

PART A: MULTIPLE CHOICE. Choose the best answer.

INTRODUCTION TO CHEMISTRY—scientific method, numbers, and significant figures

1) Which of the following is NOT a step of the scientific method?

- Asking questions
- Conducting experiments
- Making observations
- Proving a hypothesis to be true
- Interpreting data

2) How many significant figures are in the number 700.0707?

- Five
- Eleven
- Three
- Four
- Seven

3) The correct prefix for 0.01 units is:

- Centi
- Deci
- Milli
- hecta
- deka

4) The prefix meaning 1000 units is:

- Kilo
- Deci
- Centi
- Milli
- None of these

5) $0.41 \text{ mg} = \underline{\hspace{2cm}} \text{ cg}$

- $4.1 \times 10^{-2} \text{ cg}$
- 4.1 cg
- 41 cg
- $4.1 \times 10^{-3} \text{ cg}$
- None of the above

6) A book has a mass of 1.93 kg. Five students each determine the mass of the book. Which of the following is most accurate?

- 1.920 kg
- 1.926 kg
- 1.9351 kg
- 1.946931 kg
- None of the above

7) Calculate the density of an object that has a mass of 20.0g and a volume of 5.00 ml.

- 0.200 g/ml
- 4.00 g/ml
- 20.0 g/ml
- 5.00 g/ml
- Not enough data given

PROPERTIES OF SUBSTANCES

8) Which one of the following is NOT an example of a chemical change?

- The rusting of iron
- The tarnishing of silver
- The boiling of water
- The souring of milk
- The burning of a piece of paper

9) Which of the following would NOT show that a chemical reaction had occurred?

- A change of color
- Formation of a precipitate
- Formation of a gas
- A large amount of energy given off
- None of the above

10) The matter inside the beaker has a uniform appearance. Its contents are $\text{CaCl}_2 \text{ (aq)}$. This matter should be classified as a:

- Heterogeneous Mixture
- Homogeneous Mixture
- Pure Ionic Compound
- Pure Molecular Compound
- None of the above

11) A qualitative observation involves:

- Descriptions with meaning
- Descriptions without numbers
- Descriptions with numbers
- Flowery descriptions
- None of the above

12) Which of the following could not be used to separate components of a solution?

- Distillation
- Chemical treatments
- Chromatography
- Filtration
- None of the above

13) According to the Kinetic Molecular Theory,

- Particles always line up
- Particles never line up
- Particles are always in motion
- Particles never move.
- Particles only slide around each other

14) Which of the following is not a Diatomic molecule?

- He₂
- N₂
- H₂
- O₂
- F₂

INORGANIC NAMING

15) Which of the following is the correct formula of iron (III) chloride?

- FeCl
- Fe₂Cl
- Fe₃Cl
- FeCl₃
- FeCl₂

16) The correct formula for calcium chloride is:

- CaCl
- CaCl₂
- Ca₂Cl
- Ca₃Cl₂
- Ca₂Cl_{1.5}

17) The correct name for K₂CrO₄ is?

- Potassium chromite
- Potassium chromate
- potassium dichromite
- Potassium dichromate
- Dipotassium chromate

18) The correct formula for tin(IV) sulphate is?

- SnSO₄
- SnSO₃
- Sn(SO₄)₂
- Sn(SO₃)₂
- Sn₂(SO₄)₄

19) The correct name of N₂O₄ is?

- Nitrogen oxide
- Nitrogen tetroxide
- Dinitrogen oxide
- Dinitrogen tetroxide
- None of the above

20) Which of the following is the correct formula of the compound composed of strontium (Sr²⁺) and phosphate (PO₄³⁻)?

- SrPO₄
- Sr₃PO₄
- Sr₂(PO₄)₂
- Sr₃(PO₄)₂
- Sr₃P₂O₇

21) The correct formula for dichlorine heptoxide is?

- Cl₂O₇
- Cl₂O₅
- C₂O₇
- Cl₂O₆
- ClO₇

22) The correct name of NaMnO₄ is?

