Unit Review : Chemistry

SNC2DE_09 - 10

1. A gas can be proved to be oxygen by means of:

(a) a burning splint, which causes a small explosion or "pop";
(b) a glowing splint, which bursts into flame;
(c) a burning or glowing splint which goes out completely;
(d) limewater, which goes milky when shaken with the gas;
(e) a wet piece of litmus paper, which goes pink in the gas.

2. On the Periodic Table, elements in the same vertical column have the same:

(a) electron orbit structure; (b) number of protons; (c) number of total electrons;
(d) number of neutrons; (e) number of electrons in their outer orbits.

3. What is the charge on the cation in InP?

A) 2+ B) 3+ C) 6+ D) 1+

4. The reason for the general increase in ionisation energy of the elements across period 3 of the Periodic Table is the increasing number of:

A. outer electrons. B. neutrons. C. protons. D. electron sub-levels occupied.

5. The following numbers represent the first four ionization energies of an element in kJ mol^{-1}:

178, 1817, 2745, 11 578

What element is it?

A. Na B. Mg C. Al D. Si

6. Consider the equation: $Na + energy \longrightarrow Na^{+} + e^{-}$

The energy term in this equation is called the:

a) electron affinity b) electronegativity c) ionization energy d) activation energy

7. The chemical properties of atoms depend primarily upon:

a) the atomic mass of the atom
b) the number of valence electrons
c) the number of neutrons in the nucleus
d) the phases of the moon

8. Ionic bonds may be considered a result from:

a) the union of atoms of equal ionization energy
b) the transfer of one or more electrons from one atom to another
c) the sharing of electrons by atoms
d) the alkali metals reacting with the alkaline earths

9. The first four ionization energies of an element X are 740, 1450, 7730, and 10470 kJ/mol. The formula for the stable ion of X is most likely to be:

a) X^{+} b) X^{2+} c) X^{3+} d) X^{4+}

10. The energy released when a neutral atom gains an electron is called:

a) ionization energy b) bond energy c) nuclear charge d) electron affinity

11. In general, the outer shell electrons of non-metals are:

a) many in number and weakly held
b) many in number and strongly held
c) few in number and weakly held
d) few in number and strongly held

12. Similar chemical properties are a result of :

a) similar nuclear charge
b) similar numbers of valence electrons
c) similar numbers of electron shells
d) similar physical properties

13. A metallic element 'M' combines with oxygen, forming an oxide with the formula M_2O_3. The formula for the compound of this same metal with iodine would be:

a) MI_2 b) M_3I_2 c) MI_3 d) M_2I_3

14. If element 'Y' has atomic number 13 and element 'X' has atomic number 16, then the correct formula for the combination of these elements would be:

a) Y_2X_3 b) Y_2X c) Y_3X_2 d) YX

15. The formula for a compound of thulium is $TmPO_4$. The formula for the nitrate of thulium would be:

a) $Tm(NO_3)_3$ b) Tm N c) $Tm(NO_2)_3$ d) $Tm_2(NO_3)_3$

16. Which is the order of **decreasing radii** of the species S, S^{2+} and S^{2-} ?

a. $S > S^{2-} > S^{2+}$ b. $S^{2-} > S^{2+} > S$ c. $S^{2-} > S > S^{2+}$ d. $S^{2+} > S > S^{2-}$

17. Three elements X, Y, and Z have atomic numbers n, n+1 and n+2 respectively. X forms stable ions X^- and Z forms stable ions Z^+. Which statement is correct?

A. X, Y and Z all belong to the same period of the periodic table
B. Y will readily react with Z.
C. X will readily react Z.
D. X, Y and Z are all monoatomic.

18. Which of the following compounds contains the most polar covalent bonds?

a) carbon tetrachloride, CCl_4
b) hydrogen fluoride, HF
c) water, H_2O
d) boron tribromide, BBr_3

19. Which of the following generally increases going across the periodic table from left to right (→) and decreases going down the Periodic Table?

I. Ionization energy II. Atomic radius

A. I only B. II only C. Both I and II D. Neither I nor II

20. A mass spectrum of a sample of naturally occurring magnesium produced the following results:

Mass/charge	% abundance
24.0	78.60
25.0	10.11
26.0	11.29

Based on this information, one can deduce that the relative atomic mass, of magnesium is:

A. 24.0 g mol^{-1} B. 24.3 g mol^{-1} C. 25.0 g mol^{-1} D. 25.7 g mol^{-1}

21. A solution of silver nitrate is added to a solution of copper(II) iodide and a white precipitate forms. What type of reaction is this?

