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TEST CODE 01212010

FORM TP 2007059

MAY/JUNE 2007

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

CHEMISTRY

Paper 01 – General Proficiency

75 minutes

23 MAY 2007 (a.m.)

READ THE FOLLOWING DIRECTIONS CAREFULLY

1. In addition to this test booklet, you should have an answer sheet.
2. Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.
3. On your answer sheet, find the number which corresponds to your item and shade the space having the same letter as the answer you have chosen. Look at the sample item below.

Sample Item

The SI unit of length is the

(A) kilogram
(B) metre
(C) newton
(D) second

Sample Answer

Ⓐ ● Ⓒ Ⓓ

The best answer to this item is "metre", so answer space (B) has been blackened.

4. If you want to change your answer, be sure to erase your old answer completely and fill in your new choice.
5. When you are told to begin, turn the page and work as quickly and as carefully as you can. If you cannot answer an item, omit it and go on to the next one. You can come back to the harder item later. Your score will be the total number of correct answers.
6. You may do any rough work in this booklet.
7. Figures are not necessarily drawn to scale.
8. The use of silent electronic calculators is allowed.
9. This test consists of 60 items. You will have 75 minutes to answer them.
10. Do not be concerned that the answer sheet provides spaces for more answers than there are items in this test.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

AFFIX SEAL HERE

1. Which of the following techniques may be used to separate a mixture of plant pigments into their individual components?

(A) Fractional distillation
(B) Solvent extraction
(C) Paper chromatography
(D) Centrifugation

2. The rate of a chemical reaction does NOT depend on the

(A) concentration of the reactants
(B) presence of a catalyst
(C) temperature of the reacting system
(D) energy change associated with the overall reaction

3. The arrangements of electrons in atoms of X and Y are 2, 8, 5 and 2, 8, 6 respectively. Which of the following represents X and Y?

	X	Y
(A)	Metal	nonmetal
(B)	Nonmetal	nonmetal
(C)	Nonmetal	metal
(D)	Metal	metal

Items 4 - 5 refer to the following information.

The atomic number of element P is 13.

4. In which group of the periodic table should Element P be placed?

(A) 5
(B) 4
(C) 3
(D) 2

5. The oxidation state of Element P would most probably be

(A) 3
(B) +3
(C) 5
(D) +5

6. Which of these elements has 7 electrons in its outer shell?

(A) Hydrogen
(B) Oxygen
(C) Nitrogen
(D) Chlorine

7. The ionic equation for the reaction between an acid and a carbonate may be represented as

(A) $H^+(aq) + CO_3^{-2}(aq) \rightarrow HCO^{-3}(aq)$

(B) $2H^+(aq) + CO_3^{-2}(aq) \rightarrow H_2CO_3(aq)$

(C) $2H^+(aq) + CO_3^{-2}(aq) \rightarrow CO_2(g) + H_2O$

(D) $H^+(aq) + CO_3^{-2}(aq) \rightarrow CO_2(g) + H_2O$

8. The quantity, '1 mole of atoms of an element,' refers to the mass of

(A) the element which combines completely with 12 g of carbon -12
(B) the element which contains 6.0×10^{23} atoms
(C) the element which occupies 24.0 dm^3 at s.t.p.
(D) 1 atom of the element

Items 9 - 10 refer to the following method of preparing a sample of sodium chloride.

Three grams of sodium hydrogen carbonate are added to 100 cm^3 of 0.2 mol dm^{-3} hydrochloric acid. When effervescence ceases, the mixture is filtered and the filtrate heated until a saturated solution is obtained. The saturated solution is left to crystallise.

(Rel. atomic mass: Na = 23; H = 1; C = 12; O = 16; Cl = 35.5).