- Sodium manganate
- Sodium sulphate
- Sodium permanganate
- Sodium manganite
- Sodium permanganite

THE MOLE

23) Avogadro's number is:

- 6.02 * 10³
- 3.00 * 10⁸
- 6.02 * 10²³
- 6.02 * 10²³
- None of the above

24) The molar mass of N₂O₄ is about:

- 46.0 amu
- 920 amu
- 46.0 grams/mole
- 92.0 grams/mole
- None of the above

31) Which of the following is the balanced equation of the given word equation:

hydrogen phosphate + potassium hydroxide → potassium phosphate + water

- $\text{HPO}_4 + \text{KOH} \rightarrow \text{KPO}_4 + \text{H}_2\text{O}$
- $\text{H}_3\text{PO}_4 + \text{KOH} \rightarrow \text{KPO}_4 + 2\text{H}_2\text{O}$
- $\text{H}_3\text{PO}_4 + 3\text{KOH} \rightarrow \text{K}_3\text{PO}_4 + 3\text{H}_2\text{O}$
- $\text{H}_3\text{PO}_4 + \text{KOH} \rightarrow \text{K}_3\text{PO}_4 + \text{H}_2\text{O}$
- None of the above

32) Balance the following chemical equation: $\text{Al(s)} + \text{AgCl(aq)} \rightarrow \text{AlCl}_3\text{(aq)} + \text{Ag(s)}$
The coefficients in the balanced equation are:

- 2.6.2.3.
- 2.1.6.3
- 4.3.2.2
- 2.1.2.5
- None of the above

33) The equation in the previous question is an example of a:

- Synthesis reaction
- Decomposition reaction
- Neutralization reaction
- Single replacement reaction
- None of the above

34) Classify the following reaction: $2\text{KClO}_3\text{(s)} \rightarrow 2\text{KCl(s)} + 3\text{O}_2\text{(g)}$

- Synthesis
- Decomposition
- Single replacement
- Double replacement
- None of the above

35) Complete and balance the following chemical equation:



- $\text{Al(s)} + \text{CuCl}_2\text{(aq)} \rightarrow \text{AlCl}_3\text{(aq)} + \text{Cu(s)}$
- $2\text{Al(s)} + 3\text{CuCl}_2\text{(aq)} \rightarrow 2\text{AlCl}_3\text{(aq)} + 3\text{Cu(s)}$
- $\text{Al(s)} + \text{CuCl}_2\text{(aq)} \rightarrow \text{AlCl}_3\text{(aq)} + \text{Cu(s)}$
- $2\text{Al(s)} + 3\text{CuCl}_2\text{(aq)} \rightarrow 2\text{AlCl}_3\text{(aq)} + \text{Cu(s)}$
- None of the above

36) Complete the following chemical equation:



- $\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + \text{Na}_2\text{Cl}_2$
- $\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + (\text{NaCl})_2$
- $\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + \text{NaCl}$
- $\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{NaCl}$

25) How many atoms are there in 8 molecules of $\text{Sr}(\text{SCN})_2$?

- 8
- 4
- 56
- 64
- 6.02×10^{23}

26) Calculate the number of moles of methane (CH_4) in 8.00 g of methane.

- 5.00 mol
- 40.0 mol
- 0.615 mol
- 0.500 mol
- 8.00 mol

27) A certain compound gave the following chemical analysis: 85% C and 14.3% H. The empirical formula for the compound is:

- CH
- CH_2
- C_2H
- CH_3
- C_2H_6

28) The molar mass of the compound in the previous question is 56.0 g/mol. The molecular formula for the compound is?

- C_4H_4
- C_2H_4
- C_3H_6
- C_4H_{12}
- C_4H_8

CHEMICAL REACTIONS

29) The reaction $\text{PbCl}_2 + 2\text{AgNO}_3 \rightarrow 2\text{AgCl} + \text{Pb}(\text{NO}_3)_2$ is an example of

- Combination
- Combustion
- Decomposition
- Double replacement
- Single replacement

30) The following reaction, $2\text{Fe}_2\text{O}_3 + 3\text{C} + \text{heat} \rightarrow 4\text{Fe} + 3\text{CO}_2$ is an example of

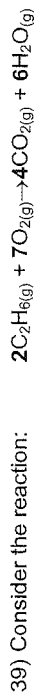
- Endothermic & Decomposition
- Endothermic & Single replacement
- Exothermic & Decomposition
- Exothermic & Single replacement
- None of the above

STOICHIOMETRYThe number of grams of zinc chloride (ZnCl_2) that can be prepared from 32.7g of zinc is

- a. 68.2g
- b. 136g
- c. 272g
- d. 32.7g
- e. 0.500g

If 12 moles of KClO_3 were used, how many moles of O_2 would be produced?

- a. 18 moles
- b. 32 moles
- c. 16 moles
- d. 12 moles
- e. No moles

The number of grams of water produced from the burning of 1.50 moles of ethane (C_2H_6)

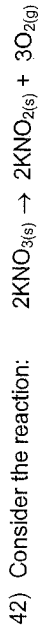
- a. 9.00g
- b. 54.0g
- c. 27.0g
- d. 81.0g
- e. 2.50g

40) S.T.P. stands for?

