Physics

Question 1. Length of clocks second hand is 0.1 m what is the order of its angular velocity in Radian per/sec.

    (1) 10^{-1}

    (2) 10^{-2}

    (3) 10^{-3}

    (4) 10^{-4}

Ans. (1)

Sol. $\omega = \dfrac{2\pi}{T} = \dfrac{2\pi}{60} = \dfrac{\pi}{30} = \dfrac{\pi}{3} \times 10^{-1}$

Question 2. A Gas have 3 translation and 2 Rotational degree of freedom find $\dfrac{C_p}{C_v}$?

    (1) $\dfrac{5}{7}$

    (2) $\dfrac{7}{5}$

    (3) $\dfrac{2}{5}$
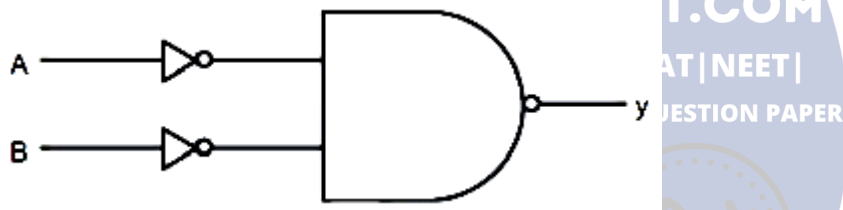
(4) $\dfrac{5}{2}$

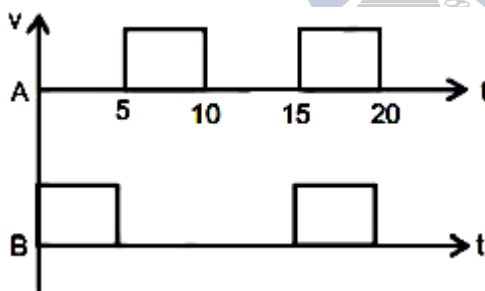Ans. (2)

Sol. $f = 5$

$$\gamma = 1 + \dfrac{2}{f} = 1 + \dfrac{2}{5} = \dfrac{7}{5}$$

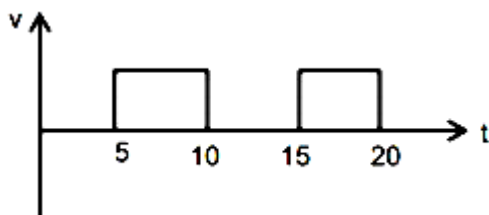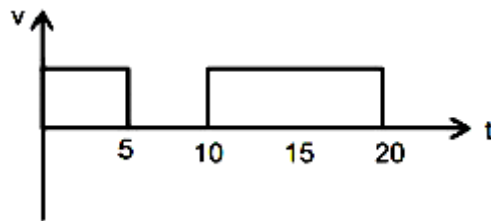$$\dfrac{C_p}{C_v} = \dfrac{7}{5}$$

Question 3.

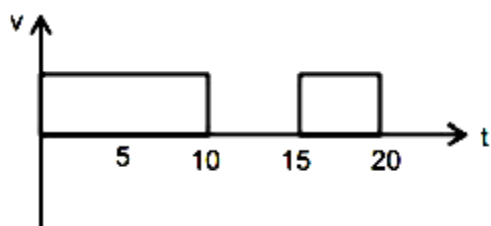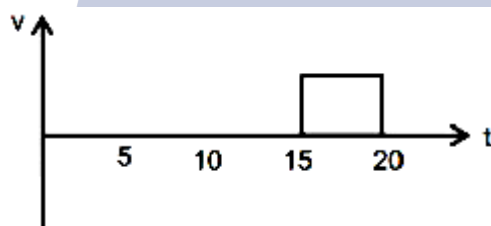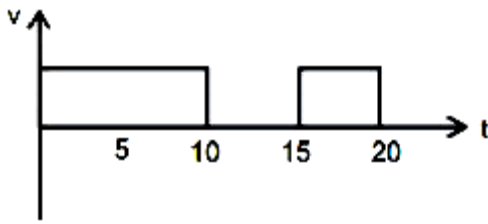input are given as shown

then output signal is -

(1)

(2)

(3)

(4)

Ans. (3)

Sol. Truth Table

A	B	Y
0	1	1
1	0	1
0	0	0
1	1	1

Question 4. Potential Energy in a field is given by

$$U = \frac{-A}{r^6} + \frac{B}{r^{11}}$$ then find value of r for equilibrium position.

