Chemistry Entrance Material for Grade 11 to 12

2018-2019

Chapter 1: The Condensed Phases of Matter

In all multiple choice questions, more than answer could be correct

Section №: 1 Pure Substances
Concept №:

1. <u>Know where gaseous elements are located in the periodic table</u>
01. What are the elements that are normally found as gases?

_____

02. Where are these gaseous elements placed in the periodic table?

_____

2. <u>What the vapour pressure of a liquid depends upon</u>
03. What is the only factor that affects the vapour pressure?

_____

3. <u>Know what a volatile liquid is</u>
04. A liquid is called volatile if:
[-A-] it burns spontaneously in air
[-B-] it reacts explosively with oxygen
[-C-] it readily evaporates at room temperature
[-D-] it boils when heated in air

4. <u>Effect of temperature on vapour pressure</u>
05. How does the vapour pressure of a liquid vary with temperature?

_____

5. <u>When a liquid boils it absorbs heat at constant temperature</u>
06. When a liquid at its boiling point is heated, what happens to the temperature? What happens to the heat given to the liquid?

_____

_____

6. <u>Liquid-gas phase change is endothermic</u>
07. When a liquid evaporates, it
[-A-] gives energy to the surroundings
[-B-] takes energy from the surroundings
[-C-] neither takes nor gives energy to the surroundings

08. Which of these equations is correct?
a) H_2O (*l*) + 42 kJ $\rightarrow$ H_2O (*g*).
b) H_2O (*g*) $\rightarrow$ H_2O (*l*) + 42 kJ.
c) H_2O (*g*) + 42 kJ $\rightarrow$ H_2O (*l*).

7. Definition of molar heat of vaporization
09. Define the molar heat of vaporization?

_____

8. Variation of molar heat of vaporization

10. Which of the following liquids has the lowest molar heat of vaporization? _____

Which one has the highest molar heat of vaporization? _____

Which one has the highest vapour pressure at its boiling point? _____

Liquid	**A**	**B**	**C**	**D**	**E**
Boiling Point/ ^oC	-20	-15	0	10	20

11. Substances that have higher boiling points have _____ (higher/ lower) molar heat of vaporization.

12. Consider the following liquids with their boiling points: A (30^{o}C), B (60^{o}C), C (25^{o}C).

- Which one of the liquids has the highest molar heat of vaporization? _____
- Which one of the liquids has the lowest molar heat of vaporization? _____
- Which of the liquids have the highest vapour pressure at their boiling points?

_____

13. Substances that have higher boiling points have _____ (higher/ lower) molar heat of vaporization.

9. Defining vapour pressure of a liquid at a fixed temperature
14. When a liquid is in contact with its vapour at equilibrium at a constant temperature, the pressure exerted by its vapour is called
[-A-] the total pressure
[-B-] the partial pressure of the liquid
[-C-] the liquid pressure of the vapour
[-D-] the vapour pressure of the liquid
[-E-] the atmospheric pressure

15. Place some liquid water (in excess) in a flask at t°C and seal the flask. Wait until no more water can evaporate. Does the partial pressure of the water vapour in the flask depend upon:

[-A-] the amount of liquid water left in the flask? _____

[-B-] the volume of the flask? _____

[-C-] the temperature of the flask? _____

16. With a surrounding pressure of 760 mm Hg, water boils at 100°C and ethanol boils at 78.6°C. Which of the 2 compounds has higher vapour pressure at their boiling points?

_____

17. Experiments with many liquids lead us to the following generalization: As the _____ increases, the vapour pressure of the liquid will always increase.

10. Properties of the boiling point

18. At the boiling point:

[-A-] Can molecules escape from the surface of a liquid to enter the gas phase as vapour? _____

[-B-] What is the relationship between the vapour pressure and the atmospheric pressure? _____

[-C-] Can bubbles of vapour form anywhere within the liquid? _____

11. Know when a liquid boils

19. In general, a liquid boils when
[-A-] its vapour pressure is 1 atmosphere
[-B-] its vapour pressure is 760 mm Hg
[-C-] its temperature is $100^{o}C$
[-D-] its vapour pressure equals the surrounding pressure
[-E-] bubbles form only on the sides of its container

12. Recognize location where the boiling point of water is highest

20. Where will the boiling point of water be the highest or the lowest?

[-A-] at 600 m altitude? _____

[-B-] at 1000 m altitude ?_____

[-C-] at 1200 m altitude ?_____

[-D-] at sea level?_____

13. Definition of the normal boiling point

21. What is the normal boiling point of a liquid?

_____

14. Solid-liquid phase change is endothermic

22. When a solid at its melting point is heated, what happens to the temperature? What happens to the heat given to the solid?

---

23. State whether the following changes are endothermic or exothermic?

- Liquid into solid. _____
- Liquid into Gas. _____
- Gas into liquid. _____
- Solid into liquid. _____

24. Is the energy needed to change S-L smaller or greater than changing L-G? _____

25. When a solid melts, it _____ (absorbs/ releases) energy from/to the surroundings.

15. Molar heat of fusion is less than the molar heat of vaporization

26. Is the molar heat of fusion less than the molar heat of vaporization?

---

27. If H_2O *(l)* + 42 KJ → H_2O *(g)*, which of these equations is ***CORRECT***?

[-A-] H_2O (*s)* → H_2O *(l)* + 42 KJ

[-B-] H_2O (*s)* + 6.0 KJ → H_2O *(l)*

[-C-] H_2O (*s)* + 42 KJ→ H_2O *(l)*

[-D-] H_2O (*l)* + 42 KJ→ H_2O *(s)*

16. Definition of molar heat of fusion

28. What is the molar heat of fusion?

---

17. Variation of molar heat of fusion with melting point

29. In general, for pure substances, the higher the melting point is, the _____ (higher/ lower) is the energy required to melt one mole of it.

30. The melting points of five substances, in °C, are given in the following table:

SOLID	**V**	**W**	**X**	**Y**	**Z**
Melting Point (^oC)	60	30	10	180	50

Based on this data *alone*, which of the above substances is *expected* to have the highest molar heat of fusion? _____

31. The temperature at the boiling point or melting point _____ (increases/ decreases/ stays the same).

18. At the same temperature, average KE is the same in all states

32. At the same temperature, the average kinetic energy of molecules in the solid, liquid and gaseous phases of a substance is _____(the same/ different).

19. At the same temperature gases have the highest potential and overall energy

33. The potential energy of the particles is the _____ (highest/ lowest) in the gaseous state and _____ (highest/ lowest) in the solid state.

21. What happens when a liquid in a closed bottle evaporates

34. When some of the liquid in a closed bottle evaporates until no more can evaporate,

[-A-] The remaining liquid continues to become cooler because the molecules continue to evaporate all the time.

[-B-] The liquid continues to cool down.

[-C-] The liquid may cool down initially, but then it will stay at the same temperature because the system has reached equilibrium.

[-D-] The remaining liquid becomes hotter because evaporation needs heat.

[-E-] None of the above

Section №: 2 Solutions

Concept №:

1. A solution is a homogeneous solution

35. Are all gaseous mixtures homogenous solutions?_____

2. Recognize a solution

36. What is a solution? _____

37. Which of the following may not be classified as a solution?

[-A-] air

[-B-] ethanol mixed thoroughly with water

[-C-] a mixture of oil and water

[-D-] steel

[-E-] milk

38. Give examples of solid solutions. _____

3. Effect of freezing or boiling salt water

39. Which of the following observation(s) is/are *TRUE* about boiling and freezing a sample of pure water and another one of salt solution?

