Chem 1

Multiple Choice questions may have more than one correct answer. Indicate all correct responses Which of the following formulas cannot be correct for a stable compound?

a) (NH4)2SO4

b) KNO2

c) Ca2O

d) Fe2(PO4)2

Answer: d) Fe2(PO4)2

2. Give the correct formula for:

a) Copper(II) nitrate

b) Diphosphorus tetrasulfide

c) Sodium periodate

d) Nitrous acid

e) Calcium bromide

Answer: a) Copper(II) nitrate : Cu(NO3)2

b) Diphosphorus trisulfide: P2S3; Dinitrogen tetrasulfide: S4N2

c) Sodium periodate: (metaperiodate) NaIO4

d) Nitrous acid: HNO2

e) Calcium Bromide: CaBr2

3. Which of the following is the correct order of increasing pressure?

a) 100 mbars < 100 torr < 100 inches of water < 100 Pa < 100 psi

b) 100 Pa < 100 mbars < 100 torr < 100 inches of water < 100 psi

c) 100 Pa < 100 mbars < 100 psi < 100 inches of water < 100 torr

d) 100 inches of water < 100 torr < 100 mbars < 100 psi < 100 Pa

Answer: b) 100 Pa < 100 mbars < 100 torr < 100 inches of water < 100 psi

4. If you have an insulated glass of water at 25 oC containing 10 fluid oz at

25 oC, how much ice would you have to add to end up with a final temperature of 0 oC and no ice left?

Answer: 10 fluid oz = 295. 735 g water at 25 oC.

Heat taken out of water = specific heat of water x wt. of water x temperature difference

= 4. 178 J/g. K x 295. 735g x 25 K

= 30889. 52 J

Therefore, ice has to absorb 30889. 52 J of energy out of water to bring down its temperature to 0 oC.

Suppose, X g of ice (which may be at -10 oC) is required to add to water.

Heat absorbed by ice

(from -10 oC to 0 oC) = specific heat of ice x wt. of ice x temperature difference

= 2. 05 J/g. K x X g x 10 K

= 20. 5 X J

Heat absorbed by ice

(to become liquid at 0 oC) = heat of fusion of ice x wt. of ice

= 333. 55 J/g x X g

= 333. 55 X J

Total heat ice has to absorb= Total heat taken out of water

20. 5 X J +333. 55 X J = 30889. 52 J

354. 05 X J = 30889. 52 J

Therefore, X = 87. 24 g of ice would you have to add to end up with a final temperature of 0 oC and no ice left.

5. Two very common materials are chlorine and propane. What would the NFPA diamond look like for each of these? Explain the significance of the

numbers in each category.

NFPA 704 is a standard maintained by the U. S.-based National Fire Protection Association. The four divisions are typically color-coded, with blue indicating level of health hazard, red indicating flammability, yellow (chemical) reactivity, and white containing special codes for unique hazards. Each of health, flammability and reactivity is rated on a scale from 0 (no hazard; normal substance) to 4 (severe risk).

NFPA 704 Rating for chlorine:

a) Blue = Health Hazardard Rating: 4

b) Red = Fire Hazardard Rating: 0

c) Yellow = Reactivity Hazardard Rating: 0

d) White = Other Hazards: OXY

NFPA 704 Rating for propane:

a) Blue = Health Hazardard Rating: 1

b) Red = Fire Hazardard Rating: 4

c) Yellow = Reactivity Hazardard Rating: 0

d) White = Other Hazards: empty

6. During a rail accident, you see a tank car with a placard of UN 1888. There is a fire involving the adjacent tank car. Are you worried about a fire from the tank car placarded with 1888? What would be the danger of exposure to the contents of this car? Would the vapor hug the ground?

Placard of UN 1888 indicates, the tank care contains chloroform.

Following are the potential hazards associated with it.

HEALTH

Highly toxic, may be fatal if inhaled, swallowed or absorbed through skin. Avoid any skin contact.

Effects of contact or inhalation may be delayed.

Fire may produce irritating, corrosive and/or toxic gases.

Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.

FIRE OR EXPLOSION

Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.

Containers may explode when heated.

Runoff may pollute waterways.

Since the vapor may hug the ground, it is wise to keep out of low areas

7. If someone left the valve open on a 15 L cylinder of carbon monoxide gas at 23 oC and 750 psig and the tank emptied into a room that was 25 feet by 15 feet by 8. 5 feet high, what would the final concentration of carbon monoxide be in the room in ppm? Will you die if you stay in the room?

Total room size = 25 feet x 15 feet x 8. 5 feet = 3187. 5 cubic feet= 9. 03 x104L.

