Chemistry 11

Practice Examination

1. Which of the following is not an SI unit?

↑ base

   A. s
   B. mL
   C. g
   D. m

2. How many significant digits are present in 56070?

   A. 4
   B. 5
   C. 3
   D. 2

3. Considering significant figures, the correct answer for $\left(\frac{6.02\times10^{23}}{0.02457}\right)$ is

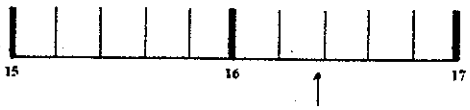
   A. 1.48×10^{22}
   B. 2.450×10^{25}
   C. 2.45×10^{24}
   D. 2.45×10^{25}

4. If a chemical reaction produces 0.0150g of CO_2 in 2.00 min, the rate would best be described in which unit?

OMIT

   A. g/s
   B. g • min
   C. g/s^{-1}
   D. g^{-1}/s

5. What is the measure indicated on the scale below?



   A. 16.3
   B. 16.29
   C. 16.35
   D. 15.16

6. Matter can best be defined as anything that has _____ and occupies _____.

   A. mass, area
   B. volume, mass
   C. atoms, volume
   D. mass, volume

7. Matter can be identified by its _____.

   A. properties
   B. shape
   C. molecular structure
   D. coreolis effect

8. New substances with new properties produced describes

   A. a chemical change
   B. a physical change
   C. vaporization
   D. sublimation

9. Which of the following cannot chemically be separated into simpler substances?

   A. element
   B. compound
   C. solution
   D. polyatomic ion

10. The correct name for $KClO_4$ is

   A. Potassium Chlorate
   B. Potassium I Perchlorate
   C. Potassium Chlorine tetraoxide
   D. Potassium Perchlorate

11. The correct name for $Mg_2(PO_4)_2$ is

   A. Magnesium Phosphate
   B. Manganese Phosphate
   C. Magnesium II Phosphate
   D. Manganese II Phosphate

12. The correct name for SCl_2 is

A. Sulphur Chloride
B. diSulphur Chloride
C. Sulphur diChloride
D. Sulphur II Chloride

13. The correct name for PbO_2 is

A. Lead Oxide
B. Lead II Oxide
C. Lead dioxide
D. Lead IV Oxide

14. The correct chemical formula for Ammonium Oxalate is

A. $NH_4C_2O_4$
B. $(NH_4)_2C_2O_4$
C. $(NH_4)C_2O_4$
D. $NH_4(C_2O_4)_2$

15. The correct chemical formula for diPhosphorus pentachloride is

A. P_2O_5
B. P_5Cl_2
C. P_2C_5
D. P_2Cl_5

16. The unit used to count the numbers of atoms. molecules or ions present is

A. the mole
B. the atomic number
C. the isotope
D. the joule

17. The molar mass of Yttrium is

A. 88.9 g
B. 88.9 AMU
C. 39 g
D. 39 AMU

18. The molar mass of $Mn_2(CO_3)_3$ is

A. 289.8 g
B. 289.8 AMU
C. 239.9 g
D. 239.9 AMU

19. How many moles are in 32.0 g CH_2O ?

A. 960 mol
B. 0.938 mol
C. 1.07 mol
D. 0.107 mol

20. How many molecules are present in 0.150 moles of RbCl?

A. 9×10^{22}
B. 2.49×10^{-23}
C. 9.03×10^{22}
D. 9.03×10^{22}

21. How many molecules are in 1.63×10^{-3} g of KCl?

A. 7.32×10^{-22} molecules
B. 7.32×10^{22} molecules
C. 2.02×10^{-25} molecules
D. 1.32×10^{19} molecules

22. What volume would 75.0 mol $NO_{(g)}$ occupy at STP?

A. 1680 L
B. 168.0 L
C. 3.35 L
D. 56.0 L

23. What is the mass of 150.0mL of $Cl_{2(g)}$ at STP?

A. 26.67 g
B. 238.5 g
C. 475.4 g
D. 0.4754 g

24. Phentylfloroform is 57.54% C. 3.45% H and 39.1% F. What is the empirical formula of the compound?

A. $C_7H_5F_5$

B. $C_3H_2F_1$

C. $C_5H_7F_3$

D. $C_7H_3F_5$

25. Molarity is a measure of

A. molar ability

B. molar volume

C. moles per mass

D. molar concentration

26. The molarity of a solution prepared by dissolving 0.350 mol KI in 2.75 L of water is

A. 1.27 M KI

