SELAQUI INTERNATIONAL SCHOOL
WINTER VACATION ASSIGNMENT 2017-18

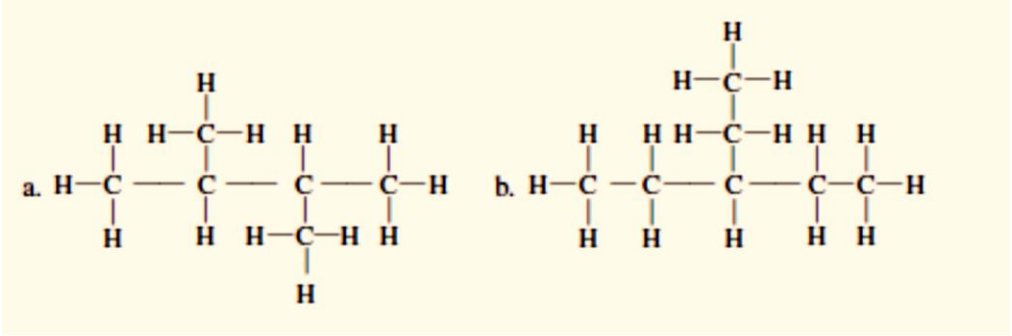
CLASS XI PURE SCIENCE

CHEMISTRY

To whom correspondence should be addressed.
soham.roy@selaqui.org

1. At what condition surface tension vanishes?
2. At what temperature below which a gas does not obey ideal gas law? At what temperature the volume of a gas is supposed to be zero?
3. Name the temperature above which a gas cannot be liquefied by any amount of pressure.
4. Why vegetables are cooked with difficulty at hill station?
5. What would have happened to the gas if the molecular collisions were not elastic?
6. Why liquids diffuse slowly as compared to gases?
7. 34.05 ml of phosphorus vapors weigh 0.0625 g at 543 ^oC and 1 bar pressure, what is molar mass of phosphorous?
8. Critical temperature of CO_2 and CH_4 gases are 31.1 ^oC and 81.9 ^oC respectively. Which of these has strong intermolecular forces & why?
9. Why a sharpened edge does become smooth on heating up to melting point?
10. Arrange following in order of increasing density:
    $O_2(g)$ at 25 ^oC and 1 atm, $O_2(g)$ at 0 ^oC and 2 atm, $O_2(g)$ at 273 ^oC and 1 atm
11. Write the condition in terms of temperature and pressure, under which most gases obey ideal gas law.
12. Mention the factors on, which the vapour pressure of a pure liquid depends?
13. Name the intermolecular force present in : (i) H_2O (ii) HCl
14. Explain the physical significance of van der Waals parameters.
15. Compressibility factor Z of a gas is given as Z = pV /nRT,
    (i) What is the value of Z for an ideal gas?
    (ii) For real gas, what will be the effect on value of Z above Boyle temperature?
16. Define viscosity. Mention the effect of temperature and pressure on viscosity of a liquid.
17. (i) Define surface energy in relation to surface tension.
    (ii) Name the temperature at which the density of water is maximum.
    (iii) Moist soil grains are pulled together. Explain.
18. Mention the intermolecular forces present between: (a) H_2O and alcohol (b) Cl_2 and CCl_4 (c) He and He atoms (d) Na^+ ion and H_2O (e) HBr and HBr.
19. Explain Graham's law of gaseous diffusion.
20. Out of NH_3 and N_2, which will have larger value of the van der Waals parameter, a? Explain.
21. Account for the following fact: H_2O and HF have much higher boiling points (100 ^oC and 19.4 ^oC respectively) than their homologues, H_2S and HCl (–60.7 ^oC and –85 ^oC), although the molecular weight of H_2O and HF is lower than that of H_2S and HCl.
22. A volume of carbon dioxide gas, CO_2, equal to 20.0 L was collected at 23 ^oC and 1.00 atm pressure. What would be the volume of carbon dioxide collected at 23 ^oC and 0.830 atm?
23. If you expect a chemical reaction to produce 4.38 dm^3 of oxygen, O_2, at 19 ^oC and 101 kPa, what will be the volume at 25 ^oC and 101 kPa?
24. Modern determination of %N in an organic compound is an automated version of one developed by the French chemist Jean-Baptiste Dumas in 1830. The Dumas method uses hot copper (II) oxide to oxidize C and H in the compound to CO_2 and H_2O (both are trapped chemically) and to convert N in the compound to N_2 gas. Using the Dumas method, 39.8 mg of caffeine gives 10.1 cm^3 of nitrogen gas at 23 ^oC and 746 mm Hg. What is the volume of nitrogen at 0 ^oC and 760 mm Hg?

