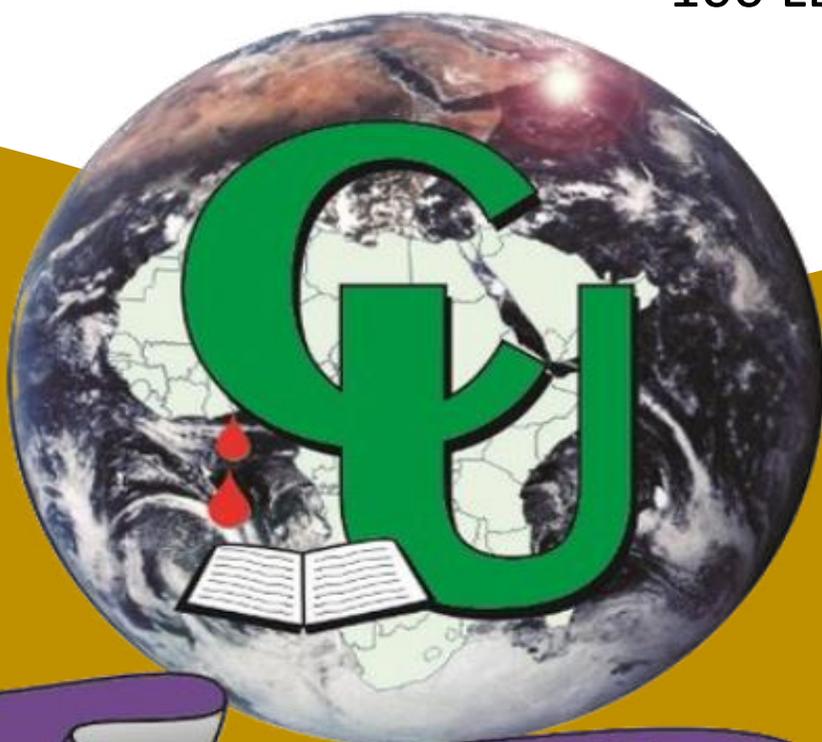# COVENANT UNIVERSITY

ALPHA SEMESTER TUTORIAL KIT
(VOL. 2)

PROGRAMME:CHEMISTRY
100 LEVEL

Raising A New Generation Of Leaders

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LIST OF COURSES

CHM111: General Physical Chemistry
CHM112: Chemistry and Society

*Not included

COVENANT UNIVERSITY

CANAANLAND, KM 10, IDIROKO ROAD
P.M.B 1023, OTA, OGUN STATE, NIGERIA.

TITLE OF EXAMINATION: B.Sc EXAMINATION
COLLEGE: Science and Technology
SCHOOL: Natural and Applied Sciences
DEPARTMENT: Chemistry
SESSION: 2015/2016   **SEMESTER:** ALPHA
COURSE CODE: CHM 111   **CREDIT UNIT:** 3
COURSE TITLE: General Physical Chemistry   **TIME:** 2 HOURS
INSTRUCTION: Attempt all questions
Useful constants: Gas constant, R = 8.314 $JK^{-1}mol^{-1}$ = 8.314 m^3 Pa K^{-1} mol^{-1}; 1 m^3 = 1000 L;
 1 atmosphere = 760 mm Hg = 760 torr = 101,325 Pa; Avogadro's number= 6.022×10^{23}

Section A: Chemical Thermodynamics/Equilibrium

1. The study of the flow of heat or any other form of energy into or out of a system undergoing physical or chemical change is called
   (a) Thermochemistry (b) thermokinetics (c) thermodynamics (d) thermochemical studies
2. A system that can transfer both energy and matter to and from its surroundings is called
   (a) isolated system (b) open system (c) closed system (d) adiabatic system
3. The first law of thermodynamics is
   (a) the total energy of an isolated system remains constant though it may change from one form to another
   (b) total energy of a system and surroundings remains constant
   (c) whenever energy of one type disappears, equivalent amount of another type is produced
   (d) all of the above
4. Two moles of an ideal gas expanded isothermally and reversibly at 300 K to twice the original volume. Calculate the work done.
   (a) -1013.25 J (b) -3457.97 J (c) -3.988 J (d) 3457.97 J
5. 1g of water at 373K is converted into steam at the same temperature. The volume of water becomes 1671ml on boiling. Calculate the change in internal energy of the system if the heat of vaporization is 2259.36 J/g.
   (a) -1013.25 J (b) -3457.97 J (c) 2087.08 J (d) 3457.97 J
6. If the value of Q_c is equals to the value of K_c at a given temperature
   (a) rate reverse > rate forward until equilibrium is achieved (b) the reaction is at equilibrium
   (c) rate forward > rate reverse until equilibrium is achieved (d) the reaction cannot achieve equilibrium
7. Which out of the following is not a state function?
   (a) work (b) enthalpy (c) internal energy   (d) entropy

8. One mole of an ideal gas at 25°C is allowed to expand reversibly at constant temperature from a volume of 10 litres to 20 litres. Calculate the work done by the gas.
   (a) -1013.25 J (b) -3457.97 J (c) 2087.08 J (d) -1717.46 J

9. For the reaction $N_2O_4 \rightleftharpoons 2NO_2$ calculate the value of the equilibrium constant if initially 2.00 mol of NO_2 and 2.00 mol of N_2O_4 are placed in a 1L vessel and at equilibrium 1.75 mol of N_2O_4 is left in the vessel.
   (a) 3.6 (b) 3 (c) 2 (d) 4

10. Consider a process in which 3.4 kJ of heat flows out of a system while 4.8kJ of work is done by the system on the surroundings. Calculate the internal energy of the system.
    (a) + 8.2 kJ   (b) - 8.2 kJ   (c) + 16.32 kJ   (d) - 16.32 kJ

11. What information does large value of K_c give about the position of equilibrium?
    (a) Large K_c: hardly any products are formed.
    (b) Large K_c: roughly equal concentrations of reactants and products.
    (c) Large K_c: reaction moves to completion (lots of product formed).
    (d) None of the above

12. Calculate the value of the equilibrium constant if at equilibrium, there are 0.02 mol of A, 0.04 mol of B, 0.08 mol of C, and 0.22 mol of D in 1litre of solution given $A + B \rightleftharpoons C + D$.
    (a) 14   (b) 11   (c) 22   (d) 12