1. When cooling, both samples freeze at the same temperature. _____

2. Heat some of each liquid until it boils, collect some of the vapours, and condense them. Both resulting liquids prove to be pure water. _____

3. The freezing point of salt solution is higher than that of pure water. _____

40. How does a solid affect the boiling point and freezing point of a liquid in which it is dissolved?

1. The boiling point *drops.*
2. The freezing point *drops.*
3. The boiling point *increases.*

4. A solution is heterogeneous with respect to change of phase

41. What is meant by heterogeneous with respect to change of phase? Give an example.

---

5. At the same pressure, BP and MP of a solution depends on composition

42. At the same pressure, the boiling and melting points of a solution
[-A-] are always constant
[-B-] are different for the same composition
[-C-] are different for different compositions

43. Substances have sharp melting points when they are _____ (pure/ impure).

44. Why do solutions have varying boiling and melting points?

Section №: 3 Separating Mixtures
Concept №:

1. Filtration: to separate heterogeneous mixture of solid in liquid

45. To obtain dry sand and salt from a mixture of sand and salt we need to follow which of the following steps and in what order?

1. Add excess water to the mixture and stir.
2. Heat the solution to crystallize.
3. Filter, and allow the residue to dry.
4. Add excess alcohol to the mixture and stir.

2. Selective solubility: to separate a mixture of two solids

46. To separate salt and sugar from a salt-sugar mixture, we need to follow which of the following steps and in what order?

1. Add excess water to the mixture and stir.
2. Heat the filtrate on a water bath to evaporate alcohol safely. Then collect the sugar.
3. Filter, and allow the salt residue to dry.
4. Add excess alcohol to the mixture and stir.

3. How to heat alcohol in a beaker

47. It is required to heat a beaker containing some alcohol. How should this be done SAFELY?

---

4. Meaning of sublimation

48. What does it mean to say that a substance sublimes?

---

49. Which mixture is easy to separate by sublimation?
[-A-] Salt + Sand
[-B-] Salt + Sugar

[-C-] Salt + Ammonium chloride
[-D-] Nitrogen liquid + Oxygen liquid
[-E-] Ammonium chloride dissolved in water

6. Recognize mixture to be separated by distillation
50. Which mixture is easy to separate by distillation?
[-A-] Salt + Sand
[-B-] Salt + Sugar
[-C-] Salt + Ammonium chloride
[-D-] Nitrogen liquid + Oxygen gas
[-E-] Calcium chloride dissolved in water
[-F-] Salt + Water
[-G-] Sugar + Water

7. Recognize distillation apparatus
51. Draw and label the distillation apparatus.

8. Recognize mixture to be separated by fractional distillation
52. Which mixture is easy to separate by fractional distillation?
[-A-] Salt + Sand
[-B-] Salt + Sugar
[-C-] Salt + Ammonium chloride
[-D-] Nitrogen liquid + Oxygen liquid
[-E-] Calcium chloride dissolved in water
[-F-] Water + alcohol

10. Recognize mixture to be separated by a separatory funnel
53. Which mixture is easy to separate by using a separatory funnel?
[-A-] Salt + Sand
[-B-] Water + Alcohol
[-C-] Salt + Ammonium chloride
[-D-] Nitrogen liquid + Oxygen liquid
[-E-] Water + oil

11. Know the meaning of adsorption
54. What is adsorption?

_____

12. Recognize mixture to be separated by adsorption
55. Which mixture is easiest to separate into components by adsorption?
[-A-] Brewed tea
[-B-] Sea water
[-C-] Sand and salt
[-D-] Blue copper sulphate solution
[-E-] Yellow potassium chromate solution

13. Recognize good adsorbing materials
56. Which of the following is a good adsorbing agent?
[-A-] Sponge
[-B-] Charcoal
[-C-] Sand
[-D-] Silica
[-E-] Filter paper

57. _____ (Sponge/ Charcoal/ Sand/ Silica/ Filter paper) is available as small sachets placed in leather and electronic items.

58. _____ (Sponge/ Charcoal/ Sand/ Silica/ Filter paper) can be placed in fridges to adsorb any offensive odor.

14. Recognize mixture to be separated by chromatography
59. Which mixture is easiest to separate into components by chromatography?
[-A-] Water + Alcohol
[-B-] Sea water
[-C-] Green liquid obtained by squashing green leaves
[-D-] Blue copper sulphate solution
[-E-] Yellow potassium chromate solution
[-F-] Black ink

Section №: 4 Aqueous Solutions
Concept №:

1. Know what aqueous solutions are
60. What is an aqueous solution?

_____

2. Know meaning of the term molar concentrations
61. What is the molar concentration?

_____

3. Concentration of a fraction of a given volume of solution

62. 500 ml of 3.0 M Na_2CO_3 solution is prepared in a flask. 300 ml of solution is poured out of the flask into a beaker. What is the concentration of the salt solution in the beaker?

4. How to make a 1.00 M salt solution

63. Explain how you would prepare a 2.00 M NaCl solution. [Na = 23; Cl = 35.5]

5. Find number moles in solution given V and M

64. 0.15 dm^3 of 2.0 M NaOH solution is to be prepared in a flask. How many moles of NaOH are required?

65. How many moles of salt are needed to prepare 750 cm^3 of a 2.5 M solution?

66. How many moles are needed to prepare 0.3 L of 2M HCl solution? [H = 1, Cl = 35.5]

6. Find mass in solution given V and M

67. 0.50 dm^3 of 0.4 M NaOH solution is to be prepared in a flask. How many grams of NaOH are required? [Na = 23; O = 16; H = 1]

68. What mass of HCl do you need to prepare 500ml of 2.5M solution? [H = 1, Cl = 35.5]

8. Find volume in solution given n and M

69. A 4 M solution containing 0.5 mol of KNO_3 is to be prepared in a flask. What is the volume of the flask required?

9. Find molecular mass of X in solution given V, mass and M

70. 2 dm^3 of a 1M solution contain 73 g of an acid X. What is the molecular mass of X?

7. Find new concentration of diluted solution

71. 400 cm^3 of a 0.40 M lithium hydroxide solution is poured into a clean volumetric 500 cm^3 flask. Distilled water is added to fill the flask up to the etched mark. What is the concentration of the salt solution in the flask?

72. 150 mL of 4M KCl solution was poured into a volumetric flask. Water was then added until the final volume is 1000 mL. What is the concentration of the resulting solution?

73. 340 mL of of a 3 M HCl solution is prepared in a flask. If you add 160 mLof water to the above solution, what is the final concentration?

10. The meaning of a saturated solution

74. What do chemists mean by the term ‘saturated solution’?

_____

_____

_____

11. Mean in g of ‘solub il ity of a sol id ’ in ch emist ry

75. Define solubility.

_____

12. T h e mean in g of th e w ord ‘solub le’ in ch emi stry

76. Which of the following is ***CORRECT*** concerning the terms 'soluble', 'slightly soluble', 'very slightly soluble' and 'negligible solubility'?

[-A-] **Soluble** if its solubility is more than 1.0 M

[-B-] **Slightly soluble** if its solubility is less than 1.0 M

[-C-] **Very slightly soluble** if its solubility is less than 10^{-2} M

[-D-] **Insoluble** or of **negligible solubility** if its solubility is so low as to be of no interest to us, e.g. glass has negligible solubility in water

77. A substance is said to be soluble if its solubility is _____ (greater/ smaller) than 0.1 M.

Section №: 5 The Electrical Nature of Matter

Concept №:

1. Know the basics of the electric model of atoms

78. In a neutral atom, the number of protons is equal to the number of _____ (electron/ neutrons/ions).

79. What is a conductor?

_____

80. What is an insulator?

_____

81. According to our model of electricity, which of the following is ***wrong***?

[-A-] Each electron carries a charge of –1.

[-B-] Each nucleus carries a charge of +1.

[-C-] If a neutral atom has 5 electrons going around it, then the charge on its nucleus is +5 units.

[-D-] If a neutral atom loses 2 electrons the total charge on it becomes +2 units.

[-E-] If a neutral atom gains 2 electrons the total charge on it becomes +2 units.