B. 0.127 M KI

C. 0.963 M KI

D. 9.63 M KI

27. The mass of RbCl required to prepare 2.000L of a 0.4500 M RbCl solution is

A. 134.4 g

B. 7.34×10^{-3} g

C. 108.9 g

D. 18.9 g

28. If 150.0mL water is added to 250.0 mL of a 1.00 M HNO_3 solution the new molarity of HNO_3 is

A. 0.625M HNO_3

B. 26.67M HNO_3

C. 0.400M HNO_3

D. 0.120M HNO_3

29. How do the masses of reactants and products relate if a reaction occurs in a closed system?

A. they are equal

B. they are proportionate

C. the mass of products decreases

D. the masses do not change

30. The following reaction can be identified as $C_2H_5OH + O_2 \rightarrow CO_2 + H_2O$

A. combustion

B. single replacement

C. synthesis/combination

D. double replacement

31. The following reaction can be identified as $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

A. combustion

B. single replacement

C. acid/base neutralization

D. double replacement

32. The following reaction can be identified as $KClO_3 \rightarrow KCl + O_2$

A. acid/base

B. synthesis

C. composition

D. decomposition

33. The coefficients for the following reaction to be properly balanced would be $Zn+HCl \rightarrow ZnCl_2 + H_2$

A. 1,2,1,1

B. 2,4,2,2

C. 2,4,2,1

D. 1,2,2,1

34. The following reaction can be identified as $H_2 + Cl_2 \rightarrow 2HCl + 185$ kJ

A. synthesis and exothermic

B. synthesis and endothermic

C. decomposition and exothermic

D. single replacement and endothermic

35. Consider the following reaction:
$4NH_{3(g)} + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(l)}$
How many moles of O_2 are required to produce 6.0 moles of NO?

A. 4.8 moles
B. 7.5 moles
C. 6.0 moles
D. 5.0 moles

36. Consider the following reaction:
$Cu + 2\,AgNO_3 \rightarrow Cu(NO_3)_2 + 2\,Ag$
There is 16.0 g Cu and 42.0g $AgNO_3$ present in a reaction vessel. Which reactant is the limiting reagent?

A. Ag
B. Cu
C. $AgNO_3$
D. $Cu(NO_3)_2$

37. How many neutrons are present in the nucleus of a Neodymium atom?

A. 84
B. 60
C. 84.2
D. 90

38. The number protons in the nucleus of an Iridium atom are

A. 115
B. 192
C. 77
D. 78

39. How many electrons are there in orbit about the P^{-3} ion?

A. 18
B. 15
C. 31
D. 16

40. What is the electronic configuration of Titanium?

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

41. What is the electronic configuration of Mn^{+4}?

A. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$
B. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^9$
C. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$
D. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^1$

42. Column 14 elements have an electronic configuration that ends in

A. s^2p^2
B. s^2p^3
C. s^2p^1
D. s^2d^2

43. Which of the following elements is a member of the Alkaline Earth metals?

A. Sr
B. Rb
C. Y
D. Xe

44. Which of the following is a property of a Halogen?

A. conducts electricity
B. very soft and malleable
C. most are hard and dense
D. diatomic in gaseous phase

45. Which element will tend to gain 3 electrons to have a noble gas configuration?

A. C
B. P
C. S
D. Cl

46. What type of bonding involves a partial electron transfer?

A. ionic
B. covalent
C. polar covalent
D. London's

47. What type of bond is present in PCl_3

A. covalent
B. ionic
C. double
D. hydrogen

Use the following information to answer the next question.