13. Calculate the enthalpy change for the following reaction:
    $$CH_{4(g)} + O_{(g)} \longrightarrow CH_3OH$$
    (ΔH_f for $CH_{4(g)}$ = -74.4 kJ mol^{-1}; $O_{(g)}$ = 249 kJ mol^{-1} and $CH_3OH_{(g)}$ = – 201.5 kJ mol^{-1})
    (a) 276.1 kJ   (b) – 376.1 kJ   (c) 524.9 kJ   (d) + 376.1 kJ

14. A system absorbs 100 kJ heat and performs 50 kJ work on the surroundings. The increase in internal energy of the system is
    (a) 50kJ   (b) 100kJ   (c) 150kJ   (d) 5000kJ

15. Which out of the following is incorrect?
    (a) heat flow into the system is positive   (b) work done on the system is negative
    (c) heat flow out of the system is negative   (d) none of these

16. Which out of the following is not an intensive property?
    (a) pressure   (b) concentration   (c) density   (d) volume

17. How will a decrease in volume affect the equilibrium position of the reaction: $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$
    (a) The equilibrium will shift to the right to maintain K_c. (b) The equilibrium will not shift.
    (c) The equilibrium will shift to the left to maintain K_c.   (d) None of the above.

18. How will addition of hydrogen gas affect the following equilibrium system? $3H_2 + N_2 \rightleftharpoons 2NH_3$
    (a) The equilibrium will shift to the right to maintain K_c. (b) The equilibrium will not shift.
    (c) The equilibrium will shift to the left to maintain K_c.   (d) None of the above.

19. How will increase in temperature affect the following equilibrium system? $3H_2 + N_2 \rightleftharpoons 2NH_3 + Heat$
    (a) The equilibrium will shift to the right to maintain K_c. (b) The equilibrium will not shift.
    (c) The equilibrium will shift to the left to maintain K_c.   (d) None of the above.

20. For an adiabatic process, according to first law of thermodynamics,
    (a) $\Delta E = - w$ (b) $\Delta E = q - w$ (c) $\Delta E = q$ (d) $\Delta E = \Delta U + w$

21. The mathematical relation for the first law of thermodynamics is

(a) $\Delta E = q - w$ (b) $\Delta E = 0$ for a cyclic process (c) $\Delta E = q$ for an isochoric process (d) all of these

22. For a reaction to occur spontaneously
    (a) $(\Delta H - T\Delta S)$ must be negative   (b) $(\Delta H + T\Delta S)$ must be positive
    (c) ΔH must be negative   (d) ΔS must be negative

23. For the reaction below, calculate ΔH
    $C_6H_{6(l)} + 71/2O_{2(g)} \leftrightarrow 6CO_{2(g)} + 3H_2O_{(l)}$ (ΔE = -14.2 J/mole at 25°C)
    (a) 3702 J/mol   (b) -3400 J/mol   (c) 3400 J/mol   (d) 5000 J/mol
24. Consider a process in which 4.9 J of heat flows into a system while 2.4 J of work is done by the system on the surroundings. Calculate the internal energy of the system.
    (a) + 10.3 J (b) – 10.3 kJ (c) + 7.3 J   (d) – 8.4 J
25. Calculate ΔE for the reaction: $H_2F_{2(g)} \rightarrow H_{2(g)} + F_{2\,(g)}$ (ΔE = -14.2 J/mol at 25°C)
    (a) 10.20 kJ/mol (b) 12 kJ/mol (c) 20 kJ/mol   (d) 2.46 kJ/mol

Section B: Atomic structure, the periodic table, Stoichiometry, Radioactivity

26. The neutron of an atom was discovered by (a) J.J. Thompson (b) Rutherford (c) Dalton (d) Chadwick
27. Chemical properties of an element are determine primarily by the
    (a) protons and electrons in its atom (b) the neutrons (c) the positrons (d) the size of the atom.
28. Chemical properties of an element are determined primarily by the
    (a) protons and electrons in its atom (b) the neutrons (c) the positrons (d) the size of the atom.
29. Isotopes of same element have
    (a) different chemical properties   (b) similar chemical properties
    (c) similar physical properties (d) all of the above.
30. How many atoms would there be in 0.5 mol of sodium Na
    (a) 30.110×10^{23} (b) 3.011×10^{23} (c) 12.044×10^{23} (d) 1.204×10^{23}.
31. In the shield effect of electron of an atom, the
    (a) outermost electron cloud shield the inner electrons from the positive nucleus
    (b) all the electrons shield themselves from the positive nucleus
    (c) the inner core of the cloud of electrons shield the valence electrons from the effect of
        the positive nucleus.
    (d) all the electrons are exposed to the positive nucleus.
32. Which of the following particles would not be defected in a magnetic field?
    (a) Gamma (b) Position (c) Alpha (d) Electrons.
33. The main radioactive radiations in order of increasing penetration power is ---
     (a) γ, β and α –rays (b) α , β and γ-rays (c) β, α and γ-rays (d) γ, α and β rays.
34. What is the number of protons, neutrons, and electrons in $^{17}_{8}O$

    (a) 80 proton, 120 neutrons, 80 electrons   (b) 80 protons, 119 neutrons, 80 electrons
    (c) 8 proton, 9 neutrons, 9 electrons   (d) 8 protons, 9 neutrons, 8 electrons.
35. CCl_4 is likely to be (a) Ionic (b) covalent (c) dative covalent (d) covalent and polar.
36. The reactant used up first in a chemical reaction is the
    (a) excess reagent (b) essential reagent (c) important reagent (d) limiting reagent.