82. What is the charge of 1 electron, 1 proton and 1 neutron?

_____

_____

83. Opposite charges _____ (repel/ attract) each other, while like charges (repel/ attract) each other.

2. Know the direction of the electric current

84. The flow of electricity inside the battery is from the _____ (positive/ negative) terminal to the _____ (positive/ negative) terminal.

85. The flow of electrons outside the battery (in the wires) is from the _____ (positive/ negative) terminal to the _____ (positive/ negative) terminal.

3. Know how a van de Graaf generator generates charge

86. A van de Graaf generator is an instrument that causes two bodies to become charged by

[-A-] connecting them to a battery

[-B-] connecting them to a dynamo

[-C-] connecting them to an electric generator

[-D-] causing between them chemical reactions

[-E-] rubbing two objects together

4. Know what an electrometer is

87. An electrometer

[-A-] creates electric energy

[-B-] creates electric charges

[-C-] detect electric charges

[-D-] causing chemical reactions between charges

Section №: 6 Electrical Properties of Condensed Phases

Concept №:

1. Recognize aqueous solutions which conduct electric current

88. Water is a _____ (poor/ good) conductor of electricity.

89. Which of the following liquids completes an electric circuit?

[-A-] Milk

[-B-] An aqueous solution of sodium chloride

[-C-] An aqueous solution of sugar

[-D-] distilled water

2. Know what is an electric current

90. What is an electric current?

_____

3. When NaCl dissolves in water we have ions

91. When NaCl dissolves in water, we have (identify the correct choices)
[-A-] sodium ions only, represented by $Na^+(aq)$
[-B-] chloride ions only, represented by $Cl^-(aq)$
[-C-] solid sodium chloride forming ions as follows: $NaCl(s) \rightarrow Na^+(aq) + Cl^-(aq)$.

4. Know what is an ion

92. In aqueous solution: 1 mole of NaCl (s) → _____ + _____

93. In aqueous solution: 1 mole of $CaCl_2$ (s) → _____ + _____

94. Complete the following reaction: $(NH_4)_2SO_4$ *(aq)* → _____ + _____

5. Model to explain how current flows through an aqueous solution

95. Which of the following points are involved in the model to explain how current flows through an aqueous solution of NaCl?
[-A-] Solid NaCl dissolves in water, forming charged particles $Na^+(aq)$ and $Cl^-(aq)$ that can move in the solution independently.
[-B-] $Na^+(aq)$ ions (and all positive ions) are repelled away from the positive electrode and attracted towards the negative electrode.
[-C-] $Cl^-(aq)$ ions are repelled away from the negative electrode and attracted towards the positive electrode.

96. In an ionic solution connected to a battery, all positive ions move in the _____ (same/ opposite) direction to current, while negative ions move in the _____ (same/ opposite) direction to current.

6. Conditions for an electric current to flow through a circuit

97. What are the points necessary for an electric current to flow through an aqueous solution?
In order for electricity to flow, the circuit should be _____ (closed/ opened).

7. Why $CaCl_2$ solution conducts current but sugar in water does not

98. Why does aqueous $CaCl_2$ solution conduct electricity but sugar in water does not?
Which of the following is a part of the explanation?
[-A-] Sugar solution in water forms only one type of ion: Sugar (*aq*).
[-B-] Calcium chloride forms two types of ions: $CaCl_2(s) \rightarrow Ca^{2+}(aq) + 2Cl^-(aq)$.
[-C-] Calcium chloride provides $Ca^+(aq)$ and $Cl^-(aq)$.

8. Know how many moles of ions one mole of $AgNO_3$ provides in water

99. One mole of silver nitrate, $AgNO_3$, in water provides how many moles of ions?
[-A-] One mole of $Ag^+(aq)$ and one mole of N^-.
[-B-] One mole of $Ag^+(aq)$ and three moles of $NO_3^-(aq)$.
[-C-] One mole of $Ag^+(aq)$ and four moles of negative ions (*aq*).
[-D-] One mole of $Ag^+(aq)$ and one mole of negative nitrate ions, $NO_3^-(aq)$.

[-E-] Five moles of ions.

9. Recognize that not all ionic solid are soluble in water

100. Which solid is not soluble in water?

[-A-] Silver chloride, AgCl

[-B-] Silver nitrate, $AgNO_3$

[-C-] Sodium chloride, NaCl

[-D-] Calcium chloride, $CaCl_2$

[-E-] Ammonium chloride, NH_4Cl

10. Definition of precipitation

101. The formation of solid from a solution is called _____.

11. Know the meaning of 'predominant reacting species'

102. What are the predominant species in the following reaction:

$Ag^+ (aq) + NO_3^- (aq) + K^+ (aq) + Cl^- (aq) \rightarrow AgCl (s) + NO_3^- (aq) + K^+ (aq)$

_____

12. Balance ionic equations

103. Is the charge conserved in the following reaction:

$$CaCl_2 (s) \rightarrow Ca^{2+} (aq) + 2\ Cl^- (aq)$$

_____

13. Know three ways to write equations involving ions

104. Consider the following reactions:

A- $Ag^+ (aq) + NO_3^- (aq) + K^+ (aq) + Cl^- (aq) \rightarrow AgCl (s) + NO_3^- (aq) + K^+ (aq)$

B- $AgNO_3 (aq) + KCl (aq) \rightarrow AgCl (s) + KNO_3 (aq)$

C- Ag+ (aq) + Cl- (aq) → AgCl (s)

Which of the following reactions is an overall non-ionic reaction? _____

Which of the following reactions is an overall ionic reaction? _____

Which of the following reactions is a net ionic reaction? _____

Section №: 8 Types of Solids

Concept №:

1. Recognize properties of molecular solids

105. Give examples on molecular compounds. _____

2. Properties of an ionic solid, e.g. NaCl

106. Give examples on ionic solids. _____

107. Ionic compounds have _____ (high/ low) boiling points while molecular compounds have _____ (high/ low) boiling points.

108. _____ is an example of an ionic compound at room temperature?

1 Sugar: $C_6H_{12}O_6$ *(s)*
2 CO_2 *(g)*
3 NaCl *(s)*

109. Does molten salt, NaCl, conduct electricity? _____

3. Know what is an anion
110. What is the charge of the anion?

_____

4. Know what is a cation
111. What is the charge of the cation?

_____

5. Know symbols and charge of the given 10 cations and 10 anions
112. Give the correct symbol of:
Silver ion: _____ Ammonium ion: _____
Sulfate ion: _____ Carbonate ion: _____

6. Name salts of the given 10 cations and 10 anions
113. What is the name of:
$AgNO_3$: _____ $CaCl_2$: _____
NaCl: _____ $BaSO_4$: _____

114. Which salt is named or written incorrectly?
[-A-] $K_2Cr_2O_7$ is potassium dichromate
[-B-] NH_4Cl is chloride ammonium
[-C-] Lead sulphate is $PbSO_4$
[-D-] K_2CO_3 is potassium carbonate
[-E-] Barium hydroxide is $Ba(OH)_2$

115. What is the chemical formula and the name of the compound formed between:
Ba^{2+} and Cl^-: _____
Ba^{2+} and SO_4^{2-}: _____
NH_4^+ and SO_4^{2-}: _____

7. Know an example of a metallic solid and a network solid
116. Examples of metallic and network solids respectively are:

[-A-] copper and wax
[-B-] salt and sugar
[-C-] gold and charcoal
[-D-] sodium and diamond
[-E-] mercury and string

117. Atoms of metallic solids are strongly bonded to each other, so they have very _____ (high/ low) melting and boiling points.

118. Atoms of network solids are strongly bonded to each other, so they have very _____ (high/ low) melting and boiling points.

