

# CH: CHEMICAL ENGINEERING

EE25BTECH11042 - Nipun Dasari

1) The direction of largest increase of the function  $xy^3 - x^2$  the point (1, 1) is -

- a)  $3\hat{i} + 4\hat{j}$                       b)  $3\hat{i} + 4\hat{j}$                       c)  $3\hat{i} + 4\hat{j}$                       d)  $3\hat{i} + 4\hat{j}$

(GATE CH 2009)

2) The modulus of the complex number is  $(1 + i)/\sqrt{2}$

- a)  $1/2$                       b)  $1/\sqrt{2}$                       c) 1                      d)  $\sqrt{2}$

(GATE CH 2009)

3) The system of linear equations  $\mathbf{Ax} = \mathbf{0}$ , where  $\mathbf{A}$  is an  $n \times n$  matrix, has a non-trivial solution ONLY if-

- a) rank of  $\mathbf{A} > n$                       c) rank of  $\mathbf{A} < n$   
b) rank of  $\mathbf{A} = n$                       d)  $\mathbf{A}$  is an identity matrix

(GATE CH 2009)

4) A dehumidifier (shown below) is used to completely remove water vapour from air

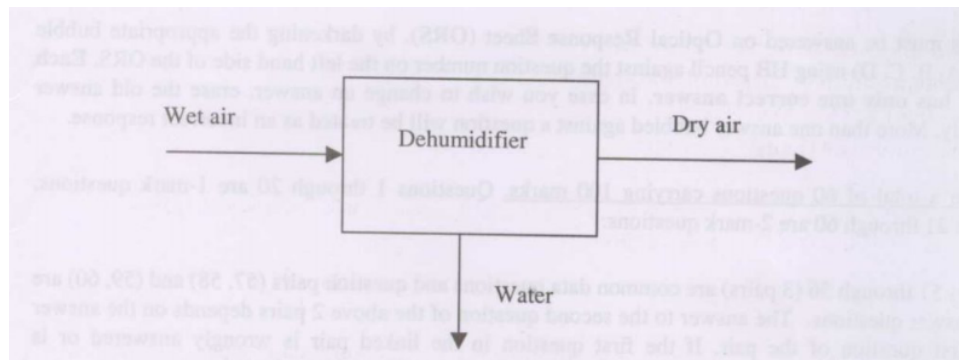


Fig. 1

Which **ONE** of the following statements is **TRUE**

- a) Water is the ONLY tie component  
b) Air is the ONLY tie component  
c) BOTH water and air are tie components  
d) There are NO tie components

(GATE CH 2009)

5) Dehydrogenation of ethane,  $H_6(g) \rightarrow H_4(g) + H_2(g)$ , is carried out in a continuous stirred tank reactor (CSTR) The feed is pure ethane. If the reactor exit stream contains unconverted ethane along with the products, then the number of degrees of freedom for the CSTR is

- a) 1                      b) 2                      c) 3                      d) 4

(GATE CH 2009)

- 6) An ideal gas at temperature  $T_1$  and pressure  $P_1$  is compressed isothermally to pressure  $P_2 (> P_1)$  in a closed system. Which ONE of the following is TRUE for internal energy ( $U$ ) and Gibbs free energy ( $G$ ) of the gas at the two states?

a)  $U_1 = U_2, G_1 \neq G_2$

c)  $U_1 \neq U_2, G_1 = G_2$

b)  $U_1=U_2, G_1 \neq G_2$

d)  $U_1 \mid U_2, G_1 = G_2$

(GATE CH 2009)

- 7) Under fully turbulent flow conditions, the frictional pressure drop across a packed bed varies with the superficial velocity ( $V$ ) of the fluid as -

a)  $V^{-1}$

b)  $V$ 

c)  $V^{3/2}$

d)  $V^2$

(GATE CH 2009)

- 8) For a mixing tank operating in the laminar regime, the power number varies with the Reynolds number ( $Re$ ) as

a)  $Re^{\frac{-1}{2}}$

b)  $Re^{\frac{1}{2}}$ 

c) Re

d)  $Re^{-1}$

(GATE CH 2009)

