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UNIVERSITY OF SWAZILAND

RESIT EXAMINATION – 2018, MAY

TITLE OF PAPER : Chemistry

COURSE NUMBER : CPR 103

TIME : Three Hours

INSTRUCTIONS :

1. **Answer all questions in Section A** (Total 50 marks)
2. **Answer any two questions in Section B** (each question is 25 marks)

NB: Non-programmable electronic calculators may be used

A periodic table and answer sheet (for **Section A**) are attached

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This Examination Paper Contains Twelve Printed Pages Including This Page

You are not supposed to open the paper until permission to do so has been granted by the Chief Invigilator.

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Section A

1) A small amount of salt dissolved in water is an example of a _____.
A) homogeneous mixture B) heterogeneous mixture
C) compound D) pure substance E) solid

2) Which one of the following is a pure substance?
A) concrete B) wood C) salt water
D) elemental copper E) milk

3) Which states of matter are significantly compressible?
A) gases only B) liquids only C) solids only
D) liquids and gases E) solids and liquids

4) Gases and liquids share the property of _____.
A) compressibility B) definite volume C) incompressibility
D) indefinite shape E) definite shape

5) Of the objects below, _____ is the most dense.
A) an object with a volume of 2.5 L and a mass of 12.5 kg
B) an object with a volume of 139 mL and a mass of 93 g
C) an object with a volume of 0.00212 m^3 and a mass of 4.22×10^4 mg
D) an object with a volume of 3.91×10^{-24} nm^3 and a mass of 7.93×10^{-1} ng
E) an object with a volume of 13 dm^3 and a mass of 1.29×10^3 g

6) Iron has a density of 7.9 g/cm^3. What is the mass of a cube of iron with the length of one side equal to 55.0 mm?
A) 2.1×10^4 g B) 4.3×10^2 g C) 1.3×10^3 g
D) 1.4 g E) 2.3×10^{-2} g

7) In which one of the following numbers are <u>all</u> of the zeros significant?
A) 100.090090 B) 0.143290 C) 0.05843
D) 0.1000 E) 00.0030020

8) Round the number 3456.5 to two significant figures.
A) 3400.0 B) 3400 C) 3000 D) 3500 E) 3000.0

9) Which atom has the smallest number of neutrons?
A) carbon-14 B) nitrogen-14 C) oxygen-16
D) fluorine-19 E) neon-20

10) Which pair of atoms constitutes a pair of isotopes of the same element?
A) ${}^{14}_{6}X$ ${}^{14}_{7}X$ B) ${}^{14}_{6}X$ ${}^{12}_{6}X$ C) ${}^{17}_{9}X$ ${}^{17}_{8}X$
D) ${}^{19}_{10}X$ ${}^{19}_{9}X$ E) ${}^{20}_{10}X$ ${}^{21}_{11}X$

11) Different isotopes of a particular element contain different numbers of _____.
A) protons B) neutrons C) protons and neutrons
D) protons, neutrons, and electrons E) None of the above is correct.

12) In the symbol below, x = _____.

$^{x}_{6}C$

A) 19 B) 13 C) 6 D) 7
E) not enough information to determine

13) In the periodic table, the elements are arranged in _____.
A) alphabetical order B) order of increasing atomic number
C) order of increasing metallic properties D) order of increasing neutron content
E) reverse alphabetical order

14) Which pair of elements below should be the most similar in chemical properties?
A) C and O B) B and As C) I and Br
D) K and Kr E) Cs and He

15) Which compounds do not have the same empirical formula?
A) C_2H_2, C_6H_6 B) CO, CO_2 C) C_2H_4, C_3H_6
D) $C_2H_4O_2$, $C_6H_{12}O_6$ E) $C_2H_5COOOCH_3$, CH_3CHO

16) Of the following, _____ contains the greatest number of electrons.
A) P^{3+} B) P C) P^{2-} D) P^{3-} E) P^{2+}

17) Which of the following are combination reactions?
1) $CH_4\,(g) + O_2\,(g) \rightarrow CO_2\,(g) + H_2O\,(l)$
2) $CaO\,(s) + CO_2\,(g) \rightarrow CaCO_3\,(s)$
3) $Mg\,(s) + O_2\,(g) \rightarrow MgO\,(s)$
4) $PbCO_3\,(s) \rightarrow PbO\,(s) + CO_2\,(g)$
A) 1, 2, and 3 B) 2 and 3 C) 1, 2, 3, and 4 D) 4 only
E) 2, 3, and 4

