B.Pharm 2nd Semester Exam., 2021
PHARMACEUTICAL CHEMISTRY-II
(Physical Chemistry by Anurag Pandey

1.What is meant by a thermochemical equation?A Thermochemical Equation is a balanced stoichiometric chemical equation that includes the enthalpy change, ΔH. In variable form,a thermochemical equation would look like this: A + B⟶ C. ΔH = (±) #

2.What is bolometer?A bolometer is a device used for detecting and measuring the heat and radiation of microwave energy. It uses the temperature-sensitive resistive element whose resistance changes with temperature.

3.Define black body and black body radiation. Or What is meant by black body and blackbody radiation?

An object that absorbs all radiation falling on it, at all wavelengths, is called a black body. When a black body is at a uniform temperature, its emission has a characteristic frequency distribution that depends on the temperature. Its emission is called black-body radiation.

4.Quantum yield and efficiency

quantum yield (Φ) is defined as the ratio of the number of photons emitted to the number of photons absorbed. Notably, quantum yield is independent of instrument settings and describes how efficiently a fluorophore converts The quantum efficiency is defined as the ratio of the number of photons emitted by the phosphor to the number of photons absorbed.the excitation light into fluorescence.

5.What is the second law of thermodynamics? The second law of thermodynamics asserts that heat cannot move from a reservoir of lower temperature to a reservoir of higher temperature in a cyclic process.

6.isothermal process is also known as?antibiotics process .

7.heat and vaporization of a liquid is known as? latent heat.

8.What is adiabatic process ? an adiabatic process is a type of thermodynamic process that occurs without transferring heat or mass between the thermodynamic system and its environment. Unlike an isothermal process, an adiabatic process transfers energy to the surroundings only as work.

9.What is Lambert's law?

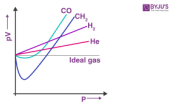
Lambert's law of absorption states that equal parts in the same absorbing medium absorb equal fractions of the light that enters them. If in traversing a path of length dx the intensity is reduced from I to I – dI then Lambert's law states that dI/I is the same for all elementary paths of length dx.

Long question

2.What are the causes of deviation of real gas from ideal behaviour?

The deviation of real gas from ideal gas behaviour occurs due to the assumption that if pressure increases the volume decreases. The volume will approach a smaller number but will not be zero because the molecules will occupy some space that cannot be compressed further.

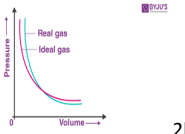
Deviation from Ideal Behaviour



The experimental observation of gases correctly corresponds to its theoretical model. The difficulty arises when we test the extent to which the relationship, pV = nRT, the ideal gas equation, is followed to depict the actual pressure-volume-temperature relation of gases. To check on this

point, let us plot pV versus V graph. At constant temperature, the pV relation will be constant. The pV versus p graph will be a straight line parallel to x-axisThe above figure shows the graph constructed from actual data for some gases at

K.Looking at the graph, it is seen that at constant temperature the pV vs p plot is not a straight line for real gases. There is a significant deviation from the ideal behaviour. In the case of hydrogen and helium, if the value of p increases then pV also increases. In other cases for example methane and carbon dioxide, initially there is a negative deviation from the ideal behaviour, the increase in pressure decreases the value of pV and reaches a minimum value. After it reaches the minimum point, pV value starts increasing and crosses the line for the ideal gas and then shows positive deviation continuously.So it can be said that the real gases do not follow the ideal gas equation at all temperatures and pressure



2b.Explain the behaviour of real gases by van der

Waals' equation at low pressure and high pressure.

The deviations from ideal gas behaviour can be ascertained to the following faulty assumptions by kinetic theory of gases. * The real volume of the gas molecules is negligible when compared to the volume of the container. * There are no forces of attraction or repulsion between the gas molecules.

Hence van der Waal suggested the following corrections: * The gas molecules possess finite volume and hence should not be neglected. It is especially true at high pressures and low temperatures and should be accounted for. * In case of real gases, both the forces of attraction as well as repulsion operate between gas molecules. Note: If the gases obey the kinetic theory of gases, then they cannot be compressed since the attractions between the gas molecules is negligible.Also the following corrections are applied by van der Waals to the ideal gas equation: P = observed pressure of the