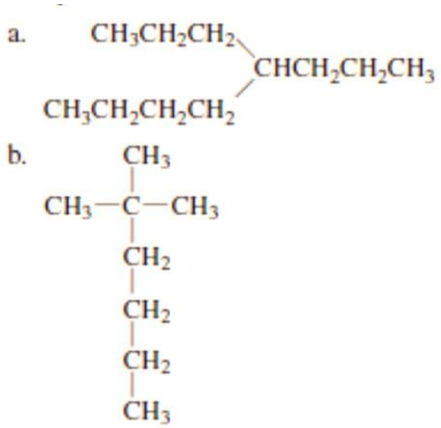
25. Calculate the density of helium, He, in grams per liter at 21 °C and 752 mm Hg. The density of air under these conditions is 1.188 g/L. What is the difference in mass between 1 liter of air and 1 liter of helium? (This mass difference is equivalent to the buoyant, or lifting, force of helium per liter.)
26. A sample of a gaseous substance at 25 °C and 0.862 atm has a density of 2.26 g/L. What is the molecular mass of the substance?
27. Three 3.0-L flasks, each at a pressure of 878 mm Hg, are in a room. The flasks contain He, Ar, and Xe, respectively.
    (a) Which of the flasks contains the most atoms of gas?
    (b) Which of the flasks has the greatest density of gas?
    (c) If the He flask were heated and the Ar flask cooled, which of the three flasks would be at the highest pressure?
    (d) Say the temperature of the He was lowered while that of the Xe was raised. Which of the three flasks would have the greatest number of moles of gas?
28. Automobiles are being equipped with air bags that inflate on collision to protect the occupants from injury. Many such air bags are inflated with nitrogen, N_2, using the rapid reaction of sodium azide, NaN_3, and iron(III) oxide, Fe_2O_3, which is initiated by a spark. The overall reaction is
    $$6NaN_3(s) + Fe_2O_3(s) \longrightarrow 3Na_2O(s) + 2Fe(s) + 9N_2(g).$$
    How many grams of sodium azide would be required to provide 75.0 L of nitrogen gas at 25 °C and 748 mm Hg?
29. A 10.0-L flask contains 1.031 g O_2 and 0.572 g CO_2 at 18 °C. What are the partial pressures of oxygen and carbon dioxide? What is the total pressure? What is the mole fraction of oxygen in the mixture?
30. A flask equipped with a valve contains 3.0 mol of H_2 gas. You introduce 3.0 mol of Ar gas into the flask via the valve and then seal the flask.
    (a) What happens to the pressure of just the H_2 gas in the flask after the introduction of the Ar? If it changes, by what factor does it do so?
    (b) How do the pressures of the Ar and the H_2 in the flask compare?
    (c) How does the total pressure in the flask relate to the pressures of the two gases?
31. Hydrogen gas is produced by the reaction of hydrochloric acid, HCl, on zinc metal.
    $$2HCl\ (aq) + Zn(s) \longrightarrow ZnCl_2\ (aq) + H_2\ (g).$$
    The gas is collected over water. If 156 mL of gas is collected at 19 °C and 769 mm Hg total pressure, what is the mass of hydrogen collected?
32. At what temperature do hydrogen molecules, H_2, have the same rms speed as nitrogen molecules, N_2, at 455 °C? At what temperature do hydrogen molecules have the same average kinetic energy?
33. A 1.00-L container is filled with an ideal gas and the recorded pressure is 350 atm. We then put the same amount of a real gas into the container and measure the pressure.
    (a) If the real gas molecules occupy a relatively small volume and have large intermolecular attractions, how would you expect the pressures of the two gases to compare?
    (b) If the real gas molecules occupy a relatively large volume and there are negligible intermolecular attractions, how would you expect the pressures of the two gases to compare?
    (c) If the real gas molecules occupy a relatively large volume and have large intermolecular attractions, how would you expect the pressures of the two gases to compare?
34. Explain Boyle's law in terms of the kinetic theory.
35. What is effusion? Why does a gas whose molecules have smaller mass effuse faster than one whose molecules have larger mass?
36. You have three identical flasks, each containing equal amounts of N_2, O_2, and He. The volume of the N_2 flask is doubled, the O_2 flask volume is halved, and the He flask volume is reduced to one-third of the original volume. Rank the flasks from highest to lowest pressure both before and after the volume is changed and indicate by what factor the pressure has changed.
37. List the different intermolecular forces you would expect for each of the following compounds:
    ` (a) propanol, $CH_3CH_2CH_2OH$ (b) carbon dioxide, CO_2 (c) sulfur dioxide, SO_2
38. Write the condensed structural formula of each of the following alkanes.