18) The formula weight of potassium phosphate (K_3PO_4) is _____ amu.
A) 173.17 B) 251.37 C) 212.27 D) 196.27 E) 86.07

19) The formula weight of a substance is _____.
A) identical to the molar mass
B) the same as the percent by mass weight
C) determined by combustion analysis
D) the sum of the atomic weights of each atom in its chemical formula
E) the weight of a sample of the substance

20) There are _____ atoms of oxygen are in 300 molecules of CH_3CO_2H.
A) 300 B) 600 C) 3.01×10^{24}
D) 3.61×10^{26} E) 1.80×10^{26}

21) How many sulfur dioxide molecules are there in 0.180 mol of sulfur dioxide?
A) 1.80×10^{23} B) 6.02×10^{24} C) 6.02×10^{23}
D) 1.08×10^{24} E) 1.08×10^{23}

22) When aqueous solutions of _____ are mixed, a precipitate forms.

A) $NiBr_2$ and $AgNO_3$ B) NaI and KBr
C) K_2SO_4 and $CrCl_3$ D) KOH and $Ba(NO_3)2$
E) Li_2CO_3 and CsI

23) The net ionic equation for the reaction between aqueous sulfuric acid and aqueous sodium hydroxide is _____.

A) $H^+ (aq) + HSO_4^- (aq) + 2OH^- (aq) \rightarrow 2 H_2O (l) + SO_4^{2-} (aq)$

B) $H^+ (aq) + HSO_4^- (aq) + 2 Na^+ (aq) + 2OH^- (aq) \rightarrow 2 H_2O (l) + 2Na^+ (aq) + SO_4^{2-} (aq)$

C) $SO_4^{2-} (aq) + 2Na^+ (aq) \rightarrow 2Na^+ (aq) + SO_4^{2-} (aq)$

D) $H^+ (aq) + OH^- (aq) \rightarrow H_2O(l)$

E) $2H^+ (aq) + SO_4^{2-} (aq) + 2Na^+ (aq) + 2OH^- (aq) \rightarrow 2 H_2O (l) + 2Na^+ (aq) + SO_4^{2-} (aq)$

24) Which one of the following is a weak acid?
A) HNO_3 B) HCl C) HI D) HF E) $HClO_4$

25) In which reaction does the oxidation number of hydrogen change?
A) $HCl (aq) + NaOH (aq) \rightarrow NaCl (aq) + H_2O (l)$
B) $2 Na (s) + 2 H_2O (l) \rightarrow 2 NaOH (aq) + H_2 (g)$
C) $CaO (s) + H_2O (l) \rightarrow Ca(OH)_2 (s)$
D) $2 HClO_4 (aq) + CaCO_3 (s) \rightarrow Ca(ClO_4)_2 (aq) + H_2O (l) + CO_2 (g)$
E) $SO_2 (g) + H_2O (l) \rightarrow H_2SO_3 (aq)$

26) Which of these metals will be oxidized by the ions of aluminum?
A) magnesium B) zinc C) chromium
D) iron E) nickel

27) Oxidation is the _____ and reduction is the _____.
A) gain of oxygen, loss of electrons B) loss of oxygen, gain of electrons
C) loss of electrons, gain of electrons D) gain of oxygen, loss of mass
E) gain of electrons, loss of electrons

28) Which of the following reactions will <u>not</u> occur as written?
A) $Zn (s) + Pb(NO_3)_2 (aq) \rightarrow Pb (s) + Zn(NO_3)_2 (aq)$
B) $Mg (s) + Ca(OH)_2 (aq) \rightarrow Ca (s) + Mg(OH)_2 (aq)$
C) $Sn (s) + 2AgNO_3 (aq) \rightarrow 2Ag (s) + Sn(NO_3)_2 (aq)$
D) $Co (s) + 2AgCl (aq) \rightarrow 2Ag (s) + CoCl_2 (aq)$
E) $Co (s) + 2HI (aq) \rightarrow H_2 (g) + CoI_2 (aq)$

29) What volume (mL) of a concentrated solution of magnesium chloride (9.00 M) must be diluted to 350. mL to make a 2.75 M solution of magnesium chloride?
A) 2.75 B) 50.0 C) 45.0 D) 107 E) 350

30) What volume (ml) of a 3.45 M lead nitrate solution must be diluted to 450.0 ml to make a 0.990 M solution of lead nitrate?