Chapter 2: Structure of the Atom and the Periodic Table

In all multiple choice questions, more than answer could be correct

Section №: 1 Structure of the Atom
Concept №:

1. Contents of an atom (nucleus, electrons) and its size

01. Atoms have diameters in the order of _____ (10^{-10}/ 10^{-6}/ 10^{-5}) m.

02. Atoms have _____ (nucleus/ electrons) around which _____ (nucleus/ electrons) move.

2. Contents of the nucleus

03. The mass of the atom is concentrated in the _____ (nucleus/ electronic cloud), while the volume is occupied by the (nucleus/ electronic cloud).

04. The nucleus contains _____ and _____, called the nucleons.

05. What is the role of the neutrons? _____

3. Common characteristics of nuclei of the same element

06. All nuclei of a particular element have the same number of _____

4. How atoms form positive and negative ions

07. Atoms become negative ions by _____ (gaining/ losing) electrons.

08. Atoms become positive ions by _____ (gaining/ losing) electrons.

5. When is energy absorbed/ released in ion formation

09. For which of the following processes will energy be absorbed?

A- Separating an electron from an electron
B- Separating an electron from a proton
C- Separating a proton from a proton
D- Removing an electron from a neutral atom

10. Which of the following is/are ***TRUE***?

1. Neutral atom + electron → negative ion + Energy
2. Neutral atom → positive ion + electron + Energy
3. Neutral atom + Energy → positive ion + electron

6. Comparison of masses of protons, neutrons and electrons

11. Mass of proton is:

A- Equal to the mass of electron

B- 1/1840 times the mass of electron
C- 1840 times the mass of electron
D- Smaller than the mass of electron

7. The nuclear model

12. What are the subatomic particles?

---

13. Fill in the following table:

Subatomic Particles	Mass	Charge
Electron		
Proton		
Neutron		

8. What is meant by a stable nucleus

14. When we say that a nucleus is stable, what do we mean?

---

10. What is meant by 'atomic diameter' in a crystalline solid

15. What is the atomic diameter in a solid?

---

11. Atomic number

16. What is the atomic number?

---

12. Mass number

17. What is the mass number?

---

13. Atomic and mass numbers

18. Consider the nucleus .

a) What is its atomic number (Z)? _____

b) What is its mass number (A)? _____

c) How many protons does it contain? _____

d) How many electrons does it contain? _____

e) How many neutrons does it contain? _____

f) How many nucleons does it contain? _____

19. Referring to symbols of atomic nuclei, the atomic number is written as a subscript at the _____ (upper/ lower) left of the symbol, and the mass number is written as a superscript at the _____ (upper/ lower) left of the symbol.

15. Recognize a symbol that defines a nucleus instead of the whole atom

20. What does represent?

_____

_____

21. What does represent?

_____

17. Know what deuterium is

22. What is deuterium?

_____

_____

18. Know what isotopes are

23. Isotopes are nuclei having the same _____ but different _____.

19. Know that chemical properties are determined by Z

24. During chemical reactions, only _____ (electrons/ protons/ neutrons) are involved, while _____ (electrons/ protons/ neutrons) and _____ (electrons/ protons/ neutrons) remain intact.

25. _____ and _____ are responsible for the chemical properties of an element.

20. Find average atomic mass from ratio of isotopes

26. Chlorine in nature consists of 75.4% o f chlorine-35 and 24.6% of chlorine-37. Find the average molar mass of chlorine.

_____

_____

_____

_____

_____

Section №: 2 The Periodic Table
Concept №:

1. Recognize that in a row of the periodic table elements have consecutive Z

27. In the periodic table, elements are placed sequentially in rows according to the _____ (atomic number/ mass number) from the left to right.

2. Recognize what 'row' and 'group' of the periodic table mean

28. Elements belonging to the same row means that they belong to the same _____ (period/group).

29. Elements belonging to the same column mean that they belong to the same _____ (period/ group).

30. Elements belonging to the same group have equal number of _____ (electrons/ protons/ neutrons) in the last energy level.

31. If a neutral atom has 7 electrons, to what group and period does it belong?

_____

32. A neutral atom of Oxygen ($_8$O) has 8 electrons around the nucleus. To what group does oxygen belong?

_____

33. A neutral atom of Sulphur ($_{16}$S) has 16 electrons around the nucleus. To what group does sulphur belong?

_____

34. If a neutral atom has an atomic number of 12. To what group and period does it belong?

_____

3. Recognize where 'metals' and 'non-metals' are in the periodic table

35. In the periodic table, metals are placed on the _____ and non-metals are present on the _____.

4. Transition metals: more than one charged ion, form colored compounds

36. Transition elements form _____ (colored/non-colored) compounds and more than one charged _____ (ions/atoms/molecules).

37. Elements located between group 2 and group 3 in the periodic table are called _____ (alkali metals/ halogens/ noble gases/ transition elements)

5. Advantage of arranging elements in groups (families)

38. In the periodic table,

[-A-] Elements on the right side are metals.

[-B-] Elements of group 7 can lose 1 electron and become stable
[-C-] Elements of group 1 can share 1 pair of electrons and become stable.
[-D-] Elements of groups 1, 2 and 3 lose electrons while elements of groups 4, 5, 6 and 7 can either gain or share electrons.

39. Fill in the following table:

	Atomic Number	**Subatomic Particles**			**Mass Number**
		Protons	**Electrons**	**Neutrons**	
Calcium ion: **Ca^{2+}**	**20**				**40**
Oxygen ion: **O^{2-}**		**8**			**16**
Neon: **Ne**		**10**		**10**	
Bromine: **Br**	**35**				**80**
Aluminum ion: **Al^{3+}**		**13**			**27**
Chloride ion: **Cl^{-}**	**17**				**35**
Barium: **Ba**		**56**		**81**	

Section №: 3 The Simplest Chemical Family- The Noble Gases
Concept №:

1. Variation of the BP and MP of noble gases with Z

40. Give examples of inert or noble gases? _____

41. In noble gases, as the atomic number increases the boiling point _____

2. Know that the electron arrangements of 2, 10, 18, 36 are stable

42. What electron arrangement around a nucleus makes the atom or ion stable?
2, 10, 18, 36
2, 10, 18, 26

3. Know that helium, Z = 2, is an unreactive monoatomic gas

43. Which property of helium, , is ***INCORRECT***?
[-A-] It has the lowest boiling point among all elements.

[-B-] It has a mass of 4 amu and 2 protons.
[-C-] It has 10 electrons around its nucleus.
[-D-] It is an inert gas.

44. Helium has the _____ (lowest/ highest) boiling points among all other elements.

4. Ne, Ar, Kr, Xe, Rn: Monoatomic gases, unreactive, form unstable compounds
45. Noble gases are called 'inert' because they are _____ (reactive/ unreactive).

5. NaCl is stable because its ions have noble gas configurations
46. NaCl is stable because Na^+ ion has _____ electrons around it while Cl^- ion has _____ electrons around it.

Section №: 4 The Alkali Metals
Concept №:
1. Properties of alkali metals
47. Give examples on alkali metals.

_____

48. Alkali metals reacts by _____ (losing/gaining) 1 electron and forms a _____ charged ions.

49. Alkali metals belong to group _____ because they have _____ electron in the last energy level.

50. Elements in groups I, II and III _____ (gain/ lose) electrons while elements in groups IV, V, VI and VII _____ (gain/ lose) electrons.

51. Alkali metals such as Li, Na, and K should be kept under kerosene because they are

_____

2. Explanation of electrical conductivity of metals
52. Scientists explain the electrical conductivity of metals by:
[-A-] the presence of electrons in the crystal that are loose
[-B-] electrons that can move throughout the metallic crystal without specific attachment to particular atoms
[-C-] the ease of freeing one electron per atom
[-D-] the presence of positive M^+ ions in the metallic object that can move easily from one end to the other
[-E-] saying that all metals conduct electricity

3. Know trend in Boiling points and Melting points of Alkali metals
53. In alkali metals, as the atomic number increases the boiling point _____.