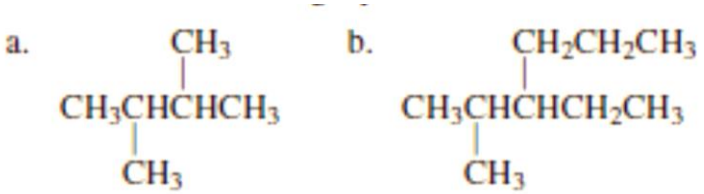
39. For each of the following alkenes, decide whether *cis–trans* isomers are possible. If so draw structural formulas of the isomers.

a. $CH_3CH_2CH{=}C(CH_3)_2$ b. $CH_3CH{=}CHCH_2CH_3$

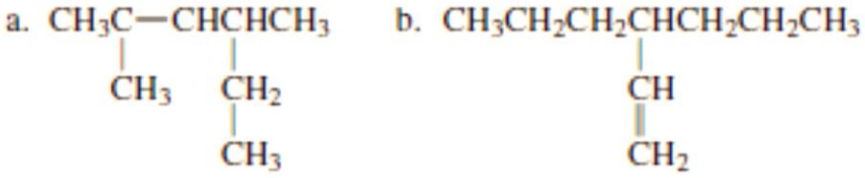
40. Give the IUPAC name for each of the following compounds.



41. What is the IUPAC name for each of the following hydrocarbons?



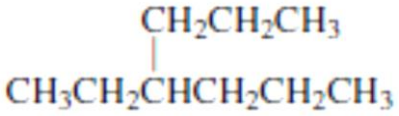
42. Write the condensed structural formula of 4-ethyl-3-methylheptane, 3,3-dimethyloctane and 2,5-dimethyl-2-heptene.
43. Give the IUPAC name for each of the following compounds.



44. Write the structural formula of
(a) ethylbenzene

(b) 1,2-diphenylethane.

45. A classmate tells you that the following compound has the name 3-propylhexane.
    (a) Is he right? If not, what error did he make and what is the correct name?
    (b) How could you redraw the condensed formula to better illustrate the correct name?



46. You encounter a hydrocarbon with the name 2-ethyl-3-methylhexane. Is this a proper IUPAC name? If not, what is the proper IUPAC name? To answer this question, start by writing the condensed structural formula based on this name.

PHYSICS

ASSIGNMENTS – 01 (DEC'2017)

STD. – XI **FM - 15**

INSTRUCTIONS :

1. **Answer ALL questions IN ORDER.**
2. **Question No's 1 to 8 are MCQ type, carries 1.5 marks each and question no 9 is of explanatory type, carries 3 marks.**

1. 'The moon is constantly falling towards the Earth' –
   (a) This statement is absurd (b) This statement is correct (c) This statement is wrong
   (d) Nothing can be said.
2. The escape velocity of a body projected vertically upward from the surface of the earth is 11.2 km/s. If the body is projected in a direction making an angle of 45^0 with the vertical, the escape velocity will be
   (a) 11.2 km/s (b) 11.2 X 2 km/s (c) 11.2 X $\sqrt{2}$ km/s (d) None of these.
3. A steel wire of length 4.7 m and cross section 3.0 X 10^{-5} m^2 stretched by same amount as a copper wire of length 3.5 m and cross section 4.0 X 10^{-5} m^2 under a given load. What is the ratio of Young's modulus of steel to that of copper ?
   (a) 1.8 (b) 10.8 (c) 0.18 (d) None of these.
4. The modulus of rigidity of ideal liquid is –
   (a) Infinity (b) Zero (c) Unity (d) None of these.
5. In case of an orbiting satellite, if the radius of the orbit is decreased, then its –
   (a) Kinetic energy decreases (b) Potential energy decreases (c) Total mechanical energy decreases(d) Speed decreases.
6. A 4 m long aluminium wire whose diameter is 3 mm is used to support a mass of 50 kg. What will be the elongation of the wire ? Given, Y for aluminium is 7 X 10^{10} N/m^2.
   (a) 3.9 mm (b) 3.9 cm (c) 3.9 m (d) None of these.
7. In order to find time, the astronauts orbiting in an Earth's satellite should use –
   (a) Pendulum clock (b) A watch having main spring to keep it going (c) Either a watch or a pendulum clock (d) Neither a watch nor a pendulum clock.
8. The escape speed of earth is 11.2 km/s. What is its value for a planet having double the radius and eight times the mass of the Earth.
   (a) 22.4 km/s (b) 11.2 km/s (c) 11.2 X $\sqrt{2}$ km/s (d) None of these.
9. Derive an expression for escape speed using the law of conservation of energy.