9. The number of moles of hydrochloric acid participating in this reaction is

(A) 0.2×100

(B) $\frac{100 \times 0.2}{1000}$

(C) $\frac{1000 \times 0.2}{100}$

(D) $\frac{100}{0.2}$

10. The effervescence is caused by the evolution of

(A) oxygen
(B) carbon dioxide
(C) hydrogen
(D) hydrogen chloride

11. Isotopes of an element contain

I. the same number of protons
II. the same number of neutrons
III. different numbers of electrons
IV. the same number of protons as electrons

(A) I and II only
(B) I and IV only
(C) II and III only
(D) II and IV only

12. Which of the following processes suggests that matter is made up of minute particles?

(A) Diffusion
(B) Capillarity
(C) Evaporation
(D) Distillation

13. Which of the following is the correct formula for ammonium carbonate?

(A) NH_4CO_3
(B) $NH_4(CO_3)_2$
(C) $(NH_4)_2CO_3$
(D) $(NH_4)_2(CO_3)_2$

14. What substance, when added to pure water, significantly increases the water's conductivity?

(A) Graphite
(B) Iron (II) hydroxide
(C) Copper (II) hydroxide
(D) Sodium chloride

15. Which of the following statements BEST describes the formation of a metallic bond?

(A) Cations are held together by a sea of mobile electrons.
(B) Metal ions are held together by a sea of anions.
(C) Anions are held together by electrons.
(D) Metal atoms are held together by anions.

16. Covalent compounds can be formed between

(A) a metal and nonmetal
(B) a positive and a negative ion
(C) two identical nonmetal atoms, excluding the noble gases
(D) **two identical nonmetal atoms, including the noble gases**

Items 17 - 18 refer to the following types of substances.

(A) Salt
(B) Base
(C) Alkali
(D) Acid

In answering items 17 - 18, a particular choice from above may be used more than once, once or not at all.

Which of these substances

17. is the oxide of a metal?

18. supplies protons as the only positive ions in aqueous solutions?

19. A substance that has a high melting point, is insoluble in water and does not conduct electricity in the solid or liquid state, has

(A) a metallic structure
(B) an ionic structure
(C) a giant covalent structure
(D) a simple molecular structure

20. When X and Y are stirred together in a beaker and the mixture filtered, X and Y are both present in the filtrate. Which of the following could describe the mixture formed by X and Y?

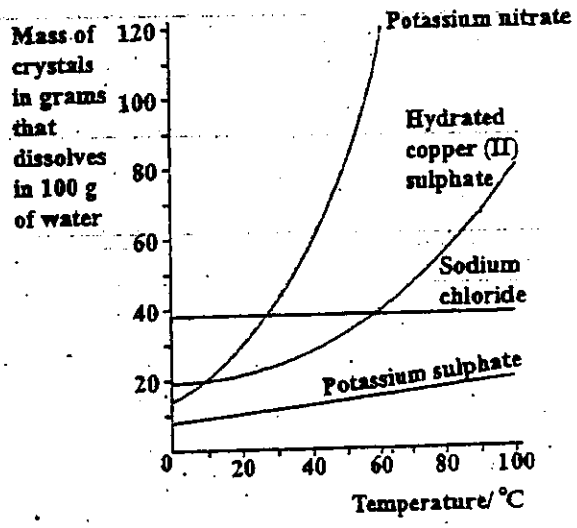
I. Solution
II. Colloid
III. Suspension

(A) I only
(B) III only
(C) I and II only
(D) II and III only

21. From which of the following can a solid be obtained by the process of sedimentation?

(A) Gels
(B) Emulsions
(C) Foams
(D) Suspensions

Item 22 refers to the solubility curves in the diagram below.



22. At approximately what temperature is the solubility of hydrated copper (II) sulphate and sodium chloride the same?

(A) 25 °C
(B) 35 °C
(C) 45 °C
(D) 55 °C

23. Which of the following salts is an acid salt?

(A) $NaHSO_4$
(B) Na_2SO_4
(C) Na_3PO_4
(D) Na_2CO_3

24. Acidified potassium manganate (VII) is

(A) a reducing agent
(B) an oxidising agent
(C) both an oxidising and reducing agent
(D) a dehydrating agent

25. Which of the following reactions involve oxidation and reduction?

I. $Mg(s)+2H^+(aq)\rightarrow Mg^{2+}(aq)+H_2(g)$

II. $Mg(s)+4H^+(aq)+2NO_3^-(aq)\rightarrow Mg^{2+}(aq)+2NO_2(g)+2H_2O(l)$

III. $Ba^{2+}(aq)+SO_4^{2-}(aq)\rightarrow BaSO_4(s)$

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

(A) I, II and III only
(B) I, III and IV only
(C) I, II and IV only
(D) II, III and IV only