- a. Several teachers' pet
- b. Standard temperature and pressure
- c. Standardized and pressurized thermometers
- d. systematic and timed performance
- e. None of the above

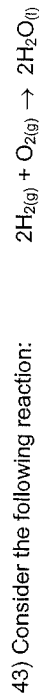
41) Calculate the number of grams of methane (CH_4) in 4.30L of methane gas at STP.

- a. 1.62g
- b. 3.07g
- c. 0.192g
- d. 0.269g
- e. 2.50g



Calculate the number of litres of oxygen gas at STP that can be formed by heating 0.333 mol of potassium nitrate

- a. 11.2 L
- b. 5.60 L
- c. 22.4 L
- d. 1.00 L
- e. 2.50 L

The grams of water that could be produced in a mixture of 5.00 g of H_2 & 64.0 g of O_2 is

- a. 72g
- b. 45g
- c. 450.g
- d. 144 g
- e. 90.0g

98.4g of Acetylene (C_2H_2) are mixed with 128.9g of O_2 . Which reactant is in excess?

- a. C_2H_2
- b. O_2
- c. CO_2
- d. H_2O
- e. All of them are

45) Calculate the percent yield if the theoretical yield is 50.0g and 40.0g is actually obtained.

- a. 66.7%
- b. 125%
- c. 80.0%
- d. 12.5%
- e. 87.7%

46) A solution contains 15.6g of sodium iodide in 400.0 mL of solution. Calculate the molarity.

- a. 0.210M
- b. 24.0M
- c. 0.260M
- d. 0.104M
- e. 39.0M

47) How many moles of sodium iodide are in 280. mL of a 0.600 M sodium iodide solution?

- a. 3.86moles
- b. 112 moles
- c. 0.168moles
- d. 25.2moles
- e. 21.3moles

ATOMIC THEORY and THE PERIODIC TABLE

- 48) Atoms are made up of
- Sugar and Spice and everything nice
 - Protons, electrons & isotrons
 - Protons, neutrons & electrons
 - axons, dendrites & synapses
 - None of the above
- 49) The atomic number of an element represents its
- Electron number
 - Proton number
 - Allotrope number
 - Neutron number
 - None of the above

50) Which is the largest atom?

- He
- Cr
- Ba
- Ra
- None of the above

51) Which of the following is correct?

- Atomic radius increases as you go across a period
- Atomic radius increases as you go down a column
- Two isotopes of Carbon are Diamonds & Graphite
- All of the above are correct
- None of the above

52) Which of the following is correct?

- Ionization energies increase as you go across a period
- Ionization energies increase as you go down a column
- Ionization energy is the same as Atomic radius
- There is no such thing as ionization energy.
- None of the above

53) Choose the correct statement

- Column 1 contains the Alkaline Earth Metals
- Column 3 contains transition metals
- Column 18 contains halogens
- All of the above are correct
- None of the above

54) Identify the metalloid

- Aluminum
- Carbon
- Silicon
- Zinc
- All allotropes

55) Which one of the following elements is the most metallic?

- Al
- Si
- P
- S
- Ga

56) Calculate the atomic mass to four significant figures for the hypothetical element X given the following data:

Isotope	Exact atomic mass in amu	% Abundance in nature
15X	15.00	30.00
17X	17.10	70.00

- 16.05 amu
- 15.63 amu
- 16.00 amu
- 16.50 amu
- 16.47 amu

57) $^{32}\text{S}^{2-}$ has

- 15 protons, 16 electrons, & 16 neutrons
- 16 protons, 16 electrons, & 32 neutrons
- 32 protons, 32 electrons, & 16 neutrons
- 16 protons, 18 electrons, & 16 neutrons
- None of the above

58) Which of the following isotopes is INCORRECT?

- ^{14}C
- ^{37}Cl
- ^{15}P
- ^{39}K
- ^{14}N

59) Isotopes are atoms of the same element which contain different numbers of

- Protons
- Neutrons
- Electrons
- Electron shells
- Positron

60) Which one of the following is the ionic charge of Se when it exists as a negative ion?

- 3⁻
- 2⁻
- 1⁻
- 4⁻
- 5⁻

61) Noble gases have

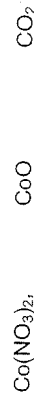
- No electrons in their outermost shell
- The maximum number of electrons in their outer shells
- Only protons in their outer shells
- Only neutrons in their outermost shells
- None of the above

CHEMICAL BONDING

62) The number of valence electrons in N is?