ASSIGNMENTS – 02 (DEC'2017)

STD. – XI **FM - 15**

Answer ALL questions IN ORDER.

1. Acceleration is defined as the rate of change of velocity. Suppose we call the rate of change of acceleration as "SLAP" . (i) What is the unit of SLAP? (ii) How can we calculate instantaneous SLAP ? (1)
2. Write dimensional formula for (a) Stress and (b) Plank's constant. (1)
3. The position of particle at time t is given by $x(t) = \left(\frac{V_0}{\alpha}\right)\left(1 - e^{-\alpha t}\right)$, where V_0 is a constant and $\alpha > 0$. What are the dimensions of V_0 and α ? (1)
4. According to Vander Waal's equation, the Pressure (P), volume (V) and temperature (T) are related as $\left[P + \frac{a}{V^2}\right](V - b) = RT$. Determine the dimensions of a and b. (2)
5. A particle starts moving from position of rest under a constant acceleration. If it travels a distance x in t second, what distance will it travel in the next t second? (2)
6. Derive the $S = ut + \frac{1}{2}at^2$ by calculus method, where the letters have their usual meaning. (2)
7. Given that the period T of oscillation of a gas bubble from an explosion under water depends on P , d and E ; where P is the pressure , d is the density of water and E is the total energy of explosion. Find dimensionally a relation for T. (3)
8. In two system of units relation between velocity, acceleration and force is $v_2 = \frac{v1\, e^2}{\tau}$, $a_2 = a_1 e\tau$ and $F_2 = \frac{F1}{e\tau}$, where e and τ are constants. What is the relation between mass, length and time in the two systems? (3)

ASSIGNMENTS – 03 (DEC'2017)

STD. – XI **FM - 15**

Answer ALL questions IN ORDER.

1. Can a body have (i) uniform speed, but still have acceleration and (ii) a zero velocity, but still have acceleration ? (1)
2. The velocity of the particle is $v = 10 + 3(a_1 + a_2 t)$, where a_1 and a_2 are constants and t is time. What is the acceleration of the particle ? (1)
3. A physical quantity X is related to four measurable quantities a, b, c and d as follows: $P = a^2 b^3 c^{5/2} d^{-2}$. The percentage error of measurement in a, b, c and d are 1%, 2%, 3% and 4% respectively. What is the percentage error in the quantity X ? (2)
4. The displacement x of a particle moving in one dimension, under the action of a constant force is related to time t by the equation $t = \sqrt{x} + 3$ where x is in metres and t is in seconds. Find the displacement of the particle when its velocity is zero. (2)
5. Drops of water from the roof of a house 6m high fall at regular intervals. The first drop reaches the ground at an instant of time when the third drop leaves the roof. Find the height of the second drop at that instant. (3)
6. Derive the relation by calculus method for uniformly accelerated motion along a straight line $v2 - u^2 = 2aS$, where the symbols have their usual meanings. (3)
7. Given that the period T of oscillation of a gas bubble from an explosion under the water depends on P, d and E where P is the static pressure, d is the density of water and E is the total energy of the explosion. Find dimensionally a relation for T. (3)

ASSIGNMENTS – 04 (DEC'2017)

STD. – XI **FM - 25**

Answer ALL questions IN ORDER.

1. Two artificial satellites, one close to the surface and the other away are revolving around the earth. Which has larger speed? (1)
2. Why space rockets are usually launched from west to east in the equatorial plane? (2)
3. Discuss Newton's law of gravitation in vector from. (3)

4. Calculate that imaginary angular velocity of the earth for which effective acceleration due to gravity at the equator becomes zero. In this condition, find the length (in hours) of a day? Radius of earth = 600 km. Given, $g = 10\ ms^{-2}$. (3)
5. Derive an expression for the total energy of a satellite revolving around Earth in an orbit. (3)
6. Derive an expression for escape speed using the law of conservation of energy. (3)
7. Define orbital velocity. Derive its expression for a satellite of mass m moving around the earth at a height h above the surface of the earth. (5)
8. Define centripetal and centrifugal forces. Derive an expression for the centripetal force. (5)

MATHEMATICS

1. **On separate Notebook do Miscellaneous Exercises from NCERT Book of Chapters covered.**

Ajay Kapoor
98974999151
ajay.kapoor@selaqui.org