26. Crystals of sodium chloride are BEST referred to as

(A) molecular crystals
(B) macromolecular crystals
(C) metallic crystals
(D) ionic crystals

27. In the anodising of an aluminium pot, which of the following is TRUE?

(A) Aluminium is the anode in the cell.
(B) The electrolyte is a solution of sodium chloride.
(C) Hydrogen is given off at the anode.
(D) A layer of aluminium hydroxide forms on the pot.

28. In an experiment, on heating 402g of mercury, a black powder with a mass of 434g is obtained (Rel. atomic mass: Hg = 201; O = 16). The balanced equation representing this reaction is

(A) $Hg(\ell)+O_2(g)=HgO(s)$
(B) $2Hg(\ell)+O_2(g)=2HgO(s)$
(C) $402\,Hg(s)+O_2(g)=434\,HgO(s)$
(D) $2\,Hg+O_2=2HgO$

Items 29 - 30 refer to the following acids.

(A) Sulphuric acid
(B) Hydrochloric acid
(C) Nitric acid
(D) Ethanoic acid

In answering Items 29 - 30, a particular choice from the above may be made more than once, once or not at all.

Which acid

29. has a basicity of 2?

30. is weakly ionised in aqueous solutions?

31. Which of the following chemicals reacts with an acid, liberating a gas which turns lime water milky?

(A) Calcium carbonate
(B) Magnesium metal
(C) Barium chloride
(D) Methyl orange

32. Calcium, magnesium and barium are Group II metals. Which of the following is true of these metals when they react with cold water?

(A) Magnesium is more reactive than calcium.
(B) Calcium is more reactive than barium.
(C) Barium is more reactive than magnesium.
(D) There are no differences in reactivities.

33. Which of the following would allow the passage of an electric current through it?

(A) Solid potassium bromide
(B) Pure water
(C) Propane
(D) Aqueous sodium chloride solution

Items 34 - 35 refer to the following terms.

(A) Isomers
(B) Polymers
(C) Allotropes
(D) Isotopes

Match each of the following descriptions with one of the terms above. Each option may be used more than once, once or not at all.

34. Solid forms of a given element which differ in physical properties

35. Compounds having the same molecular formula but different structural formulae

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Items 36 – 37 refer to the following sequence of reactions involving iron compounds, where I, II, III and IV represent the stages involved.

$$FeCO_3 \xrightarrow{I} FeO \xrightarrow{II} Fe_2O_3 \xrightarrow{III} Fe_2(SO_4)_3 \xrightarrow{IV} Fe(OH)_3$$

36. In which stage is the oxidation state of iron increased?

(A) I
(B) II
(C) III
(D) IV

37. A suitable reagent that could be used at IV is

(A) steam
(B) aqueous sodium hydroxide
(C) hydrogen
(D) solid copper oxide

Item 38 refers to the Haber process for the production of ammonia, according to the equation

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \quad \Delta H = -92 \text{ kJ mol}^{-1}$$

38. The catalyst used in this process is

(A) iron
(B) nickel
(C) platinum
(D) vanadium (V) oxide

39. When copper (II) carbonate is heated alone in a dry test tube a gas is evolved and a black residue is formed. This gas is expected to

(A) relight a glowing splint
(B) turn red litmus blue
(C) decolourize acidified aqueous potassium manganate (VII)
(D) form a white precipitate with aqueous calcium hydroxide

40. Which of the following may be true of metals?

I. They form solid chlorides.
II. They generally form basic oxides.
III. They conduct electricity only when molten.

(A) III only
(B) I and II only
(C) II and III only
(D) I, II and III

41. Which of the following is the MOST complete list of raw materials used in the extraction of iron?

(A) Air, coke, iron ore and limestone
(B) Air, coke, cryolite and limestone
(C) Coke, iron ore, bauxite and limestone
(D) Air, iron ore and limestone