Chlorine (Cl_2) is used in great quantity as a bleach for the pulp and paper industry and as a disinfectant for municipal water supplies. Iodine is another chemical commonly used for water disinfection on a smaller scale. The boiling point of chlorine is −34.6° C while the boiling point of iodine is 184° C.

48. The electrons involved in the bonding within chlorine molecules are

A. completely transferred from one atom to another
B. equally shared
C. unequally shared
D. the inner shell electrons only

Written Response

1. Define the following:
   a. Atom
   b. Solution
   c. Mole

2. State Avogadro's Hypothesis.

3. What is the percent composition by mass of H_2CO_3 ?

4. Determine the molecular formula of a compound given its empirical formula is C_2H_6O and its molar mass is 138.0 g

5. Consider the following reaction:
   $Fe_2O_3 + 3\,C \rightarrow 2\,Fe + 3\,CO$
   What mass of carbon is required to react completely with 100.0 g of iron (III) oxide?

6. Showing all work, draw the Lewis structures for the following:
   a. $CSCl_2$
   b. PO_4^{3-}

7. Jacqueline dilutes the concentration of chloride ions present in 125.0 mL of a 0.150 M NaCl solution by adding 75.0 mL of 0.195 M NaI. She has diluted the concentration of chloride ions, but has she diluted the concentration of sodium ions. Show all work.

Solutions – Practice Examination One

1. B	12. C	23. D	34. A	45. B
2. A	13. D	24. A	35. B	46. C
3. D	14. B	25. D	36. C	47. A
4. A	15. D	26. B	37. A	48. B
5. C	16. A	27. C	38. C	49. A
6. D	17. A	28. A	39. A	50. D
7. A	18. A	29. A	40. D	51. D
8. A	19. C	30. A	41. A	52. C
9. A	20. C	31. D	42. A	
10. D	21. A	32. D	43. A	
11. A	22. D	33. A	44. D	

1. B

Litre is the base SI unit of volume and mL is variation on it.

2. A

There are 4 significant figures present in **56070** – the final zero is a place value and is not indicated to be significant as there is no decimal place present. The zero between the 6 and the 7 is significant.

3. D

In a multiplication or division involving significant figures the value with fewest sig figs is used to determine the number of sig figs in the answer. 6.02×10^{23} has 3 sig figs while 0.02457 has 4 so the answer will have 3.

4. A

To determine rate we would divide the mass by the time and end up with a rate in g/min or g/s. The latter is more correct as the SI unit of time is the second.

5. C

We know the point is between 16.2 and 16.4 and appears to be more than halfway between 16.2 and 16.4 so is at least 16.3. We cannot see how far past 16.3 the measure is as there is no marker so we can estimate and say half way in this case thus 16.35. The five is a somewhat certain digit and is considered to have significance but us recognized as not precise.

6. D

All matter is considered to have mass and occupy volume.

7. A

All matter will have defining properties such as melting point, boiling point and density which can be used to identify it.

8. A

A chemical change alters the molecular composition of the matter which results in new substances which will have their own distinct properties.

9. A

An element consists of only one type of atom and therefore cannot be chemically reduced into any simpler substance. Compounds, solutions and polyatomic ions all consist of more than one type of atom and thus can be chemically altered into a simpler substance.

10. D

This is a metal – non-metal compound thus is an ionic compound. K is the symbol for Potassium which is always +1 and requires no roman numeral to indicate its charge. ClO_4^- is the Perchlorate ion and as no roman numerals are required the names are simply written together **Potassium Perchlorate**.

11. A

This again is an ionic compound. Mg is the symbol for Magnesium which always has a charge of +2 and thus does not require a roman numeral in the name to indicate its charge. PO_4^{-3} is the phosphate ion and as no roman numerals are required the names are simply written together Magnesium Phosphate.

12. C

This is a covalent compound as it is a composed of two non-metals. There is only a single Sulphur present so no prefix is required to indicate number of them. There are two chlorides present so a prefix, di, is required to indicate the number of chloride atoms in the compound – **Sulphur dichloride**.

