questions
* Data booklet may be used

**Section A**

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

Use of the Data Booklet may be appropriate for some questions.

**1** Which compound contains two different elements with identical oxidation states?

**A** HC*l*O **B** Mg(OH)2 **C** Na2SO4 **D** NH4C*l*

**2** For the element sulfur, which pair of ionisation energies has the largest difference between them?

**A** third and fourth ionisation energies

**B** fourth and fifth ionisation energies

**C** fifth and sixth ionisation energies

**D** sixth and seventh ionisation energies

**3** Which ion has both more electrons than protons and more protons than neutrons?

**A** D - **B** H3O + **C** OD – **D** OH –

**4** Which species contains the smallest number of electrons?

**A** B 3+ **B** Be 2+ **C** H – **D** He +

**5.** A student mixed 25.0 cm3 of 4.00 mol dm–3 hydrochloric acid with an equal volume of

4.00 mol dm–3 sodium hydroxide. The initial temperature of both solutions was 15.0 °C. The

maximum temperature recorded was 30.0 °C.

Using these results, what is the enthalpy change of neutralisation of hydrochloric acid?

**A** –62.7 kJ mol–1

**B** –31.4 kJ mol–1

**C** –15.7 kJ mol–1

**D** –3.14 kJ mol–1

**6.** HOCl (aq) is the molecule that kills bacteria when chlorine is added to water.

The following reaction produces this molecule.

Cl2(g) + H2O(I) ⇌ HOCl (aq) + H+(aq) + Cl–(aq)

Which statement about this reaction is correct?

**A** Chlorine is both oxidised and reduced.

**B** Chlorine is oxidised but not reduced.

**C** Hydrogen is both oxidised and reduced.

**D** Hydrogen is oxidised but not reduced.

**7**. All the reactants and products of an exothermic reaction are gaseous.

Which statement about this reaction is correct?

**A** The total bond energy of the products is less than the total bond energy of the reactants, and

 ΔH for the reaction is negative.

**B** The total bond energy of the products is less than the total bond energy of the reactants, and

 ΔH for the reaction is positive.

**C** The total bond energy of the products is more than the total bond energy of the reactants,

 and ΔH for the reaction is negative.

**D** The total bond energy of the products is more than the total bond energy of the reactants,

 and ΔH for the reaction is positive.

**8.** The gas laws can be summarised in the ideal gas equation. *pV* = *nRT*

0.960 g of oxygen gas is contained in a vessel of volume 7.00 × 10–3 m3 at a temperature of 30 °C.

Assume that the gas behaves as an ideal gas.

What is the pressure in the vessel?

**A** 1.07 kPa **B** 2.14 kPa **C** 10.8 kPa **D** 21.6 kPa

**9.** Hess’ Law and bond energy data can be used to calculate the enthalpy change of a reaction.

Bromoethane, CH3CH2Br, can be made by reacting ethene with hydrogen bromide.

CH2=CH2 + HBr → CH3CH2Br

What is the enthalpy change for this reaction?

**A** – 674 kJ mol–1

**B** – 64 kJ mol –1

**C** +186 kJ mol –1

**D** +346 kJ mol –1

**10.** Histidine is an amino acid.

What are the approximate bond angles 1, 2, and 3?

**1 2 3**

**A** 109.5 107 90

**B** 120 107 109.5

**C** 120 120 90

**D** 120 120 109.5

**11.** Acidified potassium manganate(VII) reacts with iron(II) ethanedioate, FeC2O4.

The reactions taking place are shown.

MnO4 – + 8H+ + 5e– → Mn2+ + 4H2O

Fe2+ → Fe3+ + e–

C2O4 2– → 2CO2 + 2e–

How many moles of iron(II) ethanedioate react with **one** mole of potassium manganate(VII)?

**A** 0.60 **B** 1.67 **C** 2.50 **D** 5.00

**12** When copper is added to a solution of silver ions, the following equilibrium is established.

Cu (s) + 2Ag+(aq) ⇌ Cu2+(aq) + 2Ag (s) *K*c = 1.0 × 105

What is the concentration of silver ions at equilibrium when [Cu2+] = 0.10 mol dm–3?

**A** 5.0 × 10–7 mol dm–3

**B** 5.0 × 10–4 mol dm–3

**C** 1.0 × 10–3 mol dm–3

**D** 1.0 × 102 mol dm–3

**13.** A solution contains both Mg2+(aq) and Sr2+(aq) at the same concentration.

The solution is divided into two equal portions. Aqueous sodium hydroxide is added dropwise to

one portion. Dilute sulfuric acid is added dropwise to the other portion.

Which row is correct?

 **precipitate seen first precipitate seen first**

 **when NaOH(aq) is added when H2SO4(aq) is added**

**A** magnesium hydroxide magnesium sulfate

**B** magnesium hydroxide strontium sulfate

**C** strontium hydroxide magnesium sulfate

**D** strontium hydroxide strontium sulfate

**14** The volatility of the Group 17 elements, chlorine, bromine and iodine, decreases down the group. What is responsible for this?

**A** bond length in the halogen molecule

**B** bond strength in the halogen molecule

**C** electronegativity of the halogen

**D** number of electrons in the halogen molecule

**15** Bromine is extracted from sea-water.

 In the final stages of the process two redox reactions take place.

Br2(aq) + SO2(g) + 2H2O(l) → 2HBr(aq) + H2SO4(aq)

2HBr(aq) + C*l*2(g) → Br2(g) + 2HC*l* (aq)

Which row is correct?