The volume for a compressed gas when released can be calculated using Boyles Law:

pa Va = pc Vc (1)

where

pa = atmospheric pressure (14. 7 psi, 101. 325 kPa)

Va = volume of the gas at atmospheric pressure (cubic feet, cubic meter)

pc = compressed pressure (psi, kPa)

Vc = volume of the gas at compressed pressure (cubic feet, cubic meter, liters)

Va = pc Vc / pa = 750 x 15/14. 7 = 765. 31 L

765. 31L occupies in 9. 03 x104L of room.

Therefore, ppm= 765. 31x 106 microlit /9. 03 x104L= 8475 ppm. At this concentration of exposure death may occur.

The severity of symptoms of CO exposure is influenced by three main factors: (1) the concentration of CO in the environment; (2) how long the exposure lasts, and (3) work-load and breathing rate. In general, assuming that users of gasoline-powered engines are engaged in at least a moderate level of activity, exposure to CO concentrations of 80 to100 parts per million (ppm) for 1 to 2 hours can result in decreased exercise tolerance and, in persons who are at risk, may bring on chest pain and cause irregular heartbeat [EPA 1991a]. Symptoms associated with CO exposure concentrations of 100 to 200 ppm include headache, nausea, and mental impairment. More serious central nervous system effects, coma, and death are associated with CO exposure concentrations of 700 ppm or greater for an hour or more .

8. Which of the following statements is true?

a) Sulfur dioxide is a cryogenic gas.

b) If ice were to be placed in a container at a temperature of -2 oC, with a water vapor pressure of 2 torr, you would see a decrease in the volume of solid ice over time.

c) If there were a leak of hydrazine (N2H4) from a tank, it would tend to hug the ground.

d) Ammonia gas can be liquifed just by applying pressure as long as the temperature is below 130 oC.

e) You should be concerned about a BLEVE when a truck placarded as 1202 is involved in a fire.

f) Osmium is a transition metal.

g) If a commercial product contains 0. 5% of styrene and 0. 5% of ethylbenzene, the MSDS must list the styrene, but does not have to list ethylbenzene as a component.

Answer: True statements:

a) Sulfur dioxide is a cryogenic gas

d) Ammonia gas can be liquifed just by applying pressure as long as the temperature is below 130 oC.

e) You should be concerned about a BLEVE when a truck placarded as 1202 is involved in a fire.

f) Osmium is a transition metal.

9. Explain what is involved in Employee Training and Information as required by the Hazardous Communication Standard.

Employers shall provide employees with effective information and training on hazardous chemicals in their work area at the time of their initial assignment, and whenever a new physical or health hazard the employees have not previously been trained about is introduced into their work area. Information and training may be designed to cover categories of hazards (e. g., flammability, carcinogenicity) or specific chemicals. Chemical-specific information must always be available through labels and material safety data sheets.

10. Fill in the blanks in the following table

Symbol

Protons

Electrons

Neutrons

Charge

63Cu

29

27

34

+2

I

53

54

74

11. Which of the following would be listed as a flammable liquid and which would be a combustible liquid as defined by OSHA? Explain.

a) Dimethylamine

b) Toluene

c) Ethylene glycol

d) Carbon tetrachloride

Answer: Flammable and combustible liquids are liquids that can burn. They are classified, or grouped, as either flammable or combustible by their flashpoints. Generally speaking, flammable liquids will ignite (catch on fire) and burn easily at normal working temperatures. Combustible liquids have the ability to burn at temperatures that are usually above working temperatures.

There are several specific technical criteria and test methods for identifying flammable and combustible liquids. Under the Workplace Hazardous Materials Information System (WHMIS), flammable liquids have a flashpoint below 37. 8°C (100°F). Combustible liquids have a flashpoint at or above 37.

8°C (100°F) and below 93. 3°C (200°F).

Dimethylamine and toluene are flammable liquids since they can be ignited by heat, sparks, or open flames. Ethylene Glycol is a combustible liquid.

12. Of the following elements: P, K, Zn, S, Ca

a) Which element(s) would tend to form an ionic compound with oxygen?

b) Which element(s) would tend to form anions?

c) Are any of the elements halogens?

Answers: a) All the elements would tend to form an ionic compound with oxygen

b) S would tend to form anion

c) No

13. a) How many O atoms are present in 5 g of dry ice, CO2?

b) If this sample of dry ice were to be placed in an evacuated 1. 0 L container and allowed to come to room temperature (25 oC), what would the pressure be?

Answer: a) Total oxygen atoms = 5 g x 6. 022x 1023 molecules x 2 atoms /44. 01 g

= 1. 36 x 1023 atoms

b) 5g of CO2 is equal to 0. 1137 mols

volume of 1 mol of any gas at 25˚C, 1 atm, is 24. 5 Liters. Therefore, volume of 5 g of CO2 has a volume of 2. 785 Liters, at 25˚C.

According to the combined gas law,

P1V1/T1 = P2V2/T2

The temperature term can be cancelled. And, since volume of container 1 lit, therefore, pressure inside the container is 2. 785 atm.