13. D

Pb is Lead which does not have a consistent charge so a roman numeral is required to indicate its charge in the compound. O^{-2} is the oxide ion of which there are 2 in the compound. This gives us a total negative charge of 4 and as the sum of the charges in an ionic compound is zero there must be a positive charge of 4. There is only one Lead atom in the compound so it must have a charge of +4 – **Lead IV Oxide**.

14. B

This is an ionic compound despite NH_4^+ not being a metal – it is a positively charged polyatomic ion. Ammonium has a +1 charge while Oxalate has a -2 charge and as the charge sum of the compound equals zero we require two Ammonium ions to have a +2 to match the -2. There is a subscript 2 placed after the Ammonium to indicate that there are two of them present in the compound - $(NH_4)_2C_2O_4$.

15. D

This is a covalent compound as it is comprised of non-metals. The prefixes indicate the number of each atom present in the compound thus we would have 2 phosphorus atoms and 5 Chlorine atoms in the compound. The subscripts written indicate the number of atoms of each element that precedes them - P_2Cl_5.

16. A

The mole is the arbitrary unit used to relate the relative masses and quantities of atoms, molecules and ions to one another.

17. A

The molar mass of an element is equal to its atomic mass in grams. The atomic mass of Yttrium is 88.9 AMU so it molar mass would be **88.9 g**.

18. A

The molar mass is equal to the sum of the atomic masses of all the atoms present in the compound.

$Mn(2\times54.9\,g)+C(3\times12.0\,g)+O(9\times16.0\,g)$

$= 289.8\,g$

19. C

This is a unitary conversion form mass to moles.

$$32.0\,g\ CH_2O\times\frac{1\,mol}{30.0\,g\ CH_2O}$$

$= 1.07\,mol\ CH_2O$

20. C

Unitary conversion from moles to molecules

$$0.150\,mol\ RbCl\times\frac{6.02\times10^{23}\ molecules}{1\,mol}$$

$= 9.03\times10^{22}$ molecules RbCl

21. ~~A~~ D

Unitary conversion from mass to molecules. To do this we must first convert the mass to moles and then the moles can be converted to molecules

Plan: mass KCl → moles KCl → molecules KCl

$$1.63\times10^{-3}\,g\ KCl\times\frac{1\,mol}{74.6\,g\ KCl}\times\frac{6.02\times10^{23}\ molecules}{1\,mol}$$

= ~~8.07×10^{22} molecules~~ KCl

1.32×10^{19} molecules KCl

22. A

Unitary conversion from moles of NO to Litres at STP

$$75.0\,\text{mol NO} \times \frac{22.4\,\text{L}}{1\,\text{mol}}$$

= 1680L NO

23. D

This is a unitary conversion between mass and volume of a substance. Mass cannot directly be converted into volume and we must go through the unit mole. Any of the measures can be converted into moles and moles can be converted into any measure.

First change the volume into Litres – 150.0mL = 0.1500L

Plan L Cl_2 → mol Cl_2 → mass Cl_2

$$0.1500\,\text{L Cl}_2 \times \frac{1\,\text{mol}}{22.4\,\text{L}} \times \frac{32.0\,\text{g}}{1\,\text{mol}} = 0.4754\,\text{g Cl}_2$$

24. A

Step 1: we assume the mass of the compound analyzed to be 100.0g so that the percent by mass of the elements is easily determined: 57.45g C, 3.45g H and 39.1g F. Then we follow the procedure for finding empirical formula: grams → mol: find ratio and ratio is empirical formula.

Step 2: $57.45\,\text{g C} \times \frac{1\,\text{mol}}{12.0\,\text{g}} = 4.788\,\text{mol}$

Step 3: C/2.06 = 2.33

Step 4: ×3 = 7

All ratio numbers are multiplied by 3 to make them whole numbers as the C ratio value was 2.33 and the H ration number is 1.67. The result is 7C:5H:3F and empirical formula is $C_7H_5F_3$.