5. Meaning of a stable compound in chemistry

54. In chemistry, a compound is said to be stable if it has a relatively _____ (low/ high) potential energy.

6. Know what happens when an ionic bond takes place

55. If an ionic bond forms between two atoms; then the result is two ions: _____ ion and _____ ion.

7. Reactions of the alkali metals with chlorine

56. Which represents the reaction of chlorine with an alkali metal?

[-A-] Cl^- *(aq)* + Na^+ *(aq)*→ NaCl *(s)* + energy

[-B-] NaCl *(s)* → Cl^- *(aq)* + Na^+ *(aq)* + energy

[-C-] Na *(s)* + ½ Cl_2 *(g)* → NaCl *(s)* + energy

[-D-] NaCl *(s)* → Na^+ *(aq)* + Cl^- *(aq)*

9. Action of the alkali metals on hydrogen

57. Which of the following equations representing the reaction of an alkali metal and hydrogen gas is ***CORRECT***?

[-A-] $Ca(s) + ½\ H_2(g) \rightarrow CaH(s)$

[-B-] $Ca(g) + ½\ H_2(g) \rightarrow CaH(s)$

[-C-] $Na(s) + ½\ H_2(g) \rightarrow NaH(s)$

[-D-] $Ne(g) + ½\ H_2(g) \rightarrow NeH(g)$

[-E-] $½\ I_2(s) + ½\ H_2(l) \rightarrow HI(l)$

11. Test for Li^+, Na^+ and K^+

58. The salts of sodium are distinguishable by flame tests. What is the color of the flame produced?

_____

59. The salts of potassium are distinguishable by flame tests. What is the color of the flame produced?

_____

60. The salts of lithium are distinguishable by flame tests. What is the color of the flame produced?

_____

Section №: 5 The Halogens

Concept №:

1. F, Cl, Br, I At are called the halogens or group 7 elements

61. Fluorine, chlorine, bromine, iodine and astatine are halogens. These elements have one less electron than does its neighboring noble gas. All these elements are found in group _____ _____ (I/ II / III/ VII/ VIII).

2. State of the halogens under normal conditions

62. Under room temperature and pressure, which is ***TRUE*** about F, Cl, Br, and I?
1. Fluorine and chlorine are gases, bromine is a liquid and iodine is solid.
2. Fluorine and chlorine are gases, and the rest are solids.
3. They are all gases.

3. Know what happens when a covalent bond forms

63. When a covalent bond is formed, one atom _____ (shares/ gains/ loses) electrons with another atom.

4. Differences between covalent and ionic bonding

64. What is the main difference between an ionic bond and a covalent bond?

_____

_____

5. F^-, Ne and Na^+ are isoelectronic: Know why F^- is largest, Na^+ is smallest

65. F^-, Ne and Na^+ are isoelectronic. Which is the smallest and why?

[-A-] F^- is the smallest because it has one more electron than Ne and two more than Na^+.
[-B-] Na^+ is the smallest because it has one more electron than Ne and two more than F^-.
[-C-] Na^+ is the smallest because it has one more neutron in the nucleus than Ne and two more than F^-.
[-D-] F^- is the smallest because it has one more proton than Ne and two more than Na^+.
[-E-] Na^+ is the smallest because it has one more proton in the nucleus than Ne and two more than F^-.

6. Reaction of the alkali metals with halogens

66. Which of the following represents the reaction of a halogen with an alkali metal?

[-A-] $K\,(s) + \frac{1}{2}\,Br_2\,(l) \rightarrow KBr\,(s)$.
[-B-] $Ca\,(s) + 2I_2\,(s) \rightarrow CaI_2\,(s)$.
[-C-] $Br^- + Na^+ \rightarrow NaBr\,(s)$ + energy.
[-D-] $LiF\,(s) \rightarrow F^- + Li^+$ + energy.
[-E-] $NaF\,(s) \rightarrow Na^+\,(aq) + F^-\,(aq)$.

67. Which represents the reaction of alkali metal with a halogen?

[-A-] $F^-\,(aq) + Na^+\,(aq) \rightarrow NaF\,(s)$ + energy
[-B-] $NaF\,(s) \rightarrow F^-\,(aq) + Na^+\,(aq)$ + energy
[-C-] $Na\,(s) + \frac{1}{2}\,Br_2\,(l) \rightarrow NaBr\,(s)$ + energy
[-D-] $NaF\,(s) \rightarrow Na^+\,(aq) + F^-\,(aq)$

7. Reactions of halogens with hydrogen: Equation and Condition

68. Which of these reactions take place at room temperature?

[-A-] $H_2(g) + F_2(g) \rightarrow 2HF(g)$ + energy.
[-B-] $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$ + energy.
[-C-] $H_2(g) + Br_2(l) \rightarrow 2HBr(g)$ + energy.
[-D-] $H_2(g) + I_2(s) \rightarrow 2HI(g)$ + energy.

[-E-] None, because the molecules are stable and energy is needed to break some bonds to start the reaction.

69. Chlorine reacts explosively with hydrogen when a spark is introduced? Which of the following is ***TRUE***?

[-A-] The equation is H_2 *(g)* + Cl_2 *(g)* → 2HCl *(g)* + energy

[-B-] The equation is H_2 *(g)* + Cl_2 *(g)* + energy →2HCl *(g)*

8. Know that halogens react by gaining or by sharing

70. The halogen groups (Group 7 elements) may react to acquire noble gas structure by

_____

9. Know test for halide ions

71. When silver nitrate ($AgNO_3$) is added to solution of sodium chloride (NaCl), sodium bromide (NaBr) and sodium iodide (NaI), we will observe the following respectively

[-A-] yellow, white and cream precipitates will form

[-B-] white, cream and yellow precipitates will form

[-C-] cream, white and yellow precipitates will form

[-D-] white, yellow and cream precipitates will form

10. HX are gaseous molecules that dissolve in H_2O giving H^+ (aq) ions

72. Hydrogen halides are _____ (gases/ solids/ liquids) at room temperature. They dissolve in water to produce a(n) _____ (acid/ base) releasing hydrogen ions and halide ions.

11. Know that a halogen replaces a halide ion in this order: F > Cl > Br > I

73. Given a solution of NaBr in water. Which of the following is ***TRUE***?

[-A-] If I_2 is added, bromine will be released.

[-B-] If Cl_2 is added, bromine will be released.

[-C-] If I_2 is added, bromide ion will be formed in solution.

[-D-] If Cl_2 is added, no reaction takes place.

[-E-] None of the above

Section №: 6 Hydrogen- A Family by Itself

Concept №:

1. Properties of hydrogen under normal conditions

74. Under room temperature and pressure, which is ***TRUE*** about hydrogen?

A. It is a diatomic gas

B. It has a low melting and boiling points.

C. It has the lowest boiling point among all elements.

D. It has the second lowest boiling point among all elements.

2. Reaction of hydrogen with alkali metals; properties of NaH

75. Which is ***TRUE*** about the reaction of sodium with hydrogen?

1 It reacts spontaneously according to the reaction Na *(s)* + ½ H_2 *(g)* → NaH *(s)*

2 It reacts only with heating: Na *(s)* + ½ H_2 *(g)* → NaH *(s)*

3 The product formed dissolves silently in water.
4 The product formed effervesces in water.
5 The product reacts with water: $NaH\ (s) + H_2O\ (l) \rightarrow H_2\ (g) + Na^+\ (aq) + OH^-\ (aq)$

3. Reaction of hydrogen with chlorine

76. Which is ***TRUE*** about the reaction of chlorine with hydrogen when a spark is introduced?
1 The equation is $H_2\ (g) + Cl_2\ (g) \rightarrow 2HCl\ (g)$ + energy
2 The product is an ionic compound.
3 The product dissolves in water to give a base.
4 The product is a molecular compound.
5 The product dissolves in water to give an acid.
6 The equation is $H_2\ (g) + ½\ Cl_2\ (g) \rightarrow HCl\ (g)$
7 The product dissolves in water to give an ionic solution.