$\left(P + a\frac{n^2}{V^2}\right)$ = pressure corrected for ideal gas

real gas whereas,V = volume occupied by the real gas and is equal to the volume of the container. whereas, (V -

nb) = available volume for gas molecules

At low pressures: Since V is large and therefore 'b' is negligible compared to V, the van der Waals equation for one mole of a gas is reduced to:

$$\left(P + \frac{a}{V^2}\right)V = RT$$

$$PV + \frac{a}{V} = RT$$

$$PV = RT - \frac{a}{V}$$

*Note that V = Vm = molar volume. Therefore: PV < RT at lower pressures. This is the reason for decrease in the Z value at low pressures. *Note: By dividing with RT on each side, the above equation can

$$\frac{PV}{RT} = 1 - \frac{a}{RTV}$$

or

$$Z = 1 - \frac{a}{RTV}$$

be written as:

At high pressures: Since the volume of the gas is small, the value of 'b' cannot be neglected. Although a/V2 is also large its value may be neglected in comparison with very high value of P. Hence the van der Waals equation is reduced to: P(V - b) = RT or PV - Pb = RT or PV = RT + Pb Therefore: at high pressures, PV > RT. This explains the raising parts of the isotherms, at high pressures, plotted between Z vs P.

Note: By dividing with RT on each side, the above equation can be written as:

$$\frac{PV}{RT} = 1 + \frac{Pb}{RT}$$

or

$$Z = 1 + \frac{Pb}{RT}$$

3a.What is the effect of temperature on surface tension?

Surface tension is a property of liquid by which the liquid or fluid acts as a stretchable membrane and this effect can be seen in our everyday life. Surface tension occurs because of the attractive forces around all the direction of the molecules and these attractive forces make the outermost layer of the liquid to act like an elastic membrane and this is known as surface tension. Since the surface tension depends on the intermolecular forces of molecules of liquid and When we increase the temperature then the molecules gains more energy and hence they become more active and starts moving randomly since the molecule becomes more unstable when we increase the temperature and this reduces the strength of the outermost membrane of the liquid so the strength of surface tension decreases.

So, we can conclude that surface tension decreases with the increase in temperature.

Note:

When we increase the temperature then the molecules gain more energy and hence they become more active and start moving randomly with more velocity and this changes the direction of the net force and hence because the randomness increases so the surface tension or the elastic property of the outer membrane of liquid becomes weak.

3b.Explain the term of parchor ?an empirical constant for a liquid that relates the surface tension to the molecular volume and that may be used for a comparison of molecular volumes under conditions such that the liquids have the same surface tension and for determinations of partial structure of compounds by adding values obtained for constituent

What is parachor formula?The parachor is defined by relation:$P_c = M\gamma^{1/4}/(\rho_l - \rho_g)$where γ is the surface tension of the liquid, and ρi and ρg are the densities of the liquid and of the vapors in equilibrium at the given temperature.

Applications of Parachor

It is a molecule's constitutive property that is additive and connected to both surface tension and molar volume. It is an empirical constant for a liquid that connects the surface tension to the molecular volume.

4a.What is a Second Order Reaction?Derive an expression for rate constant of second-order reaction involving one reactant only

From the rate law equations given above, it can be understood that second order reactions are chemical reactions which depend on either the concentrations of two first-order reactants or the concentration of one-second order reactants.Since second order reactions can be of the two types described above, the rate of these reactions can be generalized as follows:r = k[A]x[B]y ,eg : H+ + O H − ⟶ H 2 O. C + O 2 ⟶ C O + O.or Nitrogen dioxide produces nitrogen monoxide and oxygen.

k [A].[B] y = rate

A reaction of second order is one in which x + y = 2. This can happen if one reactant is used at a rate proportional to its concentration squared (rate = k[A]2), or if both reactants are

consumed linearly over time (rate = k[A][B]).

4b.Describe some characteristics of second-r

The rate of the reaction is not proportional to the concentration of the reactant.

B) The rate of the reaction is directly proportional to the square of the concentration of the reactant.

C) The rate of the reaction is directly proportional to the square root of the concentration of the reactant.

D) The rate of the reaction is directly proportional to the natural logarithm of the concentration of the reactant.

E) No determinations of proportionality can be determined from the information provided.

5a Discuss Freundlich adsorption isotherm of a gas on a solid.