25. D

Molarity is a measure of concentration and is equal to the numbers of moles in a given volume M = mol/L. Molar concentration is another way of stating molarity

26. B

Molarity = mol/L so to determine the molarity of the KI we simply divide the mol KI by the volume it is dissolving in.

$$\text{Molarity} = \frac{\text{mol}}{\text{L}} = \frac{0.350\,\text{mol}}{2.75\,\text{L}}$$

= 0.127M KI

27. C

We use the formula $MV = \frac{\text{mass}}{\text{g/mol}}$

$$(0.4500\text{M RbCl})(2.000\,\text{L}) = \frac{\text{mass RbCl}}{121.0\,\text{g/mol}}$$

→ mass RbCl = (0.4500)(2.000)(121.0)

mass RbCl = 108.9 g

28. A

When volumes are mixed the molarity of a solution will change. It changes because the molarity is volume dependent as it is a measure of the number of moles in a given volume. To determine the new molarity we us the dilution formula. $M_iV_i = M_fV_f$ where M is molarity, V is volume, i is initial and f is final. This basically finds the moles of the substance and divides it by the new volume.

$M_i = 1.00\text{M}$

$V_i = 1.2500\text{L}$

$M_f = ?$

$V_f = 2.500\text{L} + 0.1500\text{L} = 0.4000\text{L}$

$(1.00\text{M})(0.2500\text{L}) = M_f(0.4000\text{L})$

$$M_i = \frac{(1.00\text{M})(0.2500\text{L})}{(0.4000\text{L})}$$

= 0.625 M HNO_3

29. A

The reaction is in a closed system meaning nothing is entering or leaving the reaction vessel. It involves no gases being consumed or produced so the mass of the reaction vessel and its contents can be taken before and after the reaction accurately. We cannot measure the mass of a gas directly. A chemical reaction involves the reactant atoms rearranging to form the products so the mass of the reactants should, given the Law of Conservation of Mass, equal the mass of the products.

30. A

This reaction is a combustion reaction. They can be identified by a Hydrocarbon compound reacting with Oxygen to form Carbon Dioxide and Water. These components are always present in a combustion reaction even though it may contain other substances as well.

31. D

This is a double replacement reaction. They can be recognized as the reactants are both ionic compounds and the products are formed by the metals of the reactants switching places with the respective non-metals. Note in the above reaction that the Ag^+ is originally with the NO_3^- as a reactant and finishes with the Cl^- as a product while the Na^+ starts with the Cl^- as a reactant and finishes with the NO_3^- as a product.

32. D

This reaction is a decomposition and they are easily recognizable as they have only one reactant compound which forms two or more products.

33. A

A balanced chemical reaction is necessary to reflect the Law of Conservation of Mass. Given that the reactants are rearranging to form the products there must be the same number of atoms of each element on the reactant side of the reaction as there is on the product side of the reaction. This of course is the reason that the mass of the products will equal the mass of the reactants as per the Law of conservation of Mass. We can only use coefficients to change the numbers of atoms of the elements as changing any of the subscripts will change what the actual substance is.

34. A

Firstly this is a synthesis and/or combination reaction. These reaction types can be recognized by there being two lone elements as the reactants, H_2 and Cl_2 in this reaction, which combine to form a single compound as the product, HCl. The change in enthalpy for this reaction is -185kJ. It is a negative value because it appears as a product indicating the products have less enthalpy, potential energy, than the reactants. When energy is lost in the system it has been released into the environment and the reaction is called Exothermic.

35. B

We can determine the moles of O_2 required directly as it is possible to do calculations within a balanced chemical reaction as long as you have the unit mole.

$$6.0\,\text{mol NO} \times \frac{5\,\text{mol O}_2}{4\,\text{mol NO}}$$

$= 7.5$ mol O_2

36. C

The limiting reagent is the reactant that is consumed first and thus stops the reaction and limits the amount of the product that can be produced. We can use molar ratio numbers to see how many moles of $AgNO_3$ are required to react with the Cu in the question.