37. Percentage % yield is
    (a) actual yeild× theoretical yeild×100% (b) actual yield+ theoretical yeild×100%
    (c) theoretical yield/ actual yeild×100%   (d) actual yield /theoretical yeild×100%.
38. A radioactive isotope has a decay constant of 1.22×10^{-4} yrs^{-1}. What is its half life?
    (a) 6.2×10^{4} yrs (b) 2.8×10^{3} yrs (c) 5.7×10^{3} yrs (d) 3.6×10^{4} yrs
39. In the equation: $^{238}_{92}U + {}^{1}_{0}n \rightarrow {}^{239}_{94}Pu + 2A$, A represents
    (a) An electron (b) A position (c) A neutron (d) A proton
40. Give an example of a case in which two molecules have same empirical formula but
    different molecular formula
    (a) benzene and ethane (b) ethylene and ethane (c) benzene and ethylene (d) acetylene and
    benzene.
41. The periodic table has
    (a) s and p block elements (b) d block elements only (c) s,p,d and f block elements (d) all
    of these
42. NH_4^+ is likely to be (a) Ionic (b) covalent (c) dative covalent (d) covalent and polar.
43. Which set of the chemical name and chemical formula for the compound is correct?
    (a) Iron (III) phosphate, $FePO_4$ (b) Ammonium sulfite, $(NH_4)_2S$
    (c) Lithium carbonate, $LiCO_3$ (d) Magnesium dichromate, $MgCrO_4$
44. What is the bond order in the following compounds N_2 ,O_2 , H_2
    (a) 3, 2, 2 respectively (b) 2, 3, 2 respectively (c) 2, 2, 3 respectively (d) 2, 2, 2 respectively
45. Give the ratio of atoms in the molecular formula, N_2O_4 (a) 1:3 (b) 1:2 (c) 4:6 (d) 2:4
    Use the equation below to answer questions 46-47.
    $$2H_2 + O_2 \rightarrow 2H_2O$$
46. How many moles of water can be produced from 2.58 moles of O_2 and excess H_2.
    (a) 5.76 mol H_2O (b) 5.16 mol H_2O (c) 5.66 mol H_2O (d) 5.96 mol H_2O
47. How many moles of water can be produced from 2.58 moles of H_2 and excess O_2?
    (a) 2.58 mol H_2O (b) 2.88 mol H_2O (c) 2.78 mol H_2O (d) 2.98 mol H_2O
48. What element is in Period 2, Group 7? (a) Helium (b) Radon (c) Neon (d) Florine
49. J.J. Thompson determined
    (a) the area of an electron   (b) the area of a proton
    (c) the electric charge to mass ratio of an electron   (d) the electric charge to mass ratio of
    a proton.
50. A stoichiometric amount is the proportion
    (a) indicated in the formula of a compound   (b) indicated by the balanced equation
    (c) indicated by in equality of equation   (d) the calculated amount.

Section B: States of matter & Kinetics

51. A mixture of liquids with sufficiently different boiling points can often be separated into its
    components by ---------------.
    (a) Distillation (b) Evaporation   (c) Decantation   (d) Sublimation
52. What is the vapour pressure of water at 35.0 $°C$ and the vapour pressure changes to 55.3
    mmHg at 40.0 $°C$? The ΔH_{vap} of water is 44.0 kJ mol^{-1}
    (a) 41.9 mmHg   (b) 14.9 mmHg   (c) 19.4 mmHg   (d) 49.1 mmHg

53. The standard enthalpy of vapourization of H_2O, ΔH_{vap} = 40.7 kJmol^{-1} at 373 K. Assuming this value remains constant at temperatures close to 373 K, use the Clausius- Clapeyron equation to estimate the vapour pressure of liquid at 80 °C.
   (a) 48.2 kPa   (b) 2.48 kPa   (c) 22.3 kPa   (d) 42.8 kPa

54. The reaction: A + B → products, is found to be second order in [A] and first order in [B]. The rate equation would be -----------------
   (a) R = k [A][B]   (b) R= k[A]^2[B]   c) R= k[A][B]^2 d) R=k[B]

55. Which of the following would not increase the rate of reaction?
   (a) raising the temperature or adding a catalyst   (b) increasing the concentration of the reactants
   (c) increasing the surface area of a solid reactant (d) increasing the volume of the container for a gaseous reaction

56. Consider the rate law: rate = k[Y]^m[z]^n. How best can the exponents m and n be determined?
   (a) By using the balanced chemical equation (b) By using the subscripts of the chemical formulas
   (c) By using the coefficients of the chemical formulas (d) By experiment

57. The catalyzed reaction has a ------------activation energy and thus causes -------reaction rate.
   (a) higher, lower   b) higher, higher   (c) lower, higher   d) lower, steady

58. The half life for a first order reaction is 2768 years. If the concentration after 11,072 years is 0.0216 M, What was the initial concentration?
   (a) 0.345 M   (b) 3.045 M   (c) 1.063 M   (d) – 1.063 M

59. The different types of solids are ------------------------ and ------------------------
   (a) amorphous and crystalline   (b) amorphous and body centered cubic
   (c) body centered cubic and face cubic center   (d) Molecular and Metallic solids

60. A substance at a temperature above its critical temperature is called a -------------------.
   (a) supercritical fluid   (b) fluid   (c) Supercritical liquid (d) supercritical solids

Use the phase diagram below to answer questions 61 - 65.
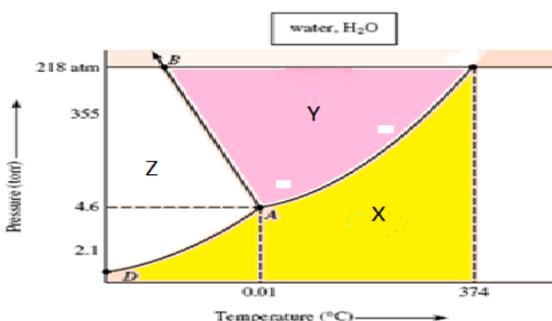
61. The area marked X is in the --.
   (a) Gaseous phase (b) Liquid Phase (c) Solid phase (d) Sublimation phase

62. The area marked Y is in the --
   (a) Liquid phase (b) Gaseous phase (c) Solid phase (d) Condensation phase

63. The movement from the yellow phase to the pink phase is called --------------------------

(a) Condensation (b) Evaporation (c) Sublimation (d) Melting

64. The point depicted as A is called the --------------------------------
    (a) Critical point (b) Triple point (c) Melting point (d) Boiling point

65. The line AB is called the ----------------------------
    (a) triple curve (b) boiling curve (c) critical curve (d) melting curve

66. Which of the following is not correct?
    i. Solids have definite shapes and volumes   ii. Solids are not very compressible
    iii. Solids diffuses very slowly   iv. Solids have indefinite shape
    (a) 1   (b) 2   c) 3   (d) 4

67. The equation $P \alpha \frac{1}{V}$ is a mathematical relationship that describes -------------------------
    (a) Charles's Law (b) Boyles's Law (c) Archimedes Principle (d) Avogadro's Law

68. The units of the rate of a chemical reaction are
    (a) $mol\ s^{-1}$ (b) $mol\ dm^{-3}s^{-1}$ (c) $mol^{-1}dm^{3}\ s^{-1}$ (d) $mol^{-1}dm^{-3}s^{-1}$.