A) 129 B) 109 C) 101 D) 56 E) 45

31) Which one of the following substances is produced during the reaction of an acid with a metal hydroxide?
A) H_2 B) H_2O C) CO_2 D) NaOH E) O_2

32) In which set of elements would all members be expected to have very similar chemical properties?
A) O, S, Se B) N, O, F C) Na, Mg, K
D) S, Se, Si E) Ne, Na, Mg

33) Which one of the following orbitals can hold two electrons?
A) $2p_x$ B) 3s C) $4d_{xy}$ D) all of the above
E) none of the above

34) The ground state electron configuration of Fe is _____.
A) $1s^22s^23s^23p^63d^6$ B) $1s^22s^22p^63s^23p^64s^23d^6$ C) $1s^22s^22p^63s^23p^64s^2$
D) $1a^22s^22p^63s^23p^64s^24d^6$ E) $1s^22s^23s^23p^10$

35) The ground state configuration of fluorine is _____.
A) $[He]2s^22p^2$ B) $[He]2s^22p^3$ C) $[He]2s^22p^4$
D) $[He]2s^22p^5$ E) $[He]2s^22p^6$

36) In which set of elements would all members be expected to have very similar chemical properties?
A) O, S, Se B) N, O, F C) Na, Mg, K
D) S, Se, Si E) Ne, Na, Mg

37) Which one of the following atoms has the largest radius?
A) O B) F C) S D) Cl E) Ne

38) Which ion below has the largest radius?
A) Cl^- B) K^+ C) Br^- D) F^- E) Na^+

39) Which one of the following is a metalloid?
A) Ge B) S C) Br D) Pb E) C

40) Which of the following does <u>not</u> have eight valence electrons?
A) Ca^+ B) Rb^+ C) Xe D) Br^-
E) All of the above have eight valence electrons.

41) How many isomers are possible for C_4H_{10}?
A) 1 B) 2 C) 3 D) 4 E) 10

42) Which statement about hydrocarbons is <u>false</u>?
A) The smallest alkane to have structural (constitutional) isomers has 4 carbon atoms.
B) Cyclic alkanes are structural isomers of alkenes.
C) Alkanes are more reactive than alkenes.
D) Alkanes can be produced by hydrogenating alkenes.
E) Alkenes can be polymerized.

43) The following reaction would produce a(n) _____.

R-OH + R'COOH →

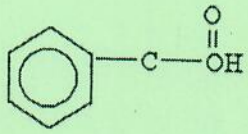
A) ketone B) ether C) aldehyde D) alcohol E) ester

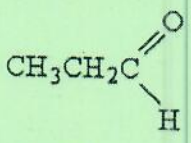
44) What is the general formula for a ketone?

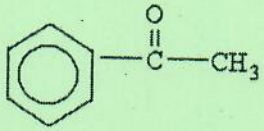
A) R-O-R B) R-CO-R' C) R-CO-OH D) R-OH E) R-CHO

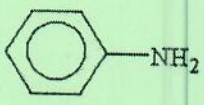
45) Which structure below represents a ketone?

A) 

B) 

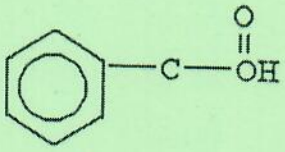
C) 

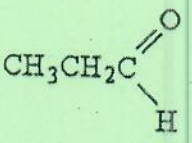
D) 

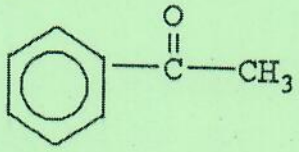
E) 

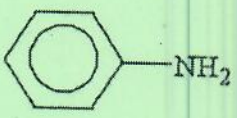
46) Which structure below represents an aldehyde?

A) 

B) 

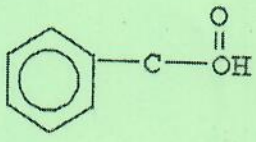
C) 

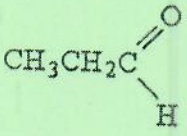
D) 

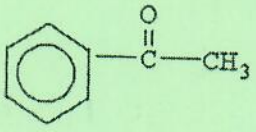
E) 

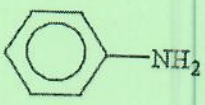
47) Which structure below is not correctly drawn?