Section №: 7 The Third-Row Elements
Concept №:

1. Properties of the 3rd row: Z, A, MP, type of solid

77. Which is ***TRUE*** about the third row elements?
1 They have consecutive atomic numbers, increasing from left to right.
2 They have decreasing mass numbers from left to right.
3 The elements to the left are metallic solids.
4 The elements to the left are molecular solids.
5 Silicon is the only network solid in the period.
6 The melting and boiling points increase then decrease as we go from left to right.

2. Hydrides of the third row: formulae and type of bonding

78. List the chemical formula of hydrides with the third row elements.

_____

_____

79. Which is ***TRUE*** about hydrides of the third row elements?
[-A-] Sodium hydride is a molecular compound. [$_{11}$Na, $_{1}$H]
[-B-] The chemical formula of Magnesium hydride is MgH_2. [$_{12}$Mg, $_{1}$H]
[-C-] Sulfur reacts with hydrogen to produce H_4S. [$_{16}$S, $_{1}$H]
[-D-] Three hydrogen atoms react with one chlorine atom to form H_3Cl compound. [$_{1}$H, $_{17}$Cl]

3. Elements of the third row that can make either ionic or covalent bonds

80. Which is ***TRUE*** about these elements of the third row?
[-A-] Sodium ($_{11}$Na) can react by sharing an electron (e.g. with chlorine).
[-B-] A chlorine atom ($_{17}$Cl) reacts either by forming two ionic bonds or by forming three covalent bonds.
[-C-] Magnesium ($_{12}$Mg) reacts by losing two electrons per atom, thus making two ionic bonds (e.g. $MgCl_2$).
[-D-] Sulphur ($_{16}$S) can react by losing two electrons.

4. The chlorides of the third row: formulae and type of bonding

81. Which is ***TRUE*** about chlorides of the third row elements?

[-A-] Aluminum reacts with chlorine to form a covalent bond. [$_{13}$Al, $_{17}$Cl]

[-B-] Silicon chloride has a formula $SiCl_4$, and it is an ionic compound. [$_{14}$Si, $_{17}$Cl]

[-C-] Magnesium chloride ($MgCl_2$) is a covalent compound. [$_{12}$Mg, $_{17}$Cl]

[-D-] Sodium chloride is an ionic solid. [$_{11}$Na, $_{17}$Cl]

5. The oxides of the third row: formulae and type of bonding

82. What is the formula of the oxide of aluminum?_____

6. How and why elements of Period 3 form bonds

83. The following conclusions are drawn for the formation of bonds by elements of Period 3. Which of the following is ***TRUE*****?**

1. Elements of group 5 react by losing three electrons.

2. Elements of group 7 react by gaining a single electron or by sharing one pair of electron to form one covalent bond.

3. Elements of group 6 react by losing two electrons.

Section №: 8 The Periodic Table: Chemical Reactivity

Concept №:

1. How the periodic table helps us predict chemical activity

84. In the periodic table,

[-A-] elements grouped in a vertical column have similar chemical properties

[-B-] general statements can be made about the chemistry of elements in one group

[-C-] the formulas of compounds and the nature of bonds that hold the atoms together can be predicted from the position of these atoms in the periodic table

[-D-] elements in one horizontal row react to obtain an electron arrangement similar to the noble gas at the end of the row

[-E-] elements towards the lower left corner tend to be metal

Chapter 3: Energy Effects in Chemical Reactions

In all multiple choice questions, more than answer could be correct

Section №: 1 Heat and Chemical Reactions
Concept №:

2. Knowthatthesymbol H refers to the 'heat content' of a substance

01. The symbol H refers to the:
[-A-] heat content of a substance
[-B-] sum of heat contents of reactants and products
[-C-] sum of the heat contents of reactants
[-D-] sum of the heat contents of products
[-E-] difference of the heat contents of reactants and products

3. Knowthatthesymbol (delta)H refers to the 'increase' in heat content

02. For any reaction, $\Delta H =$ _____

4. Write an expression for (delta)H for a given reaction

03. Suppose heat of contents per mole of A, B, C & D are respectively the following: H_A, H_B, H_C & H_D.

$$A\ (g) + B\ (g) \rightarrow C\ (g) + D\ (g) \qquad \Delta H = -233\ KJ$$

What is ΔH in terms of H_A, H_B, H_C & H_D?

_____

_____

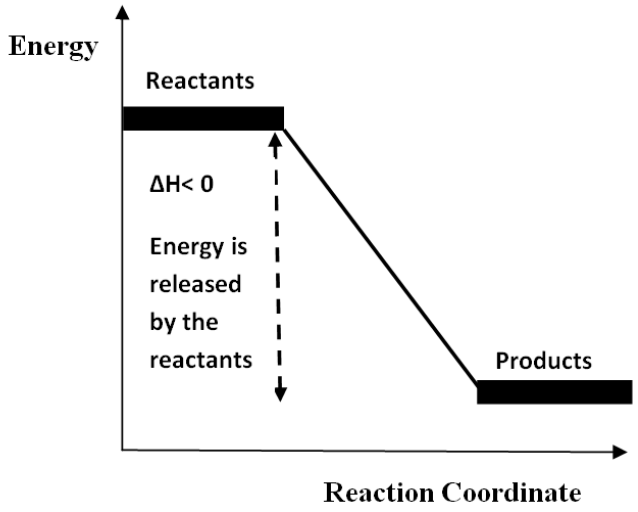
5. Recognize endothermic reaction written in (delta)H notation or otherwise

04. Which of the following reactions is ***NOT*** an endothermic reaction?
[-A-] $NH_3(g) \rightarrow \frac{1}{2}N_2(g) + 3/2H_2(g)$ $\Delta H = +46.0$ KJ
[-B-] $\frac{1}{2}\ N_2\ (g) + O_2\ (g) \rightarrow NO\ (g)$ $\Delta H = +90.4$ KJ
[-C-] $H_2\ (g) + \frac{1}{2}\ O_2\ (g) \rightarrow H_2O\ (g)$ $\Delta H = -242$ KJ

05. Identify the endothermic reactions in the following:
[-A-] $CH_4(s) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$ $\Delta H = -890$ kJ
[-B-] $4NH_3(g + 5O_2(g) \rightarrow 4NO(g + 6H_2O(l)$ $\Delta H = -1169$ kJ
[-B-] $\frac{1}{2}\ N_2\ (g) + O_2\ (g) \rightarrow NO\ (g)$ $\Delta H = +90.4$ KJ

06. If ΔH of a reaction is negative, then the reaction is _____ and the products have _____ potential energy than the reactants.

07. Is the following energy diagram showing an exothermic or endothermic reaction?



6. <u>KnowthestatementofHess'sLaw</u>

08. Hess's law states that: The heat involved in a chemical reaction whether absorbed or released _____ (depends/ is independent) of the path followed and _____ (depends/ is independent) only on the initial reactants and final products.

7. <u>Know the statement of bond energy.</u>

09. Define the term bond energy.

_____

10. <u>Determination of the heat of reaction</u>

10. The heat change ΔH of the following overall reaction is:

$H_2O\ (g) + C\ (s) \rightarrow CO\ (g) + H_2\ (g)$ $\Delta H_1 = +131$ KJ

$CO\ (g) + ½\ O_2\ (g) \rightarrow CO_2\ (g)$ $\Delta H_2 = -282$ KJ

$H_2\ (g) + ½\ O_2\ (g) \rightarrow H_2O\ (g)$ $\Delta H_3 = -242$ KJ

Overall Reaction:

$C\ (s) + O_2\ (g) \rightarrow CO_2\ (g)$ ΔH= ??