69. Examples of amorphous solids include the following except
    (a) rubber   (b) amorphous sulphur   (c) all types of glasses   (d) all kinds of plastics.

70. The following are covalent solids except (a) NaCl (b) graphite (c) quartz (d) diamond.

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TITLE OF EXAMINATION: B.Sc. Degree Examination

COLLEGE: Science & Technology   **DEPARTMENT:** Chemistry

SESSION: 2015/2016   **SEMESTER:** Alpha

COURSE CODE: CHM 111   **COURSE TITLE:** General Physical
Chemistry

Answers

1. C	26. D	51. A
2. B	27. A	52. A
3. D	28. A	53. A
4. B	29. B	54. B
5. C	30. B	55. D
6. B	31. C	56. D
7. A	32. A	57. C
8. D	33. A	57. A
9. A	34. D	59. A
10. B	35. B	60. A
11. C	36. D	61. A
12. C	37. D	62. A
13. B	38. C	63. A
14. A	39. A	64. B
15. C	40. D	65. D
16. D	41. C	66. D
17. A	42. C	67. B
18. A	43. A	68. B
19. C	44. A	69. D
20. A	45. B	70. A
21. D	46. B	
22. A	47. A	
23. A	48. D	
24. C	49. C	
25. D	50. B	

COURSE CODE: CHM 111

COURSE TITLE: GENERAL PHYSICAL CHEMISTRY

1. The brilliant red colour seen in fireworks are due to the emission of light with wavelengths around 635 nm when strontium salts such as $Sr(NO_3)_2$ and $SrCO_3$ are heated. Calculate the frequency of red light of the wavelength 6.50 X 10^2 nm.

2. Compare the wavelength for an electron (mass = 9.11 X 10^{-31} kg) travelling at a speed of 1.0 X 10^7 m/s with that for a ball (mass = 0.10 kg) travelling at 35 m/s.

3. Calculate the energy required to excite the hydrogen electron from level n = 1 to level n = 2. Also calculate the wavelength of light that must be absorbed by hydrogen atom in its ground state to reach this excited state.

4. Microwave radiation has a wavelength on the order of 1.0 cm. Calculate the frequency and the energy of an Avogadro's number of photons of this radiation.

5. Which of these atoms has the greatest number of neutrons in its nucleus?

   a) $^{55}_{26}Fe$ b) $^{52}_{26}Fe$ c) $^{57}_{27}Fe$ d) $^{56}_{28}Fe$

6. What is the maximum possible number of electrons in a 3d subshell?

7. What is the electronic configuration of an element with Z = 60? What is the name of the element?

8. Draw atomic orbital diagrams of each of the following elements

a. Na b. N c. Cl

9. A certain oxygen atom has the electron configuration $1s^1$ $2s^2$ $2p^4$. How many unpaired electrons are present? Is this an excited state of oxygen?   In going from this state to the ground state would energy be released or absorbed?

10. Give the possible set of values of the four quantum numbers for all the electrons in a boron atom if in a ground state.

Solution

1. Convert wavelength to frequency using the equation

$$\lambda v = c \ \text{ or } v = \frac{c}{\lambda}$$

Where c = 2.9979 X 10^8 m/s, and λ = 6.35 X 10^2 nm. Changing the wavelength to meters, we have

$$6.35 \ X \ 10^2 nm \ X \ \frac{1 \ m}{10^9 \ nm} = 6.35 \ X \ 10^{-7} \ m$$

and

$$v = \frac{c}{\lambda} = \frac{2.9979 \ X \ 10^8 m/s}{6.35 \ X \ 10^{-7} \ m} = 4.72 \ X \ 10^{14} \ s^{-1} = \mathbf{4.72 \ x \ 10^{14} \ Hz}$$

2. Equation $\lambda = \frac{h}{mv}, where$

   h = 6.626 X 10 $^{-34}$ J.s or 6.626 X 10 -34 kg.m^2/s

   since 1J = kg.m^2/s^2

   For the electron,

$$\lambda_e = \frac{6.626 \ X \ 10^{-34} \ \frac{kg.m.m}{s}}{(9.11 \ kg)\left(1.0 \ x \frac{10^7 m}{s}\right)} = \mathbf{7.27 \ x \ 10^{-11} m}$$

   For the ball

$$\lambda_b = \frac{6.626 \ X \ 10^{-34} \ \frac{kg.m.m}{s}}{(0.10 \ kg)\left(35 \ x \frac{10^7 m}{s}\right)} = \mathbf{1.9 \ x \ 10^{-34} m}$$

3. E$_1$ = $-$2.178 x 10^{-18} J $\left(\frac{1^2}{1^2}\right)$ = $\mathbf{-2.178 \ x \ 10^{-18} J}$

$E_2 = -2.178 \times 10^{-18} \text{ J} \left(\frac{1^2}{2^2}\right) = -5.445 \times 10^{-19} J$

$\Delta E = E_2 - E_1 = (-5.445 \times 10^{-19} J) - (-2.178 \times 10^{-18} J) = 1.633 \times 10^{-18}$

The positive value for ΔE indicates that the system has gained energy. The wavelength of light that must be adsorbed to produce this change is

$$\lambda = \frac{hc}{\Delta E} = \frac{(6.626 \times 10 - 34 J.s)(2.9979 \times 108 \frac{m}{s})}{1.663 \times 10^{-18} J}$$

$= \mathbf{1.216 \times 10^{-7}\, m}$

4. Convert the wavelength to frequency

$$\lambda v = c \ \ or \ v = \frac{c}{\lambda}$$

Where c = 2.9979 X 10^8 m/s, and λ = 1.0 cm. Changing the wavelength to meters, we have

$$0.1\ cm \ X\ \frac{1\ m}{100\ cm} = 0.01\ m$$

$v = \frac{c}{\lambda} = \frac{2.9979\ X\ 10^8 m/s}{0.01\ m} = 2.9979 \times 10^{10}\ \text{s}^{-1} = \mathbf{2.9979\ X\ 10^{10}\ Hz = 3.0\ X\ 10^{10}\ Hz}$

Energy of a single photon

$$\frac{(6.626\ X\ 10^{-34}\ J.s)(2.998\ X\ 10^8 m.s)}{0.01\ m}$$

$= \mathbf{2.0\ X\ 10^{-23}\ J/photon}$

Energy of an Avogodro's number of photons

$$\left(2.0\ X\ 10^{-23}\ \frac{J}{photons}\right)\left(6.022\ X\ 10^{-23}\ \frac{photon}{mol}\right)$$

$= \mathbf{12}\ \frac{J}{mol}$

5. c) $^{57}_{27}Fe$ (C)

6. 10

7. 1s² 2s² 2p⁶ 3s² 3p⁶ 3d¹⁰ 4s² 4p⁶ 4d¹⁰ 4f⁴ 5s² 5p⁶ 6s²
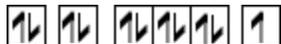
8. 1s 2s   2p   3s **orbital diagram of Na**

b.