A) synthesis B) decomposition C) single displacement D) double displacement

22. In a lab, you mix magnesium metal with hydrochloric acid. What are the products of this reaction?

A) MgH_2 and Cl_2 B) $MgCl_2$ and H_2 C) MgCl and H_2 D) $MgCl_2$ and H

23. Which of the following reactants are involved in a neutralization reaction?

A) water and an acid B) water and a salt
C) water and a base D) an acid and a base

24. Orange crystalline ammonium dichromate was heated with a Bunsen burner. A green flaky product shot out of the test tube, along with many orange sparks. The reaction continued until all of the reactants were consumed, even though the Bunsen burner was removed when the reaction started. How can this reaction be classified?

A) decomposition and endothermic B) decomposition and exothermic
C) combustion and exothermic D) combustion and endothermic

25. An increase in the pH of an aqueous solution corresponds to:

A. an increase in the H^+ concentration and a decrease in the OH^- concentration.
B. a decrease in the H^+ concentration and an increase in the OH^- concentration.
C. an increase in the H^+ concentration with no change in the OH^- concentration.
D. an increase in the OH^- concentration with no change in the H^+ concentration.

26. Which methods will distinguish between equimolar solutions of a strong base and a strong acid?

I. Add magnesium to each solution and look for the formation of gas bubbles.
II. Add aqueous sodium hydroxide to each solution and measure the temperature change.
III. Use each solution in a circuit with a battery and lamp and see how bright the lamp glows.

A. I and II only B. I and III only C. II and III only D. I, II and III

27. Which of the following describes an antacid?

A) neutralizes acids B) is a weak acid
C) neutralizes bases D) will turn blue litmus paper pink

28. When an unknown compound was dissolved in water, the following observations were recorded:

- blue litmus paper turned red
- conducted electricity
- reacted with a metal to produce a gas which produced a 'pop' with a lighted splint

What is this compound?

A) an acid B) a metal C) a metal oxide D) a non-metal oxide

29. Which one of the following describes a base?

A) turns blue litmus paper red
B) dissolves in water to produce hydroxide ions
C) dissolves in water to produce hydrogen ions
D) reacts with carbonates to produce carbon dioxide gas

30. Compare a pH of 8.0 to a pH of 10.0. The first pH is:

A) two times more acidic B) 100 times more basic
C) 100 times more acidic D) two times more basic

31. Which of the following statements is **incorrect** about catalysts?

A) They speed up the rate of reaction.
B) They increase the rate at which the reactants are used up.
C) They increase the rate at which the products are created.
D) They are used up in the reaction.

32. In a chemical reaction, which of the following is not necessary?

A) a direct collision between the reactant particles
B) sufficient energy
C) a catalyst
D) breaking the bonds in reactants and forming new bonds

33. If you spill hydrochloric acid on your hand, what should you do?

A) scream B) place your hand under running water
C) neutralize it with a base D) wipe off the acid with a paper towel

34. Which best explains why increasing concentration increases reaction rate?

a) the average kinetic energy increases b) the collision frequency increases
c) the activation energy increases d) the activation energy decreases

Short Problems

1. a. Give **two** reasons why the lithium ion, Li^+, has a smaller radius than the lithium atom. 2

b. Give **two** reasons why noble gases are not assigned electronegativity values. 2

c. Arrange the following ions in order of increasing size: O^{-2}, N^{-3}, and F^{-1} 2

d. Explain why neon has a higher first ionisation energy than a sodium atom. 2

e. Write equations to show the chemical processes which occur when the first and second ionisation energies of sodium atom are measured. 2

f. Write equations to show the chemical processes which occur when the first and second electron affinities of a chlorine atom are measured. 2

g. Distinguish between electron affinity and electronegativity. 2

2. Explain the trend for atomic radii as you move from left to right in period 3. Which element in this period has the largest atomic radius? Which has the smallest atomic radius? 2

3. The first and second ionisation energies of potassium are shown in the table below:

Ionisation	**1st**	**2nd**
Ionisation Energy ($kJ\ mol^{-1}$)	419	3051

(i) Explain what you understand by the term *first ionisation energy* of potassium. 2

(ii) Why is there a large difference between the first and the second ionisation energy of potassium? 2

(iii) Compare the expected first and second ionisation energies for calcium. Would you expect each to be greater than, or smaller than those of potassium. Justify! 2

4. The first , second and third ionization energies for a certain element are 496 kJ, 4563 kJ and 6913 kJ respectively.

a) In which **group** of the periodic table would you expect to find this element and **why**? 2

b. Would you expect the fourth ionization energy to be greater than, equal to or smaller than 6913 kJ? **Why**? 2

c) Account for the fact that the IE value for each electron is **larger** than for the previous one. 2