(1) $r = \left(\dfrac{6A}{11B}\right)^{\frac{1}{5}}$

(2) $r = \left(\dfrac{11B}{6A}\right)^{\frac{1}{5}}$

(3) $r = \left(\dfrac{6B}{11A}\right)^{\frac{1}{5}}$

(4) $r = \left(\dfrac{11A}{6B}\right)^{\frac{1}{5}}$

Ans. (2)

Sol. $U = \dfrac{-A}{r^6} + \dfrac{B}{r^{11}}$

$F = -\dfrac{dU}{dr} = +\dfrac{6A}{r^7} - \dfrac{11B}{r^{12}}$

For equilibrium

F = 0

$$\frac{6A}{r^7} - \frac{11B}{r^{12}} = 0$$

$$r = \left(\frac{11B}{6A}\right)^{\frac{1}{5}}$$

Question 5. Electron, proton and He^{++} are moving with same KE. Then order of de-Broglie wavelength are.

(1) $\lambda_e < \lambda_p < \lambda_{He^{++}}$

(2) $\lambda_p > \lambda_e > \lambda_{He^{++}}$

(3) $\lambda_e > \lambda_{He^{++}} > \lambda_p$
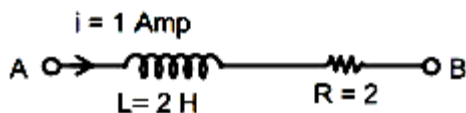
(4) $\lambda_e > \lambda_p > \lambda_{He^{++}}$

Ans. (4)

Sol. $\lambda = \dfrac{h}{mv} = \dfrac{h}{\sqrt{2mk}}$

$$\lambda_e : \lambda_p : \lambda_{He^{++}} = \frac{1}{\sqrt{m_e}} : \frac{1}{\sqrt{m_p}} : \frac{1}{\sqrt{He^{++}}}$$

$$\frac{1}{\sqrt{9.1 \times 10^{-31}}} : \frac{1}{\sqrt{1.6 \times 10^{-27}}} : \frac{1}{\sqrt{4 \times 1.6 \times 10^{-27}}} = 84 : 2 : 1$$

Question 6.

If current is increases with rate of 2 Amp/sec., then find VA - VB.

    (1) 2V

    (2) 4V

    (3) 8V

    (4) 6V
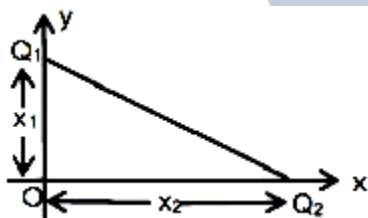
Ans. (4)

Sol. $VA - 2 \times 2 - 1 \times 2 = VB$

    $VA - VB = 4 + 2 = 6V$

Question 7.

Two charge Q_1 and Q_2 are placed in xy plane at a distance x_1 and x_2 from origin a shown in figure. If electric field at O is same for both charge then find ratio Q_1 and Q_2.

    (1) $\dfrac{x_1}{x_2}$

(2) $\dfrac{x_2}{x_1}$

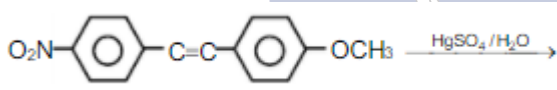(3) $\dfrac{x_1^2}{x_2^2}$

(4) $\dfrac{x_1^3}{x_2^3}$

Ans. (3)

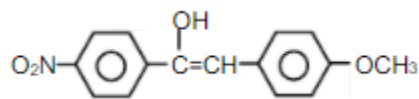Sol. $\dfrac{KQ_1}{x_1^2} = \dfrac{KQ_2}{x_2^2} \Rightarrow \dfrac{Q_1}{Q_2} = \dfrac{x_1^2}{x_2^2}$

Chemistry

Question 8.