11. Using bond enthalpies, calculate the heat of reaction, ΔH, for:

$½\ H_2\ (g) + ½\ Cl_2\ (g) \rightarrow HCl\ (g)$

Given bond enthalpies: H-H: 436 KJ; H-Cl: 433 KJ; Cl-Cl: 243 KJ

_____

_____

_____

_____

12. Using bond enthalpies, calculate the heat of reaction, ΔH, for:

$$C_2H_4\ (g) + H_2\ (g) \rightarrow C_2H_6\ (g)$$

Given bond enthalpies: H-H: 436 KJ; C-C: 348 KJ; C═C: 614KJ; C-H: 413KJ

11. Knowthemeaningoftheterm'calorimetry'

13. What is calorimetry? It is:

[-A-] measuring reaction heats by observing changes in color
[-B-] using a calorie meter to measure calories
[-C-] determining the rate of reaction by measuring how quickly the temperature rises
[-D-] the measurement of reaction heats
[-E-] the measurement of heat content of a compound

12. Know that a calorimeter is used to determine (delta)H at constant V

14. Calorimeter is used to _____.

13. Solving problems in calorimetry Q =mcΔTandΔH=Q/n.

15. To change the temperature of a calorimeter and the water it contains by 1^oC requires 10KJ. Find the heat of combustion per mole C_2H_6 if 10g of C_2H_6 *(g)* causes a temperature rise of 5.6^oC in the calorimeter. [C=12; H=1]

16. To change the temperature of a calorimeter and the water it contains by 1^oC requires 7 KJ. Find the heat of combustion per mole C_4H_{10} if 11.6g of C_4H_{10} *(g)* causes a temperature rise of 7.3^oC in the calorimeter. [C=12; H=1]

14. Recognize different formats of expressing heat of reaction

17. How can you rewrite the following equation expressing ΔH as per mole Fe *(s)*?

3C *(s)* + $2Fe_2O_3$ *(s)* + 462 KJ → 4Fe *(s)* + $3CO_2$ *(g)*

_____

15. Recognizing the reverse of an equation

18. What is the reverse of the following equation?

N_2*(g)* + $2O_2$*(g)* + 68KJ → $2NO_2$*(g)*

_____

19. When the reverse of an equation is written, the energy involved is _____. The reverse of an exothermic reaction is _____.

16. Given the heats of formation calculate the heat of reaction

20. Calculate the heat of change of each of the following reactions by using the table below:

Substance	Heat Content (KJ)
H_2O (l)	-286
CaO (s)	-1000
$CaCO_3$ (s)	-1440
CO (g)	-110
SO_3 (g)	-396

Substance	Heat Content (KJ)
CO_2 (g)	-393
C_6H_6 (l)	49
NO_2 (g)	34
N_2O_4 (g)	-43
SO_2 (g)	-297

$CaCO_3$ *(s)* → CO_2 *(g)* + CaO *(s)*

ΔH = _____

SO_2 *(g)* + ½ O_2 *(g)* → SO_3 *(g)*

ΔH = _____

$2NO_2$ *(g)* → N_2O_4 *(g)*

ΔH = _____

C_6H_6 *(l)* + 15/2 O_2 *(g)* → $6CO_2$ *(g)* + $3H_2O$ *(l)*

ΔH = _____

C_6H_6 *(l)* + 9/2 O_2 (g) → 6CO *(g)* + $3H_2O$ *(l)*

ΔH = _____

Section №: 3 The Energy Stored in a Nucleus

Concept №:

1. A positron has the same mass as an electron but has a charge of 1+

21. What is a positron?

[-A-] It is a particle that forms a neutral atom with one β particle.
[-B-] It is as massive as an electron but with a positive charge.
[-C-] It is the nucleus of a hydrogen atom.
[-D-] It is the nucleus of helium atom.
[-E-] It has a mass of 2 and a charge of +4.

2. Know that an alpha particle is the nucleus of a helium atom

22. What is an α-particle?

[-A-] It is a particle that forms a neutral atom with one β particle.
[-B-] It is an electron with a positive charge.
[-C-] t is the nucleus of a hydrogen atom.
[-D-] It is the nucleus of a helium atom.
[-E-] It has a mass of 2 and a charge of 4+.

3. Relative magnitude of heat involved in chemical and nuclear changes

23. Which of the following is ***CORRECT*** about the relative magnitude of the heat involved in nuclear and chemical changes?

[-A-] Nuclear changes usually involve energies of tens of KJ/mole.
[-B-] Chemical reactions usually involve energies of tens of KJ/mole.
[-C-] Chemical reactions usually involve energies of about a 1000 KJ/mole.
[-D-] Chemical reactions usually involve energies of several million KJ/ mole.
[-E-] Nuclear reactions usually involve energies of tens of millions of KJ/mole.

4. Find the missing particles(s) in a nuclear reaction

24. How can you balance the following reaction?

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{141}_{56}Ba + ^{92}_{36}Kr + \text{energy}$$

[-A-] three neutrons are added to the left hand side.
[-B-] three protons should be added to the right hand side.
[-C-] three protons should be added to the right hand side.
[-D-] four hydrogen atoms should be added to the right hand side.
[-E-] three neutrons should be added to the right hand side.

5. Recognize nuclear fission reaction

25. Which of the following is a nuclear fission reaction?

[-A-] ${}^{2}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}He + {}^{1}_{0}n.$

[-B-] $UF_6(l) \rightarrow UF_6(g).$

[-C-] $C(s) + O_2(g) \rightarrow CO_2(g).$

[-D-] ${}_{94}Pu + {}_{0}n \rightarrow {}_{39}Y + {}_{55}Cs + 3$

239 1

6. Recognize nuclear fusion reaction

26. Which of the following is a nuclear fusion reaction?

[-A-] ${}^{2}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}He + {}^{1}_{0}n.$

[-B-] $UF_6(l) \rightarrow UF_6(g).$

[-C-] $C(s) + O_2(g) \rightarrow CO_2(g).$

[-D-] ${}^{239}_{94}Pu + {}^{1}_{0}n \rightarrow {}^{91}_{39}Y + {}^{146}_{55}Cs + 3$

7. Charge and number of nucleons are conserved in nuclear reactions

27. Which of the following is conserved in nuclear reactions?

[-A-] Charge

[-B-] Atoms

[-C-] Number of nucleons

9. Mass lost in nuclear reactions changes to energy according to $E = mc^2$

28. In nuclear reactions, the mass will be lost and transformed into energy according to

.

10. Know what nuclear reaction is, and that it changes mass to energy

29. In nuclear fusion reactions:

[-A-] a large nucleus splits into smaller nuclei.

[-B-] two nuclei come together to form a larger nucleus.

[-C-] is exemplified by ${}_{1}H + {}_{1}H \rightarrow {}_{2}He + {}_{0}n$ + energy

[-D-] is exemplified by ${}^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{141}_{56}Ba + {}^{92}_{36}Kr + 3\ {}^{1}_{0}n$ + energy

[-E-] the mass lost is related to energy

91 146

Chapter 4: The Rates of Chemical Reactions

In all multiple choice questions, more than answer could be correct

Section №: 2 Reaction Rates
Concept №:

1. The study of reaction rates is called chemical kinetics

01. The study of reaction rates is called _____ _____.

2. Rate is measured by consumption of reactant or production of product

02. What are the changes that can you measure during a chemical reaction?

_____

03. Consider the following reaction: **A → B**

Time (min)	[A] $mol.L^{-1}$	[B] $mol.L^{-1}$
0	1.00	0.00
4	0.30	0.70
8	0.15	0.85

What is the average rate of production of B?

_____

_____

04. Consider the following reaction: $2H_2 + O_2 \rightarrow 2H_2O$. What is the average rate of production of H_2O if the average rate of consumption of O_2 is 0.8 $mol.L^{-1}.min^{-1}$?