First we need to find moles of each reactant

$$16.0\,\text{g Cu} \times \frac{1\,\text{mol}}{63.5\,\text{g Cu}} = 0.252\,\text{mol Cu}$$ 42.0g

$$\text{AgNO}_3 \times \frac{1\,\text{mol}}{169.9\,\text{g AgNO}_3} = 0.247\ \text{mol AgNO}_3$$

$$\frac{\text{Cu}}{0.252\,\text{mol}} = \frac{2\,\text{AgNO}_3}{x}$$

x = the moles $AgNO_3$ required to react with 0.252mol Cu

$x = 0.504$mol $AgNO_3$ as we only have 0.247 mol $AgNO_3$ it is the limiting reagent.

37. A

The neutrons and the protons make up the mass of the atom and have essentially the same mass equal to one. Therefore the mass of the atom minis the number (thus mass) of the protons will equal the number (and mass) of the neutrons. Recall number of protons is equivalent to the atomic number.
Number neutrons = atomic mass – atomic number

Number neutrons = 144.2 – 60 = 84.2 = 84 neutrons

38. C

The number of protons in the nucleus of any element's atom is equivalent to the element's atomic number. The atomic number of Iridium is 77 therefore it has 77 protons in the nucleus.

39. A

P^{-3} is an ion with a -3 charge. This indicates there are three more electrons present than protons. electrons having a negative charge and protons having a positive charge. The number of protons never changes therefore the atom has gained and electron and the total will be the number of protons (atomic number) plus three. Number electrons = atomic number + 3 = 15 + 3 = 18 electrons

40. D

Ti is a neutral atom therefore the number of electrons is equal to the number of protons. The number of protons is equivalent to the atomic number which is 22. The electrons are placed into the orbits and sub shells filling the lowest energy levels first: Order of electron filling: $1s \rightarrow 2s \rightarrow 3s \rightarrow 3p \rightarrow 4s \rightarrow 3d \rightarrow 4p \rightarrow 5s \rightarrow 4d \rightarrow 5p \rightarrow 6s \rightarrow 4f$... remembering that s holds 2 electrons, p holds 6 electrons, d holds 10 electrons and f holds 14 electrons.

41. A

Mn+4 is an ion therefore the number of electrons is not equal to the number of protons. The number of protons is equivalent to the atomic number which is 25 for Manganese. The +4 charge means there is 4 more protons present than electrons indicating the atom has lost 4 electrons. The number of electrons is then 25 – 4 = 21. The electrons are placed into the orbits and sub shells filling the lowest energy levels first: Order of electron filling: $1s \rightarrow 2s \rightarrow 3s \rightarrow 3p \rightarrow 4s \rightarrow 3d \rightarrow 4p \rightarrow 5s \rightarrow 4d \rightarrow 5p \rightarrow 6s \rightarrow 4f$... remembering that s holds 2 electrons, p holds 6 electrons, d holds 10 electrons and f holds 14 electrons.

42. A

Column 14 elements are in the P – block and thus the final valance electrons are in the p subshell. Column 14 is the second column in the p block and all elements in this column have 2 electrons in the p subshell while in ground state.

43. A

The alkaline earth metals are those elements in column 2 of the periodic table and Sr is in column (group) 2.

44. D

Halogens are non-metals and do not have any metallic properties. The properties in b,c and d are all those of metals while diatomic in the gaseous phase is a specific property of the halogens.

45. B

The elements in column 15 end in s^2p^3 and require 3 more electrons to have the electronic configuration of the noble gases which is full valence - s^2p^6.

46. C

When there is an electronegativity difference between the substances of between 0.2 and 1.7 there will be a partial electron transfer from the substance with the lower electronegativity to the substance with the higher electronegativity. This results with a substance having a partial positive charge and a substance with a partial negative charge. The partially charged atoms are called dipoles.