A) 

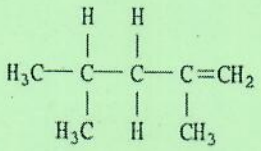
B) 

C) 

D) 

E) 

48) What is the name of the compound below?



A) 2,4-methylbutene B) 2,5-dimethylpentane C) 2,4-ethylbutene
D) 2,4-dimethyl-1-pentene E) 2,4-dimethyl-4-pentene

49) The addition of HBr to 2-butene produces _____.
A) 1-bromobutane B) 2-bromobutane C) 1,2-dibromobutane
D) 2,3-dibromobutane E) no reaction

50) Alkenes have the general formula _____.
A) C_nH_{2n} B) C_nH_{2n-2}. C) C_nH_{2n+2} D) C_nH_n. E) $C_{2n}H_n$.

Section B

Question 1

a) Argon has three naturally occurring isotopes, 36Ar, 38Ar and 40Ar.

i) What is the mass number of each? (4)

ii) How many protons, neutrons and electrons are'present in each? (9)

b) Name the following anions and give the names and formulas of the acids derived from them: .

i) Br^-

ii) ClO_3^-

iii) SO_4^{2-}

iv) I^- (12)

Question 2

a) Indicate whether each of the following molecules is capable of geometrical (cis-trans) isomerism. For those that are, draw the structures: (9)
   i) 1,1-dichloro-1-butene
   ii) 2,4-dichloro-2-pentyne
   iii) 1-chloro-1-pentene

b) Give the name and structure of the product of the reaction of 6-ethyl-3-nonene with HBr. (6)

c) Draw the structures of the following compounds: (10)

   i) 2-chloropropanal

   ii) 3-hydroxypentanal

   iii) 1,4-pentadiene-3-one

   iv) l,3-cyciopentanedione

v) butanoic acid

Question 3

a) Write the balanced net ionic equation for the reaction of aqueous solutions of BaI_2 and Na_2SO_4 that yields a precipitate of $BaSO_4$. Indicate which ion(s) is/are spectator ions in the reaction?
(5)

b) What is the concentration (M) of a NaCl solution prepared by dissolving 9.3 g of NaCl in sufficient water to give 350 mL of solution? (10)

c) How many grams of sodium chloride are there in 550.0 mL of a 1.90 M aqueous solution of sodium chloride? (10)

UNIVERSITY OF SWAZILAND

CHEMISTRY DEPARTMENT

C112 SECTION A ANSWER SHEET

STUDENT ID NUMBER:_____

The correct answer must be indicated by putting a circle on the letter for that answer on the answer sheet provided. If you change your answer, please cancel the wrong answer with a cross and then put a circle around the correct one. If more than one option has a circle around it a zero will be given for that question.

1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E
9	A	B	C	D	E
10	A	B	C	D	E
11	A	B	C	D	E
12	A	B	C	D	E
13	A	B	C	D	E
14	A	B	C	D	E
15	A	B	C	D	E
16	A	B	C	D	E
17	A	B	C	D	E
18	A	B	C	D	E
19	A	B	C	D	E
20	A	B	C	D	E
21	A	B	C	D	E
22	A	B	C	D	E
23	A	B	C	D	E
24	A	B	C	D	E
25	A	B	C	D	E

26	A	B	C	D	E
27	A	B	C	D	E
28	A	B	C	D	E
29	A	B	C	D	E
30	A	B	C	D	E
31	A	B	C	D	E
32	A	B	C	D	E
33	A	B	C	D	E
34	A	B	C	D	E
35	A	B	C	D	E
36	A	B	C	D	E
37	A	B	C	D	E
38	A	B	C	D	E
39	A	B	C	D	E
40	A	B	C	D	E
41	A	B	C	D	E
42	A	B	C	D	E
43	A	B	C	D	E
44	A	B	C	D	E
45	A	B	C	D	E
46	A	B	C	D	E
47	A	B	C	D	E
48	A	B	C	D	E
49	A	B	C	D	E
50	A	B	C	D	E

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