1s 2s   2p   orbital diagram of Nitrogen

c. $[Ne]\ 3s^2\ 3p^5$ **Orbital diagram of Chlorine**

9. **1.** None **2.** An excited state **3.** Energy is released.

10.

	n	ℓ	m_ℓ	m_s
1s	1	0	0	$+\dfrac{1}{2}$
1s	1	0	0	$-\dfrac{1}{2}$
2s	2	0	0	$+\dfrac{1}{2}$
2s	2	0	0	$-\dfrac{1}{2}$
2p	2	1	-1	$+\dfrac{1}{2}$

There are 6 possibilities for the 2p electrons

11. For a reaction of type A + B + C going to product, the following observations are made: Doubling the concentration of A doubles the rate, doubling the concentration of B has no effect on the rate, and tripling the concentration of C increases the rate by a factor of 9. What is the rate law for the reaction? (a) rate = k $[A]^2$ [B] $[C]^2$ (b) rate = k [A] $[C]^2$ (c) rate = k $[A]^2$ [B] [C] (d) rate = k [A] [B] [C]

Answer: B

12.) For first order reactions the rate constant k, has the units

(a) S^{-1} (b) s^2 (c) S (d) S^{-2}

Answer: A

13. Rate laws for a chemical reactions are determined by

(a) By examining the coefficient in the balanced chemical equation
(b) From the equilibrium constant
(c) From the rates of the forward and reverse reactions of the system at equilibrium
(d) By experiment

Answer: D

14. Which concentration plot is linear for a first- order reaction? (A is one of the reactants)

a. [A] versus time
b. Square root of [A] versus time
c. ln [A] versus time
d. $[A]^2$ versus time

Answer: C

15. which two of the following metals do not react with aqueous HCl.

Mg, Ag, Zn, Fe, Au

Answer : Ag and Au.

16. As temperature decreases the reaction rate …………
    a. Decrease then increase
    b. Decrease
    c. Increases
    d. Stays the same
        Answer: C

17. The rate law relates the rate of a chemical reaction to
    a. The concentrations of a reaction
    b. The temperature
    c. The activation energy
    d. The reaction mechanism
        Answer: A

18. How many grams of Cu could be produced from $CuSO_4$ by a current of 3 amperes in 2 hours?
    a. 5g
    b. 7 g
    c. 8 g
    d. 11 g
        Answer: B

19. A current of 5.0 amperes is passed through molten magnesium chloride $MgCl_2$, for 3 hours. How many grams of Magnesium Mg (s) can be produced by this reduction ? 1F = 96500 C/mol. RMM ((Mg) = 24.305g/mol
    ANS: 6.80 g

20. In an electrolysis of aqueous NaCl, how many liters of Cl_2 (g) at STP are generated by a current of 7.50 A for a period of 100 min?
    Answer: 5.22 L

21. For the reaction $3H_2 + N_2 \rightleftharpoons 2NH_3$ + Heat, increase in temperature favours (a) more ammonia (b)more nitrogen (c) all of the above (d) none of the above
    ANS: B

22. The reaction $H_2O(l) \rightleftharpoons H_2O(g)$ is an example of (a) homogeneous equilibrium (b) mixed equilibrium (c) heterogeneous equilibrium (d) all of the above
    Ans: Heterogenous equilibrium

23. Which of the following is an intensive property of the system? (a) volume (b) enthalpy (c) entropy (d) pressure
    ANS: D

24. For adiabatic process (a) volume is constant (b) quantity of heat is constant (c) none of the above (c) Gibbs free energy is zero
    ANS: B

25. For isothermal process (a) temperature is constant (b) temperature difference is zero (c) all of

the above (d) none of the above

ANS: C

26. (20)The equilibrium constant for the reaction H2 (g) + I2 (g) 2 HI (g)would be:

(a) $K = [HI]^2/[H_2][I_2]$ (b) $K = [H_2][I_2]/[HI]$ (c) $K = 2[HI]/[H_2][I_2]$ (d) $K = [H_2][I_2]/2[HI]$

ANS: A

27. For Boyle's law (a) $V = aT$ (b) $V = a/P$ (c) $V = aP$ (d) none of the above (Note: V is volume, P is pressure, T is temperature and a is a constant)

ANS: B

28. For isochoric process (a) volume is zero (b) volume change is zero (c) All of the above (d) none of the above.

ANS: B

29. An intensive property does not depend on
   a. Nature of substance
   b. Quantity of matter
   c. External pressure
   d. Atmospheric pressure
      ANS: B

30. A system that can transfer both energy and matter to and from the surroundings is called
   a. An isolated system
   b. An closed system
   c. An open system
   d. A heterogenous system

COVENANT UNIVERSITY

CANAANLAND, KM 10, IDIROKO ROAD

P.M.B 1023, OTA, OGUN STATE, NIGERIA.

TITLE OF EXAMINATION: B.Sc EXAMINATION

COLLEGE: SCIENCE AND TECHNOLOGY

DEPARTMENT: CHEMISTRY

SESSION: 2015/2016   **SEMESTER:** ALPHA

COURSE CODE: CHM112   **CREDIT UNIT:** 1

COURSE TITLE: CHEMISTRY AND SOCIETY

INSTRUCTION: ANSWER ALL QUESTIONS   **TIME:** 1 HOUR

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1. Fossil fuels could be best defined as _____.

    (A) non-renewable energy resources

    (B) renewable energy resources

    (C) non-renewable energy resources formed from dead remains of plants and lower animals

    (D) renewable energy resources formed from dead remains of plants and lower animals

2. Which of the following is false?

    (A) Reserves are fossil fuel deposits that have been discovered.