- 3
- 4
- 5
- 6
- 7

63) Classify the following compounds as essentially ionic or covalent:



- All are ionic
- Co(NO₃)₂ and CoO are ionic; CO₂ is covalent
- CoO and CO₂ are covalent; Co(NO₃)₂ is ionic
- All are covalent
- Co(NO₃)₂ & CoO are covalent; CO₂ is ionic

64) The compound formed by Ca and Br would probably

- Be an ionic compound
- Have the formula CaBr
- Be a covalent compound
- Be a polar covalent compound
- Involve hydrogen bonding

65) Covalent compounds

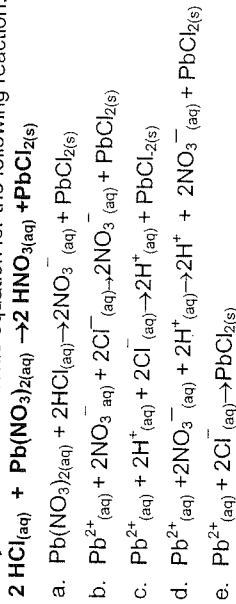
- engage electrons
- exchange electrons
- share electrons
- get rid of electrons
- find electrons

SOLUTION CHEMISTRY

66) A saturated solution would most likely be ?

- A clear blue liquid
- Clear colourless liquid
- Clear liquid above some crystals
- Cloudy liquid that you cannot see through
- Liquid you can see through, but is ever so slightly cloudy

67) Identify the correct net ionic equation for the following reaction:



68) In the previous question, which two are spectator ions?

- $\text{Pb}(\text{NO}_3)_2 + 2\text{HCl}_{(aq)}$
- $\text{NO}_3^-(aq) + \text{H}^+(aq)$
- $\text{Pb}^{2+}(aq) + \text{Cl}^-(aq)$
- $\text{H}^+(aq) + \text{Cl}^-(aq)$
- None of the above

ORGANIC CHEMISTRY

69) Organic chemistry is the

- chemistry of organisms
- chemistry of compounds having carbon as the main component
- chemistry of naming compounds
- chemistry involving organic growth practices
- None of the above

70) Which of the following is TRUE

- Alkane molecules have a double bond
- Alkane molecules have a triple bond
- Alkanes are saturated molecules
- Alkanes are unsaturated molecules
- None of the above

71) The general formula for alkanes is

- C_xH_{2y}
- C_nH_{2n-2}
- C_xH_y
- C_nH_{2n+2}
- None of the above

72) Classify the following substance: CH_3CH_2COOH

- alcohol
- aldehyde
- alkene
- carboxylic acid
- None of the above

73) Isomers have

- cis and trans forms in all hydrocarbons
- same number of electrons
- same number of atoms with different arrangements
- no double bonds
- no hydrogens

74) Which of the following is a saturated hydrocarbon?

- $CH_3CH_2C=CH_2CH_2C=CH_2$
- C_4H_{10}
- C_4H_8
- C_4H_6
- none of the above

LABORATORY EQUIPMENT AND LAB SAFETY

75) In order to be safe during lab exercises, one should wear

- safety goggles at all times
- Alligator shoes
- Contact lenses
- Lead-lined underwear
- None of the above

76) In the case that you get some caustic or corrosive substance in your eyes, the first thing you should do is:

- get a doctor to look at them after school
- get the teacher to have a look at them
- rub them vigorously with both hands
- wash them thoroughly using the shower at the back before fifteen seconds is up
- flush them thoroughly (for several minutes) using the eyewash spray

77) In case of a small fire in the lab one should

- attempt to extinguish it by smothering it or using a fire extinguisher
- get someone to report it to the teacher while you watch it
- run screaming out of the room, slam the door and pull the fire alarm
- throw yourself onto it, because you know eventually you will have to write some dumb final exam
- None of the above

78) In order to measure a volume precisely, one should use

- a beaker
- an Erlenmeyer flask
- a graduated cylinder
- a hot plate
- none of the above

79) Chemistry is the Science of:

- Energy
- Stars
- Matter
- Rocks

Ok, you are almost there. You only have to answer the written questions and you can begin your summer vacation.

PART B: WRITTEN RESPONSES – show all work/steps for full marks.

1. What is the difference between accuracy and precision? Give an example. (2 marks)

2. What is the name of ZnSO_3 ? (1 mark) _____

3. Draw the electron dot structure for aluminum (1 mark)

4. How many atoms of sulphur are there in 5.16 moles of $\text{Sn}(\text{SO}_3)_2$? (3 marks)

ANS _____

5. How many grams of sodium iodide are needed to make a 750.0 mL 1.5M solution? (3 marks)

6. 42.00 grams of solid Copper(I) metal are placed in a 200.0 ml solution of 4.00M Silver nitrate. a) Write the balanced equation: (2 marks)

b) Determine which reactant is in excess (3marks)

Reactant in excess _____

c) By how much (in grams) is the reactant in excess? (3marks)

ANS _____

7. Draw the benzene structure (1mark)

8. Draw 3-methyl-2-octanol (1 mark)

===== the end =====