- 9) During the transient convective cooling of a solid object, Biot number  $\rightarrow 0$  indicates

a) uniform temperature throughout the object

b) negligible convection at surface of the object

c) significant thermal resistance within the object

d) significant temperature gradient within the object

(GATE CH 2009)

- 10) The Prandtl number of a fluid is the ratio of

a) thermal diffusivity to momentum diffusivity

b) momentum diffusivity to thermal diffusivity

c) conductive resistance to convective resistance

d) thermal diffusivity to kinematic viscosity

(GATE CH 2009)

- 11) According to the penetration theory of mass transfer, the mass transfer coefficient ( $k$ ) varies with diffusion coefficient ( $D$ ) of the diffusing species as

a) D

b)  $D^{\frac{-1}{2}}$ 

c)  $D^{\frac{1}{2}}$

d)  $D^{\frac{3}{2}}$ 

(GATE CH 2009)

- 12) The ratio of the liquid to gas flow rate in a counter-current gas absorption column is increased, at otherwise identical conditions. Which ONE of the following statements is TRUE ?

a) The operating line shifts towards the equilibrium curve

b) The operating line shifts away from the equilibrium curve

c) The concentration of the absorbed species increases in the exit liquid stream

d) The operating line does not shift

(GATE CH 2009)

- 13) For a homogeneous reaction system, where

$C_j$  is the concentration of  $j$  at time  $t$   $N_j$  is the number of moles of  $j$  at time  $t$   $V$  is the reaction volume at time  $t$   $1$  is the reaction time The rate of reaction for species  $j$  is defined as

- a)  $\frac{dC_j}{dt}$                       b)  $-\frac{dC_j}{dt}$                       c)  $\frac{1}{V} \frac{dN_j}{dt}$                       d)  $-\frac{1}{V} \frac{dN_j}{dt}$

(GATE CH 2009)

14) The half-life of a first order liquid phase reaction is 30 seconds. Then the rate constant, in  $\text{min}^{-1}$ , is

- a) 0.0231  
b) 0.602  
c) 1.386  
d) 2.0

(GATE CH 2009)

15) For a solid catalyzed reaction, the Thiele modulus is proportional to

- a)  $\sqrt{\frac{\text{intrinsic:reactionrate}}{\text{diffusion:rate}}}$                       c)  $\frac{\text{intrinsic:reactionrate}}{\text{diffusion:rate}}$   
b)  $\sqrt{\frac{\text{diffusion:rate}}{\text{intrinsic:reactionrate}}}$                       d)  $\frac{\text{diffusion:rate}}{\text{intrinsic:reactionrate}}$

(GATE CH 2009)

16) Which ONE of the following sensors is used for the measurement of temperature in a combustion process ( $T > 1800^\circ\text{C}$ ) ?

- a) Type J thermocouple  
b) Thermistor  
c) Resistance temperature detector  
d) Pyrometer

(GATE CH 2009)

17) The roots of the characteristic equation of an underdamped second order system are

- a) real, negative and equal  
b) real, negative and unequal  
c) real, positive and unequal  
d) complex conjugates

(GATE CH 2009)

18) The total fixed cost of a chemical plant is Rs. 10.0 lakhs; the internal rate of return is 15 per cent and annual operating cost is rs. 2.0 lakhs. The annualised cost of plant is

- a) 1.8                      b) 2.6                      c) 3.5                      d) 4.3

(GATE CH 2009)

19) In petroleum refining operations, the process used for converting paraffins and naphthenes to aromatics is

- a) catalytic reforming                      c) hydrocracking  
b) catalytic cracking                      d) alkylation

(GATE CH 2009)

20) The active component of catalysts used in steam reforming of methane to produce synthesis gas is

- a) Nickel                      b) Iron                      c) Platinum                      d) Palladium

(GATE CH 2009)

21) The value of the limit

$$\lim_{x \rightarrow \pi/2} \frac{\cos x}{(x - \pi/2)^3}$$