5. a. Distinguish between an ionic bond and a covalent bond. 2

b. Show clearly, the bonding that would take place between and name the compounds formed: 8

i. Aluminium + Fluorine
ii. Silicon + Sulphur
iii. Calcium + oxygen
iv. Nitrogen + hydrogen

6. In aqueous solution, hydrochloric acid is a strong acid and ethanoic acid, (a.k.a.: acetic acid) is a weak acid.

a. State why **both** substances are classified as acids. 1
b. Solutions of 1.0 M hydrochloric acid and 1.0 M ethanoic acid have different electrical conductivities.
c. State and explain which solution has the greater conductivity. 2
d. Write a balanced equation for the reaction of a strong acid such as sodium hydroxide and sulphuric acid, H_2SO_4. 2
e. If a titration was performed using sodium hydroxide and sulphuric acid and phenolphthalein indicator was used, what will be the colour of the indicator at the end point and what will be the pH of the solution at the end point?

7. A pinch of manganese dioxide is added to hydrogen peroxide liquid in a test tube.

a. Describe fully what would be observed. 2
b. A glowing splint is held to the mouth of the test tube. Describe what happens and explain why. 2
c. Only the hydrogen peroxide reacted. Manganese dioxide is a catalyst; it helped hydrogen peroxide to react but did not react itself. Would you expect the mass of the manganese dioxide to change, i.e. increase or decrease at the end of the reaction, explain your answer
d. What type of chemical reaction occurred? 1
e. Write a balanced chemical equation for the decomposition of hydrogen peroxide. 2

8. Magnesium metal pieces are dropped into a test tube containing sulfuric acid. A burning splint is held close to the mouth of the test tube.
a. Describe what happens when the magnesium is mixed with the sulfuric acid.
b. What happens when the burning splint is held at the mouth of the test tube? What does this test for?
c. Write out a balanced chemical equation for the reaction with the magnesium.
d. Classify the reaction type.

9. Pentane, C_5H_{12}, is a hydrocarbon gas easily kept as a liquid under pressure.

a. Write out a word equation for the complete combustion of pentane.
b. Write out the balanced chemical equation for the complete combustion of pentane.
c. What else is produced that is not written as a chemical formula?

10. Magnesium carbonate chip is a white crystalline solid, is added to a colourless solution of 2.0 M hydrochloric acid. A vigorous reaction ensues, effervescence is observed, an exothermic reaction releasing a colourless gas is observed, and the white solid — the magnesium carbonate chip dissolves leaving a colourless solution.

a. Write a balanced chemical equation for the reaction of magnesium carbonate with hydrochloric acid.

b. Describe the expected observations and explain the expected observations, if the reaction is performed with the following changes:

i. 5.0 M hydrochloric acid instead of 2.0 M hydrochloric acid
ii. magnesium carbonate powder
iii. at 35.0 ^{O}C instead of 25.0 ^{O}C
iv. acetic acid is used instead of hydrochloric acid.

c. Sketch a graph showing the volume of the colourless gas being measured over the progress of reaction. Also show on this same graph the changes performed in (b) above.

11. The relative abundances of the three isotopes of magnesium are as follows:

^{24}Mg = 78.6%, ^{25}Mg = 10.1%, ^{26}Mg = 11.3%

Calculate the relative atomic mass of magnesium using these values, giving your answer to three decimal places. 3

12. Give the compound name or formula as required for the following:

K_2S _____
Ag_2O _____
sodium oxide _____
lithium iodide _____
beryllium chloride _____
PbI_2 _____
Fe_2O_3 _____
iron(II) bromide _____
copper(I) nitride _____
$AgNO_3$ _____
$CaSO_4$ _____
magnesium carbonate _____
copper(II) sulfate _____
Na_2CO_3 _____
$Cu(OH)_2$ _____
zinc chlorate _____
potassium sulfate _____
SO_2 _____
NBr_3 _____
carbon dioxide_____
silicon tetrabromide_____
ammonium phosphate_____

$AlBr_3$ _____
ZnF_2 _____
calcium nitride _____
potassium phosphide_____
magnesium hydride _____
SnF_4 _____
Cu_2S _____
tin(II) phosphide _____
lead(IV) oxide _____
$Pb(ClO_3)_2$ _____
K_3PO_4 _____
calcium hydrogen carbonate _____
iron(II) hydroxide _____
$Sn(NO_3)_2$ _____
$Al(HCO_3)_3$ _____
calcium phosphate _____
lead(IV) carbonate _____
CF_4 _____
CS_2 _____
nitrogen phosphide _____
chlorine (I) oxide _____
iron(III) nitrate trihydrate _____

13. If you react potassium hydroxide with sulphuric acid, you have performed a _____ reaction.
Provide a balanced chemical equation for this reaction.