42. The ability of an atom to form a cation increases

(A) across a period
(B) as electronegativity increases
(C) as electropositivity increases
(D) as the oxidation state increases

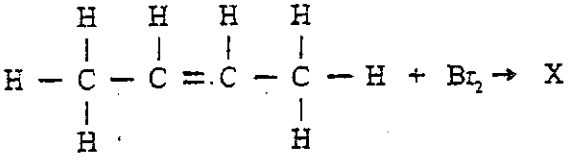
43. Copper and aluminium are both good conductors of electricity, but aluminium is preferred to copper for overhead electrical cables because

(A) aluminium is obtained in a very high degree of purity
(B) aluminium is lighter and resistant to corrosion
(C) copper, a transition metal, forms a coloured coating
(D) copper rapidly reacts with the gases present in air

44. Which of the following substances forms dense white fumes with ammonia gas?

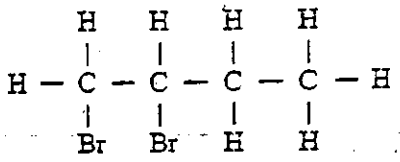
(A) Hydrogen
(B) Hydrogen chloride
(C) Nitrogen dioxide
(D) Oxygen

Item 45 refers to the following equation.

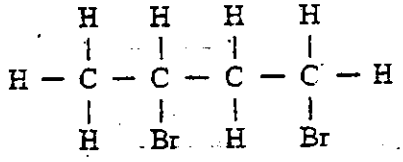


45 Which is the correct structural formula for X?

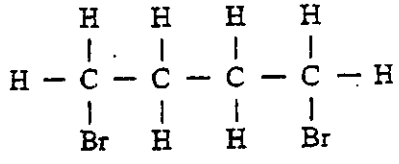
(A)



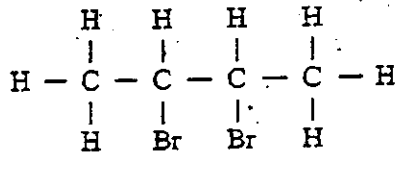
(B)



(C)



(D)



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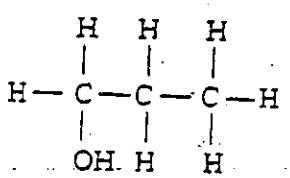
NOTE TO CANDIDATES

ERRATUM SHEET

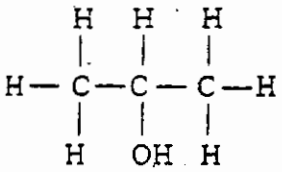
Page 9 – Question 46

The structure, I, should be as follows:

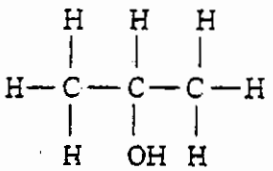


I

Item 46 refers to two organic compounds, I and II, of molecular formula C_3H_8O which have the following structures:



I



II

46. Compounds I and II are known as the

(A) isotopes of C_3H_8O
(B) isomers of C_3H_8O
(C) condensed formulae of C_3H_8O
(D) molecular formulae of C_3H_8O

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47. Which of the following compounds is NOT a member of the alkene series?

(A) C_2H_4

(B) C_5H_{10}

(C) C_2H_6

(D) C_4H_8

48. Which of the following may be true of alkanes and alkenes?

I. Both burn in air to give carbon dioxide and water.
II. Alkanes undergo substitution reactions whilst alkenes undergo addition reactions.
III. Alkanes are said to be saturated hydrocarbons whilst alkenes are unsaturated hydrocarbons.

(A) III only
(B) I and II only
(C) II and III only
(D) I, II and III

49. With which of the following does ethene show an addition reaction?

I. Hydrogen
II. Oxygen
III. Hydrogen chloride
IV. Bromine

(A) I and III only
(B) I and IV only
(C) II and IV only
(D) I, III and IV only

Items 50-51 refer to the following compounds.

I. Terylene
II. Nylon
III. Fats
IV. Proteins

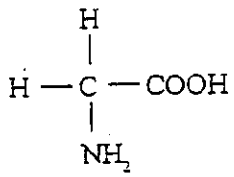
50. Which of the following compounds are synthetic?