**Strongest oxidising agent weakest oxidising agent**

**A** Br2 SO 2 C*l* 2

**B** C*l* 2 Br2 SO2

**C** C*l* 2 SO2 Br2

**D** SO2 Br2 C*l* 2

**16.** A halogenoalkane has the molecular formula C5H11Br. The halogenoalkane does **not** form an alkene when treated with ethanolic sodium hydroxide.

What could be the halogenoalkane?

**A** 1-bromo-2-methylbutane

**B** 2-bromo-2-methylbutane

**C** 3-bromopentane

**D** bromodimethylpropane

**17** The reactions of four organic compounds are given in the table.

Which compound could be propan-2-ol?

|  |  |
| --- | --- |
|  |  **reagent / observations** |
|  | when oxidised with Cr2O72–/ H+, gives an organic product with a boiling point greater than the original compound | when added to ethanoic acid, and a few drops of conc. H2SO4, gives a sweet-smelling compound |
| **A****B****C****D** | NoNoYesYes | NoYesNoYes |

**18.** Compound **Y** gives methanol and sodium ethanoate on treatment with aqueous sodium

hydroxide. What is the structure of **Y**?

**A** CH3CO2CH3

**B** HCO2C2H5

**C** HO2CCH2CHO

**D** HOCH2CH2COOH

**19** Which compound can be used to make propanoic acid by treatment with a single reagent?

**A** CH2=CHCH2CH3

**B** CH3CH2CH2CN

**C** CH3CH(OH)CN

**D** CH3CH(OH)CH3

**20.** The infra-red spectrum of compound **L** is shown.

What could be the structure of **L**?

**A** HOCH2COCH2OH

**B** HOCH2CH(OH)CHO

**C** HOCH2CH(OH)CH2OH

**D** HOCH2CHCOOH

**21** Which compound does **not** exhibit stereoisomerism?

**A** CH3CHC*l* CH2CHO

**B** CH3CHCHCH3

**C** CH2C*l* CH2CC*l*2H

**D** CHC*l* CHC*l*



**22** The diagram shows the skeletal formula of citric acid.

What is the molecular formula of citric acid?

**A** C6H8O7 **B** C6H4O7

**C** C8H8O7 **D** C10H8O7

**23** Equal volumes of aqueous silver nitrate were added to separate small volumes of bromoethane

and iodoethane in two test-tubes. The test-tubes were shaken.

Which row about the observations made for **bromoethane** is correct?

**colour of precipitate rate of reaction**

**A** cream faster than for iodoethane

**B** cream slower than for iodoethane

**C** yellow faster than for iodoethane

**D** yellow slower than for iodoethane

**24** Many, but not all, organic reactions need to be heated before a reaction occurs.

Which reaction occurs quickly at room temperature (20 °C)?

**A** CH3OH + PC*l* 5 → CH3C*l* + POC*l* 3 + HC*l*

**B** CH3CH2Br + KCN → CH3CH2CN + KBr

**C** CH3CH2OH → C2H4 + H2O

**D** CH3CH2CN + 2H2O → CH3CH2CO2H + NH3

**25** Compound G

● has a chiral centre,

● gives a positive result with alkaline aqueous iodine,

● does not give a silver mirror with Tollens’ reagent.

What could compound G be?

**A** 1-hydroxybutan-2-one

**B** 2-hydroxybutanal

**C** 3-hydroxybutanal

**D** 3-hydroxybutan-2-one

**Section B**

For each of the questions in this section, one or more of the three numbered statements 1 to 3 may be correct.

Decide whether each of the statements is or is not correct (you may find it helpful to put a tick against the statements that you consider to be correct). The responses A to D should be selected on the basis of

|  |  |  |  |
| --- | --- | --- | --- |
| **A** | **B** | **C** | **D** |
| 1, 2 and 3 arecorrect | 1 and 2 only arecorrect | 2 and 3 only arecorrect | 1 only iscorrect |

No other combination of statements is used as a correct response.

**26** Photochromic lenses in spectacles darken in sunlight because silver crystals are produced by the reaction shown. Ag + + Cl – → Ag + Cl

Which statements are correct for this reaction?

1 Both silver and chlorine atoms have an oxidation number of zero.

2 The oxidation number of chlorine increases.

3 Electrons are transferred from Cl – ions to Ag+ ions.

**27** A cathedral in New Zealand has been constructed from cardboard. Cardboard contains polymer

molecules. Part of one such polymer molecule is shown below.



Which statements about this polymer are correct?

1 The polymer molecules can form hydrogen bonds with each other.

2 The polymer can form intermolecular forces with water molecules.

3 The polymer will not burn easily because it is a secondary alcohol.

**28** X is an element that has

● its outer electrons in the 4th principal quantum shell,

● a higher 1st ionisation energy than calcium.

What could be the identity of X?

1 bromine

2 krypton

3 xenon

**29** Methanol, CH3OH, can be produced industrially by reacting CO with H2.

CO(g) + 2H2(g) ⇌ CH3OH(g) ΔH = –91 kJ mol–1

The process can be carried out at 4 × 103 kPa and 1150 K.

Which statements about this reaction are correct?

1 Increasing the temperature will increase the rate of reaction because more effective collisions will occur.

2 Lowering the temperature will reduce the rate of reaction because the forward reaction is exothermic.

3 Increasing the pressure will reduce the rate of reaction because there are a larger number of moles on the left-hand side of the equation.

**30** The compound shown is produced when sugar burns.

Which reagents would give a positive result with this compound?

1 alkaline aqueous iodine

2 2,4-dinitrophenylhydrazine

3 Fehling’s solution