::Adsorption Isotherm is a curve that Discuss Freundlich adsorption isotherm

presses the variation in the amount of gas adsorbed by the adsorbent with pressure at constant temperature.Freundlich Adsorption IsothermIn 1909, German scientist Freundlich provided an empirical

relationship between the amount of gas adsorbed by a unit mass of solid adsorbent and pressure at a particular temperature. It is expressed using the following equation –

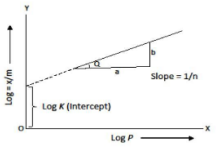
x/m = k.P1/n (n > 1)

where 'x' is the mass of the gas adsorbed on mass 'm' of the adsorbent at pressure 'P'. 'k' and 'n' are constants that depend on the nature of the adsorbent and the gas at a particular temperature.The mass of the gas adsorbed per gram of the adsorbent is plotted against pressure in the form of a curve to show the relationship. Here, at a fixed pressure, physical adsorption decreases with increase in temperature. The curves reach saturation at high pressure. Now, if you take the log of the above equation –

log x/m = log k + 1/n log P

To test the validity of Freundlich isotherm, we can plot log x/m on the y-axis and log P on the x-axis. If the plot shows a straight line, then the Freundlich isotherm is valid, otherwise, it is not. The slope of the straight line gives the value of 1/n, while the

intercept on the y-axis gives the value



of log k.

adsorption isotherm

Limitations of Freundlich Isotherm

Freundlich isotherm only approximately explains the behaviour of adsorption. The value of 1/n can be between 0 and 1, therefore the equation holds good only over a limited range of pressure.

When 1/n = 0, x/m is constant, the adsorption is independent of pressure.

When 1/n =1, x/m = k P, i.e. x/m ∝ P, adsorption is directly proportional to pressure.

5b see pdf

6a see the pdf

6b6bApplication of Adsorption

Application of Adsorption Charcoal adsorbs the colouring molecules from the coloured sugar solution and decolorizes it.Moisture is adsorbed by silica gel from the desiccators Alumina

and silica gels remove moisture and control the humidity of offices and rooms because they act as adsorbents. In gas masks, activated charcoal is used as it adsorbs vapours, toxic gases to purify the breathing air. Heterogeneous catalysis is carried out through the adsorption process. Charcoal can be used as an absorbent to separate noble gases. The chromatographic analysis is based on the adsorption phenomenon. In syrups and cosmetics, stable emulsions are formed through adsorption. Drug adsorption kills germs.

7a.Characteristics of acid-base and enzyme

Acid::They have a pH value of below 7.They are sour. The word acid has been derived from a Latin word for 'sour'. This is so because it is one of the physical properties of acids that makes it very distinguishable. Strong acids are good conductors of electricity, while weak acids are weak conductors of electricity. Mineral acids are colourless, while organic acids are white.Sometimes, when strong acids and bases react, the reaction results in the formation of water and salts. So it can be said that when acids react with water, they produce neutral substances.

Physical properties of bases – Bases are identified by the following physical characteristics –Bases are bitter to taste.

An aqueous solution of bases acts as electrolytes.If touched, bases feel very slippery in texture. Bases have a pH that is higher than 7.Except for hydroxides of copper and iron, all bases are colourless.Some bases are soluble in water.

Ac

Chemical properties of acids and basesChemical properties of acids

Reaction with metals – Hydrogen is displaced from the acid, and salts are produced along with the release of hydrogen gas when an acid reacts with metal.

Example: M + H2SO4 ⟶ MSO4 + H2

Reaction with metal oxides – Salt and water are produced when acids react with metal oxides.

Example: CuO + 2HCl ⟶ CuCl2 + H2

Reaction with metal carbonates or bicarbonates – Salt, carbon dioxide, and water are produced in this type of reaction.

Example: Na2CO3 + HCl (aq) ⟶ 2NaCl (aq) + H2O + CO2

Chemical properties of bases

Reaction with metal – Bases dissolved in water, which forms alkali's, when reacted with metals, forms hydrogen gas and salts.

Example: 2NaOH + Zn ⟶ Na2ZnO2 + H2

Reaction with non-metal oxides – Bases react with non-metal oxides to form salt and water.

Example: CO2 + Ca(OH)2 ⟶ CaCO3 + H2O

Enzyme

Characteristics of an Enzyme :

Speed up chemical reactions.They are required in minute amounts.They are highly specific in their action.They are affected by temperature.They are affected by pH.Some catalyze reversible reactions.Some require coenzymes.They are inhibited by inhibitors.

7b.What are the consequences of Light Absorption?

According to the principle of photochemical activation, only that part of the light which is absorbed by any system can cause photochemical change or reaction. However this is not essential that every time, the energy which is absorbed by any system can bring about a photochemical reaction.

Also the light absorbed by any system may be re-emitted almost at the same time, either in one step or in more steps. This phenomenon is called fluorescence. Also sometimes the light absorbed by any system may re-emit the energy slowly or even after the removal of source light, this phenomenon is called phosphorescence. Process of Fluorescence, phosphorescence is best explained with the help of Jablonski diagram.