    (B) Resources are fossil fuel deposits that are located in sedimentary basins but undiscovered.

    (C) Fossil fuel reserves can be divided into proved reserves and inferred reserves.

    (D) Proved reserves are deposits that have been discovered but have not been measured.

3. Heating coal in the absence of air is called_____.

    (A) gasification   (B) coalification   (C) liquefaction   (D) carbonisation

4. Which of these classes of coal has the lowest carbon content?

    (A) Anthracite   (B) Sub-bituminous coal   (C) Lignite   (D) Bituminous coal

5. Important physical properties of coal which determine its behaviour during handling and

    processing include the following except_____.

    (A) temperature   (B) porosity   (C) hardness   (D) grindability

6. One of these is false.

    (A) Coalification takes place via diagenesis and catagenesis.

    (B) Diagenesis is the biochemical stage of coalification.

    (C) Catagenesis is the physical conversion of peat into different classes of coal.

    (D) Factors affecting geochemical reactions are temperature, pressure, time and

        composition of organic matter in the peat.

7. High and low-temperature coal carbonisation gives these products except_____.

    (A) coal gas   (B) carbon   (C) coke   (D) coal tar

8. One of the following factors does not affect catagenesis.

    (A) Temperature   (B) Inorganic matter   (C) Pressure   (D) Time

9. Which of the following is not a component of coal?

    (A) Volatile matter   (B) Tar   (C) Fixed carbon   (D) Ash

10. In coal analyses, volatile matter, fixed carbon and moisture contain five main elements:

        (A) C, H, S, N,O   (B) C, Al, H, N, O (C)   C, H, Ca, S, O   (D) C, H, S, P, O
11. Moisture in coal is undesirable because _____.

    (A) it reduces the heating value of coal (B) it does not reduce the flame temperature

    (C) it reduces transportation costs (D) it increases the heating value of coal

12. Synthetic liquid and gaseous fuels from coal are environmentally more friendly than coal because__.

    (A) their ash contents are more

(B) their combustion produces more oxides of nitrogen

(C) they are easier and more convenient to transport and distribute

(D) their combustion produces more oxides of sulphur

13. Which of the following is odd?

    (A) Methane   (B) Stripped gas   (C) Liquefied natural gas   (D) Gas hydrates

14. One of these is a combination of methane and water.

    (A) Stripped gas   (B) Tar sands   (C) Gas hydrates   (D) Oil shale
15. Natural gas can be classified based on the following systems except_____.

    (A) associated or non-associated (B) black or brown (C) wet or dry (D) sweet or sour

16. The heating value of natural gas is

    (A) 20, 000KJ/kg   (B) 46, 000KJ/kg   (C) 52, 000KJ/kg   (D) 50, 000KJ/kg

17. Sour natural gas is undesirable. One of the following is not a reason for its undesirability.

    (A) Hydrogen sulphide has unpleasant smell.
    (B) Hydrogen sulphide dissolves in water to give acidic solution.
    (C) Hydrogen sulphide solution attacks pipes and valves.
    (D) Hydrogen sulphide dissolves in water to give basic solution.
18. The non-hydrocarbon constituents of natural gas are classified as diluents and contaminants. The

    diluents include the following except_____.

    (A) hydrogen sulphide (B) carbon (IV) oxide   (C) water vapour   (D) nitrogen

19. In natural gas processing, common absorbing liquids used do not include one of these.

    (A) water (B) amine solutions (C) sodium carbonate (D) sodium hydroxide

20. Fuel uses of natural gas do not include one of the following.

    (A) Manufacture of synthesis gas. (B) Production of steam which turns turbines.

    (C) Heating kilns in the cement industries. (D) Cooking gas utilization in homes.

21 One of the following is false?

    (A) Natural gas is a mixture of hydrocarbons with a small proportion of non-hydrocarbons.

    (B) Methane is the principal hydrocarbon component of natural gas.

    (C) The non-hydrocarbon components of natural gas include carbon (IV) oxide, hydrogen

        sulphide and moisture.

(D) The composition of natural gas does not vary from place to place.

22. The heating value of gasoline is____.

    (A) 20,000 KJ/kg   (B) 46,000 KJ/kg   (C) 52,000 KJ/kg   (D) 50,000 KJ/kg

23. One of the following is not a petroleum fraction.

    (A) Naptha   (B) Asphalt   (C) Petroleum   (D) Lubricant

24. One of the following is not a type of distillation carried out in the petroleum refinery.

    (A) Atmospheric distillation   (B) Medium oil distillation

    (C) Vacuum distillation of reduced crude   (D) Special product distillation

25. Which of the following is incorrect?

    (A) The API gravity of a liquid is inversely proportional to its density.

    (B) Petroleum whose API is over 40^0C is said to be light oil.

    (C) Petroleum whose API is less than 10^0C is called heavy oil.

    (D) The API gravities increase in the order aromatics < naphthenes < paraffins.

26. The objectives of petroleum refining include all of the following except____.

    (A) separation of crude oil into fractions

    (B) purification of petroleum products

    (C) improvement of the quality of refined products

    (D) conversion of products with lower market demand

27. Petroleum could be classified based on any of the following except____.

    (A) stability   (B) composition   (C) geochemical consideration   (D) API gravity

28. To satisfy the high market demand, other less desirable petroleum fractions are converted to

    gasoline. Which of these processes is not involved in the conversion?

    (A) Cracking   (B) Sweetening   (C) Alkylation   (D) Polymerization

29. Which of these is the preferred feedstock for cracking to produce gasoline?

    (A) HPFO   (B) PMS   (C) DPK   (D) LNG

30. Which of the following is false?

    (A) A major challenge in the utilization of petroleum fractions is the high cost of petroleum

refining and the maintenance of refineries

(B) Pipeline leakages lead to oil spillage and thus environmental pollution

(C) Many of the petroleum fractions could easily ignite leading to fire explosions and destruction

(D) Petroleum is a renewable energy resource

31. In petroleum classification based on geochemical consideration, one of these is odd.

(A) Young-shallow (B) Young-deep (C) Medium-deep (D) Old-shallow

32. One of these is not an environmental effect caused by fossil fuels.

(A) Acid rain (B) Global warming (C) Ash production (D) Transportation of fuels

33. Which of the underlisted is false?

(A) Carbon (IV) oxide is a greenhouse gas.