47. A

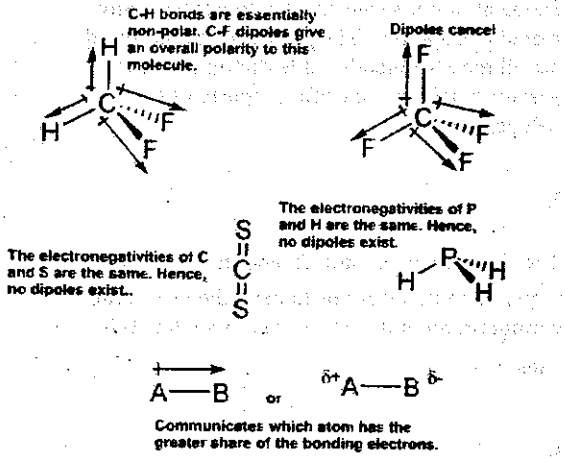
Phosphorus and chlorine are both non-metals so this will not be an ionic bond. We do not have the electronegativities of the elements so it is not possible to determine the exact nature of the bond, polar covalent versus covalent therefore the best answer is a covalent bond.

48. B

Chlorine is a molecular element held together by a single covalent bond. Since each bonded atom has the same electronegativity, the electrons are shared equally.

49. A

Only molecules that contain polar bonds can be polar and then only if the bond dipoles do not cancel as a consequence of molecular geometry. Thus the V.S.E.P.R. shape of a molecule is necessary to predict that molecule's polarity.



50. D

The structural feature of an organic molecule that allows us to classify that molecule by its reactivity is called a functional group.

Some important functional groups are shown in the adjacent column.

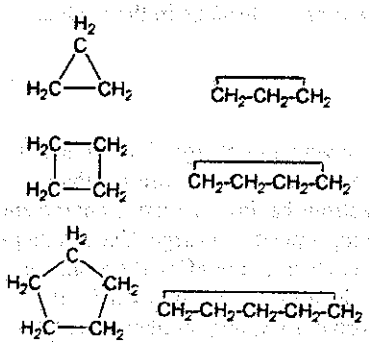
The important functional groups in citric acid are those of alcohols and carboxylic acids.

51. D

Isomers are compounds that have the same chemical formula but different chemical structures. More often than not isomers have different chemical and/or physical properties. Without knowing the precise structures of carvone (other than that it is an organic compound), its two forms meet the qualification for isomers.

52. C

The first cycloalkene is cyclopropane. C_3H_6. the second is cyclobutane, C4H8, and the third member is cyclopentane, C_5H_{10} . These are shown below.



Written Response

1. Define **a)** atom – = the smallest possible unit of an element possible which will still retain the properties of the element.

   b) solution – = a homogenous mixture containing 2 or more substances.

   c) mole – = the mole is the number of particles of Carbon in 12 grams of C-12. The atomic masses of all other elements are relative to that of C-12 so one mole of any element contains the same numbers of particle as one mole of C-12.

2. State Avogadro's hypothesis – = Equal volumes of different gases, at the same temperature and pressure, contain the same number of particles.

3. What is the percent composition by mass of H_2CO_3 ?

   To determine the percent composition by mass of all the elements in the compound, H_2CO_3, we must divide the sum of the masses for each element by the molar mass of the compound and multiply by 100.
   Mass H = 2 × 1.0 = 2.0 g
   Mass C = 1 × 12.0 = 12.0 g
   Mass O = 3 × 16.0 = 48.0 g
   Molar mass H_2CO_3 = 2.0 g
   H = 12.0 g
   C = 48.0 g
   O = 62.0 g H_2CO_3

% by mass H = (2.0g/62.0g) × 100 = 3.2% H
% by mass Mn = (12.0g/62.0g) × 100 = 19.4% C
% by mass O = (48.0g/62.0g) × 100 = 77.4% O

4. Determine the molecular formula of a compound given its empirical formula is C_2H_6O and its molar mass is 138.0 g
(C_2H_6O)n = 138.0 g therefore
$(46.0\,g)_n$ = 138.0 g and n = 138.0/46.0 = 3
So $(C_2H_6O)_3 = C_6H_{18}O_3$

5. Consider the following reaction:
$Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$
What mass of Carbon is required to react completely with 100.0g of the Iron III Oxide?