(A) I and II only
(B) I and III only
(C) II and III only
(D) III and IV only

51. Ester linkage exists in

(A) III only
(B) I and III only
(C) I and IV only
(D) II and IV only

52. Which of the following types of polymer may be derived from monomers of the type shown below?

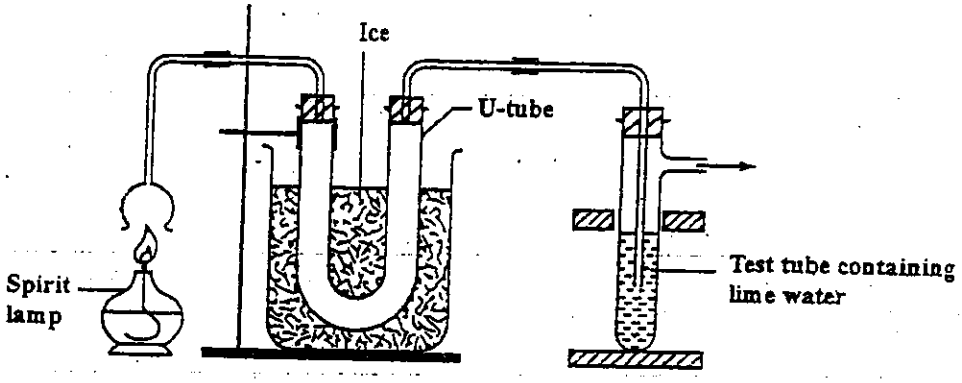


(A) Polyamide
(B) Polyester
(C) Polyalkene
(D) Polysaccharide

53. Which of the following substances is a polysaccharide?

(A) Starch
(B) Insulin
(C) Sucrose
(D) Haemoglobin

Items 54 - 55 refer to the following diagram, which shows how apparatus and materials are used to identify the products formed when ethanol burns.



54. Which of the following BEST describes what will be observed in the U-tube and the test tube at the end of the investigation?

	U-tube	Test tube
(A)	Colourless liquid	Carbon dioxide
(B)	Water	White precipitate
(C)	Colourless liquid	White precipitate
(D)	Water	Carbon dioxide

55. If the ice were removed, which of the following would represent the equation for the reaction?

(A) $2C_2H_5OH(aq) + 7\,O_2(g) \rightarrow 4\,CO_2(g) + 6\,H_2O(\ell)$

(B) $2C_2H_5OH(\ell) + 7\,O_2(g) \rightarrow 4\,CO_2(g) + 6\,H_2O(g)$

(C) $2C_2H_5OH(aq) + 7\,O_2(g) \rightarrow 4\,CO_2(g) + 6\,H_2O(aq)$

(D) $2C_2H_5OH(aq) + 7\,O_2(g) \rightarrow 4\,CO_2(g) + 6\,H_2O(g)$

56. When ethene reacts with steam the ethene is

(A) oxidised to carbon dioxide
(B) converted to ethanol
(C) converted to an ester
(D) decomposed to carbon

57. The fermentation of sugars, using glucose as the substrate, can be represented by the equation

(A) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

(B) $C_6H_{12}O_6 + C_6H_{12}O_6 \rightarrow C_{12}H_{22}O_{11} + H_2O$

(C) $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

(D) $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

Items 58 - 59 refer to the following hydrocarbons.

(A) Methane
(B) Ethane
(C) Propane
(D) Butane

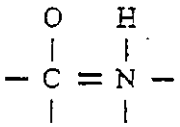
In answering Items 58 - 59, a particular choice from above may be used more than once, once or not at all.

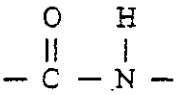
Which hydrocarbon is the

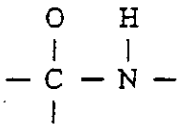
58. major constituent of natural gas?

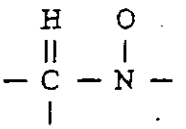
59. source of hydrogen for the Haber process?

60. Which of the following represents the amide linkage?

(A)


(B)


(C)


(D)


IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.