(B) Presence of sulphur oxides in the atmosphere increases the pH of rain water.

(C) Sour natural gas is a source of elemental sulphur for the manufacturing of H_2SO_4.

(D) Greenhouse gases absorb solar heat reflected off the earth's surface.

34. One of the following is not a renewable energy resource.

(A) Solar energy   (B) Hydroelectric energy   (C) Gas hydrates   (D) Wind power

35. Which of the following is the most prominent energy generator in the world?

(A) Solar energy (B) Hydroelectricity (C) Biomass energy (D) Nuclear energy

36. Which gas is responsible for the depletion of ozone layer which protects us from

harmful Ultraviolet rays?

(A) Chlorofluorocarbons (B) Nitrogen (C) Oxygen (D) Nitrogen Oxide

37. Which gas out of following is found highest by volume in air?

(A) Nitrogen (B) Oxygen (C) Ozone (D) Methane

38. Incomplete burning of petrol or diesel in vehicles creates........gas which is very poisonous.

(A) Carbon dioxide (B) Carbon monoxide (C) Methane (D) Ozone

39. All of the following are considered toxic metal pollutants EXCEPT

(A) Chromium (B) Cadmium (C) Potassium (D) Lead (E) Mercury

40. Which gas is primarily responsible for Greenhouse effect?

(A) Hydrogen dioxide (B) Carbon dioxide (C) Chlorofluorocarbons (D) Sulphur dioxide

41.   Cholera, Typhoid and Jaundice are commonly attributed to the pollution of _____?

    (A) Air (B) Water (C) Soil (D) Atmosphere

42.   What is the harm from the depletion of Earth's ozone layer?
    (A) The average temperature of earth's surface will increase gradually.
    (B) The oxygen content of the atmosphere will decrease.
    (C) Increased amount of Ultra violet radiation will reach earth's surface.
    (D) Sea levels will rise as the polar ice caps will gradually melt.
43. Acid rain is formed due to contribution from the following pair of gases
    (A) Methane and ozone (B) Oxygen and nitrous oxide (C) Methane and sulphur dioxide
    (D) Carbon dioxide and sulphur dioxide
44. Which of the following is a prime health risks associated with greater UV radiation through the
    atmosphere due to depletion of stratospheric ozone?
    (A) Damage to digestive system (B) Increased liver cancer (C) Neurological disorder
    (D) Increased skin cancer
45. The most serious environmental effect posed by hazardous wastes is
    (A) Air pollution (B) Contamination of groundwater (C) Destruction of habitat
    (D) None of the above
46. Photochemical smog is formed by the reaction of _____and_____ under the influence of sunlight.

    (A) Carbon dioxide and nitrogen (B) Volatile hydrocarbons and nitrogen oxide

    (C) Nitrogen oxides and organic compounds (D) Sulphur dioxide and volatile hydrocarbons

47. Which of the following is not as a consequence of global warming?
    (A) Rising sea level (B) Increased storm frequency and intensity
    (C) Worsening health effects (D) Increased agricultural productivity worldwide
48. Which of the following is not a primary contributor to the greenhouse effect?
    (A) Carbon dioxide (B) Carbon monoxide (C) Chlorofluorocarbons (D) Methane gas
49. The increase in the concentration of CO_2 in our environment in last fifty years; since 1960 is
    about   (A) 20% (B) 10% (C) 14% (D) 6%
50. Air pollutants can be divided into _____ and _____ ?

    (A) Inorganic and physical pollutants (B) Organic and biological pollutants

    (C) Chemical and biological pollutants (D) Organic and inorganic pollutants

51. A major in-stream use of water is for

    (A) Producing hydroelectric power (B) Dissolving industrial wastes
    (C) Agricultural irrigation   (D) Domestic use
52. Which of the following is a negative effect on the soil and water due to conventional, mechanized
    farming practices?
    (A) Soil compaction (B) Reduction in soil organic matter (C) Soil erosion
    (D) Leaching of pesticides and fertilizers into the groundwater
53. The percentage of the earth's air mass that can be found in the troposphere is about?

    (A) 30-40% (B) 90-100% (C) 75-80% (D) 40-50%

54. The presence of high coliform counts in water indicate

    (A) Contamination by human wastes (B) Phosphorus contamination
    (C) Decreased biological oxygen demand (D) Hydrocarbon contamination
55. Pollutants can be removed from the atmosphere by the usual scavenging processes which

includes the following except (A) Rainfall (B) Oxidation (C) Photodissociation (D) Combustion

56. The following are the adverse effects of acid rain except

   (A) Acid rain destroys the leaves of plants

   (B) It changes the chemistry of the soil making it unfit for living things that rely on soil as a

    habitat or for nutrition

   (C) Acid rain also changes the chemistry of the lakes and streams that the rainwater flows into

   (D) It is very useful for aquatic life because it increases their reproduction

57. Which of the following is a likely characteristic of hazardous waste?
    (A) Ignitability (B) Corrosivity (C) Reactivity (D) Any of the above
58. The _____ is a protective blanket which nurtures life on the earth and protects it from the hostile

    environment of outer space?

   (A) Stratosphere (B) Atmosphere (C) Mesosphere (D) Troposphere

59. The atmosphere is the source of _____ for plant photosynthesis and of _____ for respiration.

   (A) Carbon dioxide and oxygen (B) Oxygen and carbon monoxide

   (C) Carbon dioxide and nitrogen (D) Water vapour and carbon dioxide

60. Primary pollutants interact with one another or with the air to form new pollutants called _____?

   (A) Primary pollutant (B) Tertiary pollutant(C) Intermediate pollutant (D) Secondary pollutant

61. Groundwater mining in coastal areas can result into

    (A) Increase in the salinity of groundwater
    (B) Decrease in the toxicity of groundwater
    (C) Decrease in the salinity of groundwater
    (D) Increase in the water table
62. The benefits of recycling include the following except (A) Reduce urban air pollution

   (B) Reduce mineral demand (C) Reduce energy supply (D) Reduces habitat destruction

63. Which of the following devices is suitable for the removal of gaseous pollutants?
    (A) Cyclone separator (B) Electrostatic precipitator (C) Fabric filter (D) Wet scrubber
64. What is the difference between point and nonpoint pollution?