Plan: mass
$Fe_2O_3 \rightarrow$ moles $Fe_2O_3 \rightarrow$ moles C $\rightarrow$ mass C

$$100.0\,g\ Fe_2O_3 \times \frac{1\,mol}{159.6\,g\ Fe_2O_3} \times \frac{3\,mol\,C}{1\,mol\ Fe_2O_3} \times \frac{12.0\,g\,C}{1\,mol}$$

= 22.56 g C

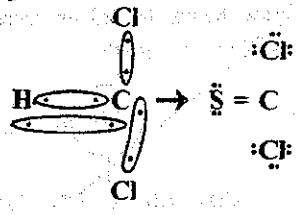
6. Magnesium has three naturally occurring isotopes: 23-Mg = 23.804amu and has an abundance of 11.01%, 24-Mg = 23.985amu and has an abundance of 79.99% and 25-Mg = 24.986amu and has an abundance of 10.00%. Determine the atomic mass of Magnesium as it appears on the periodic table.

The atomic mass as it appears on the periodic table is a relative average of the isotopes of the element.

Atomic mass = (fraction of isotope) (mass of isotope) + (fraction of isotope)(mass of isotope) + ...
Atomic mass = (0.1101 × 23.804) + (0.7999 × 23.985) + (0.1000 × 24.986)
= 24.305 AMU

6. Showing all work draw the electron (Lewis) dot diagram for
a) $CsCl_2$

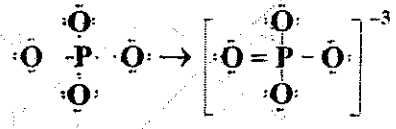
$CSCl_2$



b) PO_4^{-3}

PO_4^{-3}

5 + 4 × 6 + 3 = 32
P O



7. Jacqueline dilutes the concentration of Chloride ions present in 125.0mL of a 0.150M NaCl solution by adding 75.0mL of 0.195M NaI. She has diluted the concentration of chloride ions but has she diluted the concentration of sodium ion? Show all work.

First calculate the molarities of the compounds after the dilution using the dilution formula
$M_iV_i = M_fV_f$

$$\text{Diluted [NaCl]} = \frac{(0.150M)(0.1250L)}{(0.2000L)}$$
$$= 0.0938\ M\ NaCl$$

$$\text{Diluted [NaI]} = \frac{(0.195M)(0.0750L)}{(0.2000L)}$$
$$= 0.0731\ M\ NaI$$

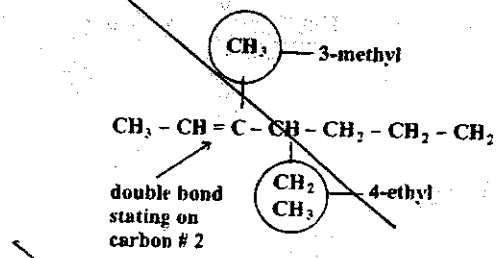
Secondly write the dissociation equations for the compounds and from them determine the concentration of the ions.

$NaCl_{(s)} \rightarrow Na^+_{(aq)} + Cl^-_{(aq)}$
0.0938M so 0.938M 0.0938M

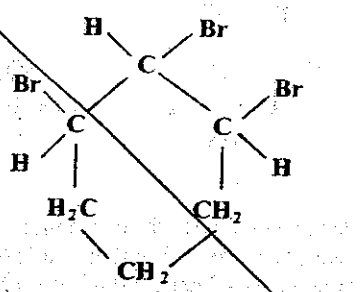
$NaI_{(s)} \rightarrow Na^+_{(aq)} + I^-_{(aq)}$
0.0731M so 0.0731M 0.0731M

$[Na^+] = 0.0938 + 0.0731 = 0.167M$
Concentration of Na^+ went up to 0.167M from 0.150M in the original solution.

9. Draw the condensed structure for 4- ethyl – 3 – methyl – 2- heptene.



10. Name the compound



= 1,3 – dibromo – 2 – methyl - cyclohexane