_____

_____

Section №: 3 Factors Affecting Reaction Rates
Concept №:

1. How reaction rate is affected by nature of reactants

05. Reactions involving bond rearrangements are _____ (slow/ rapid).

06. Reactions that do not involve bond rearrangements are _____ (slow/ rapid).

07. List the factors that affect the rate of a reaction?

_____

08. Which reaction tends to be slow at room temperature?
[-A-] Cr^{+2} *(aq)* + Fe^{+3} *(aq)* → Cr^{+3} *(aq)* + Fe^{+2} *(aq)*
[-B-] C_8H_8 *(l)* + 25/2 O_2 *(g)* → $8CO_2$ *(g)* + $9H_2O$ *(l)*
[-C-] Fe^{+2} *(aq)* + Ce^{+4} *(aq)* → Fe^{+3} *(aq)* + Ce^{+3} *(aq)*

2. Collision theory: Why reaction rate is affected by concentration of reactants

09. According to the collision theory, if the concentration of one of the reactants is increased, the rate of the reaction _____ (increases/ decreases) by increasing the number of collisions.

3. Homogenous system: How concentration can be changed in gaseous mixture

10. Consider a gas jar flask which has CO and NO_2 gases reacting to form CO_2 and NO.
CO (g) + NO_2 (g) → CO_2 (g) + NO (g)
How can you increase the rate of the above reaction?
[-A-] Injecting more CO in the gas jar flask
[-B-] Injecting more NO_2 in the gas jar flask
[-C-] Decreasing the volume of the gas jar flask at the beginning of the experiment
[-D-] Decreasing the concentration of products
[-E-] Injecting more CO_2 in the gas jar flask
[-F-] Removing NO from the gas jar flask

4. Heterogeneous system: increasing rate in gas-solid reaction

11. How can you increase the rate of burning a block of wood when it burns with oxygen in the air at a certain fixed high temperature?

_____

9. Know what is meant by a reaction mechanism

12. Reaction mechanism is _____

_____

13. Consider the following reaction mechanism:

Step 1: $HBr + O_2 \rightarrow HOOBr$

Step 2: $HOOBr + HBr \rightarrow 2HOBr$

Step 3: $2HOBr + 2HBr \rightarrow 2H_2O + 2Br_2$

_____

Overall reaction:

Write the overall reaction and identify the reaction intermediate. _____

10. A rxn involving many molecules proceeds in steps the slowest of which is the rate determining step

14. The ***slowest*** step in a multi-step reaction is called the _____.

15. If 3 molecules of A (g) react with 5 molecules of B (g), then this reaction proceeds in _____ (one/ several) step(s), and the _____ (slowest/ fastest) step is the rate determining step.

11. <u>Factors affecting rate of a single-step reaction between A (g) and B (g) at constant temperature</u>

16. Consider the reaction $H_2(g) + I_2(g) \rightarrow 2HI(g)$. Which is true about the rate R of this reaction at constant temperature?

[-A-] It is proportional to the concentration [$H_2(g)$] of hydrogen gas

[-B-] It is proportional to the concentration [$I_2(g)$] of iodine gas

[-C-] If you double the concentration [$I_2(g)$] of iodine gas and double the concentration [H2(g)] the rate of the reaction doubles

[-D-] Rate of reaction = $k[I_2] \times [H_2]$

[-E-] Rate of reaction α $[I_2] \times [H_2]$

12. <u>Know that molecules react only if their combined KE greater or equal to threshold energy</u>

17. In order for molecules A to react with molecules B, they should react in the proper orientation with a minimum energy called, _____ _____.

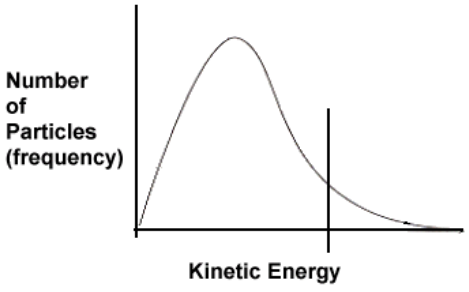
13. <u>The shape of the graph of number of molecules vs. their kinetic energy</u>

18. If we plot the ***number of molecules*** in a gas sample possessing a particular kinetic energy and the ***kinetic energy*** of molecules, the graph will be _____

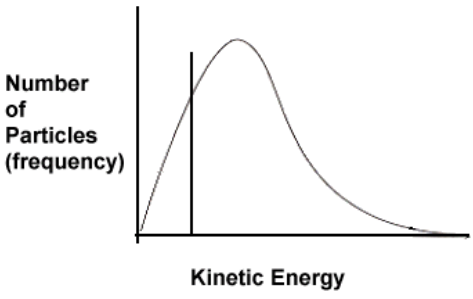
_____

19. Which reaction may have a faster rate at a suitable temperature, A or B? [Given that the vertical line inside the curve represents the threshold energy]

A



B



14. <u>The effect of heating on the graph of number of molecules vs. their kinetic energy</u>

20. If we plot the ***number of molecules*** in a gas sample possessing a particular kinetic energy and the ***kinetic energy*** of molecules, first at a temperature $\mathbf{T_1}$, then at $\mathbf{T_2}$ ($T_2 > T_1$) the graph will shift to the _____ indicating that the number of particles having the threshold energy is _____.

Section №: 4 The Role of Energy in Reaction Rates
Concept №:

1. Know that when two molecules react they first form an activated complex

21. In order for any 2 molecules to react, they must combine with each other forming unstable molecule called the _____.

3. Activated complex is unstable and breaks up into reactants or products

22. What is the activated complex?

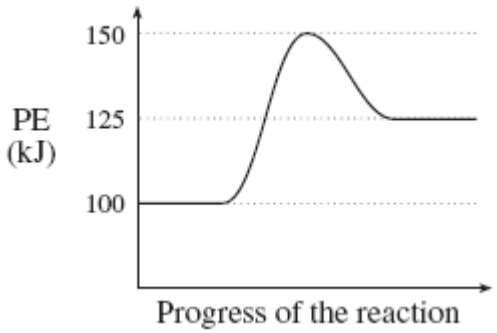
_____

23. Which is ***TRUE*** about the activated complex?
[-A-] It is a stable molecule with a low amount of potential energy.
[-B-] It is at the highest point of the potential energy curve.
[-C-] It is an unstable molecule that must break up into the product molecules only.
[-D-] It is an unstable molecule that must break up into the reactant molecules only.
[-E-] It is an unstable molecule that must break up into either reactant or product molecules.

4. PE of the activated complex = PE of reactants + activation energy

24. PE of the activated complex = _____

25. Consider the following Potential Energy diagram:



Find ΔH and activation energy.

_____

_____

5. The activation energy is the energy necessary to transform the reactants into the activated complex

26. What is the activation energy?

_____

27. Reaction with a lower Ea than other reaction proceeds _____ (faster/ slower).

7. A catalyst speeds up a reaction but it is regenerated at the end of the reaction

28. A catalyst _____ up a reaction but it's _____ at the end of the experiment.

8. A catalyst provides a new path of lower activation energy

29. A catalyst speeds up the reaction by forming a new activated complex having a _____ (lower/ higher) activation energy than that of uncatalyzed reaction.

9. A catalyst lowers the activation energy of both forward and reverse reactions

30. A catalyst speeds up _____ by lowering the activation energy.

[-A-] forward reaction only
[-B-] both forward and backward reactions
[-C-] backward reaction only
[-D-] neither forward nor backward reactions

10. Recognize the catalyst in a given reaction

31. What is the catalyst in the below steps of reactions?

Step 1: $Cl + CO \rightarrow COCl$
Step 2: $COCl + Cl_2 \rightarrow COCl_2 + Cl$