   (A) The type of waterway it enters

   (B) The source

   (C) The chemicals

(D) The toxicity

65. What type of radiation must be present for smog to form?

(A) Ultraviolet

(B) Infrared

(C) Gamma

(D) X-ray

66. The eutrophication is caused by

(A) Heavy metals dumped in the sewage (B) Excess nutrients from fertilizer

(C) Pesticides used along the waterways (D) Global warming from human use of fossil fuel.

67. How the biological oxygen demand gets affected with the increased presence of organic matter
   in water? (A) The oxygen demand increases (B) The oxygen demand decreases
   (C) The oxygen demand remains unchanged (D) None of the above

68. The carbon cycle describes the exchange of carbon between the atmosphere, land, and water.

Which processes add carbon, in the form of carbon dioxide, to the atmosphere?

I. deforestation by cutting and burning trees

II. Use of solar power

III. combustion of fossil fuels

IV. respiration of humans and animals

(A) I, II, III only

(B) I, III only

(C) I, III, IV only

(D) II, III, IV only

69. Ozone depleting substances include the following except

(A) Halon (B) Methyl bromide (C) Chlorofluorocarbons (D) Dimethyl sulphide

70. Bad ozone can be found in the?

(A) Atmosphere (B) Troposphere (C) Mesosphere (D) Stratosphere

[70 Marks]

COVENANT UNIVERSITY

CANAANLAND, KM 10, IDIROKO ROAD

P.M.B 1023, OTA, OGUN STATE, NIGERIA

TITLE OF EXAMINATION: B.Sc. Degree Examination

COLLEGE: Science & Technology   **DEPARTMENT:** Chemistry

SESSION: 2015/2016   **SEMESTER:** Alpha

COURSE CODE: CHM 112   **COURSE TITLE:** Chemistry & Society

ANSWERS

1. C
2. D
3. D
4. C
5. A
6. C
7. B
8. B
9. B
10. A
11. A
12. C
13. D
14. C
15. B
16. C
17. D
18. A
19. D
20. A
21. D
22. D
23. C
24. B
25. D
26. D

27. A
28. B
29. A
30. D
31. C
32. D
33. B
34. C
35. B
36. A
37. A
38. B
39. C
40. C
41. B
42. C
43. D
44. D
45. B
46. B
47. D
48. B
49. D
50. C
51. A
52. D
53. C
54. A
55. D
56. D
57. D
58. B
59. A
60. D
61. A
62. B
63. D
64. B
65. A
66. B
67. B
68. C
69. D
70. B

COURSE CODE: CHM 112

COURSE TITLE: CHEMISTRY & SOCIETY

TUTORIAL QUESTIONS AND ANSWERS

1. One of these is a combination of methane and water

   (B) Stripped gas   (B) Tar sands   (C) Gas hydrates   (D) Oil shale

2. Petroleum could be classified based on any of the following except_____.

   (A) stability (B) composition   (C) geochemical consideration (D) API gravity

3. The heating value of gasoline is

   (A) 20, 000KJ/kg   (B) 46, 000KJ/kg (C) 52, 000KJ/kg   (D) 50, 000KJ/kg

4. In natural gas processing, common absorbing liquids used include these except___.

   (A) water (B) amine solutions (C) sodium carbonate (D) sodium hydroxide

5. Which of the following is odd?

   (A) Methane   (B) Stripped gas   (C) CH_4 (D) Gas hydrates

6. Which of these is the preferred feedstock for cracking to produce gasoline?

   (A) HPFO   (B) PMS   (C) DPK   (D) LNG

7. The following are the advantages of natural gas over coal except one.

   (A)   Natural gas liberates more heat per unit weight than coal.
   (B)   Natural gas leaves no residue of ashes when burned.
   (C) Natural gas is easy to meter and regulate.

   (D) Natural gas requires liquefaction at low temperatures.

8. One of the following is not a petroleum fraction

   (A) Naptha   (B) Asphalt   (C) Petroleum   (D) Lubricant

9. The non-hydrocarbon constituents of natural gas are classified as diluents and

   contaminants. The diluents include the following except

   (A) Hydrogen sulphide (B) Carbon (IV) oxide   (C) Water vapour   (D) Nitrogen

10. Which of the following is incorrect?

    (A)   The API gravity of a liquid is inversely proportional to its density.
    (B)   Petroleum whose API is over 40^0C is said to be light oil.
    (C)   Petroleum whose API is less than 10^0C is called heavy oil.
    (D)   The API gravities increase in the order aromatics < naphthenes < paraffins.

11. The atmospheric layer includes the following except_____.

    (A) troposphere   (B) endosphere   (C) mesosphere   (D) themosphere

12. The layer is responsible for short-term weather and long-term climate is_____.

    (A) troposphere   (B) stratosphere   (C) mesosphere   (D) thermosphere

13. The main sources of acid rain are--------

    (A) oxides of sulphur and copper (B) oxides of Nitrogen and carbon

    (C) oxides of Sulphur and carbon (D) oxides of sulphur and nitrogen

14. The atmosphere is the source of _____for plant photosynthesis and of_____for

    respiration

(A) carbon dioxide and oxygen   (B) oxygen and carbon monoxide

(C) carbon dioxide and nitrogen (D) water and carbon dioxide

15. The_____is a protective blanket which nurtures life on the earth and protects it from

the hostile environment of outer space.

(A) stratosphere (B) atmosphere (C) mesosphere (D) troposphere

16. The_____ is vitally important to life because it absorbs biologically <u>harmful</u>

ultraviolet (UV) radiation coming from the sun.

(A) ozone   (B) atmosphere (C) oxygen   (D) carbon monoxide

17. The following are the effects of air pollution on organisms and materials except_____.

(A) it breaks down the natural defenses if overloaded

(B) it increases the risk of having cancer

(C) it gives rise to several respiratory diseases

(D) it reduces the death rate in organism over a period of time

18. The following are examples of secondary pollutants except_____.

(A) sulphuric acid   (B) ozone   (C) carbon monoxide   (D) nitric acid

19. Respiratory diseases are usually caused by_____.

(A) air pollution (B) water pollution (C) land pollution   (D) noise pollution

20. The greenhouse gases include the following except----

(A) water vapour   (B) methane   (C) carbon dioxide   (D) oxygen

TUTORIAL ANSWERS

1. C
2. A
3. D
4. D
5. D
6. A
7. D
8. C
9. A
10. D
11. B
12. A
13. C
14. A
15. B
16. A
17. D
18. C
19. A
20. D