Product is

(1)

(2)

(3)
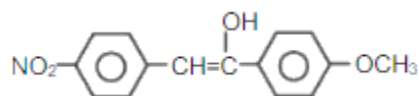
(4)
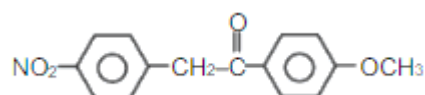
Answer: (4)

Solution:
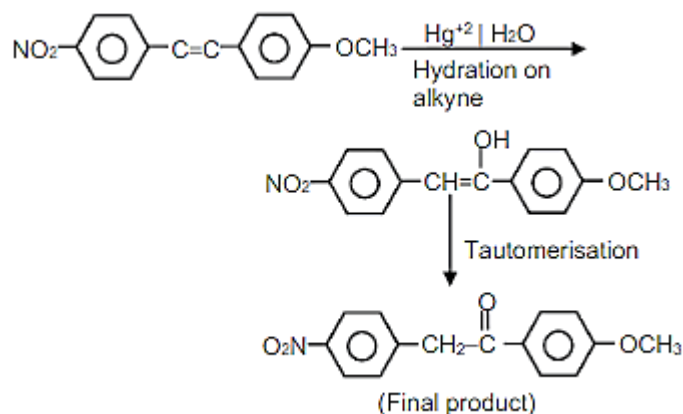
Question 9. Write down increasing order of PKb for following?
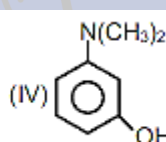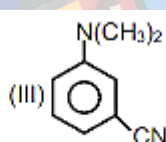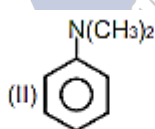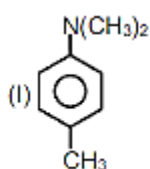
 (1) IV < III < II < I

 (2) I < II < III < IV

 (3) I < II < IV < III

 (4) I < III < IV < II

Answer: (3)

Solution:

$$PK_b \propto \frac{1}{\text{Basic strength}\left(K_b\right)}$$

$K_b \propto +I, +M$ effect (e- density)

$$K_b \propto \frac{1}{-I, -M \text{ effect}}$$

$Kb = 1 > 2 > 4 > 3$

$PKb = 1 < 2 < 4 < 3$
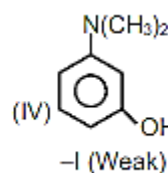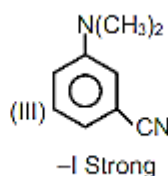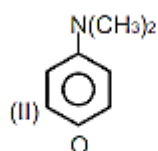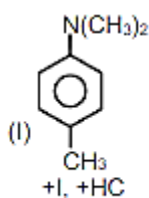
(I) +I, +HC (II) (III) −I Strong (IV) −I (Weak)
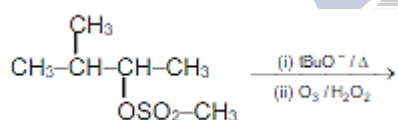
Question 10.

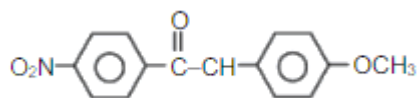Final product is

   (1)

   (2)

   (3)

$$>-COOH + HCOOH$$

(4)

$$>=O + CH_3-COOH$$
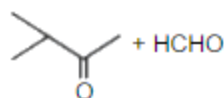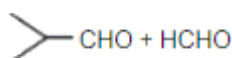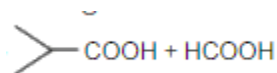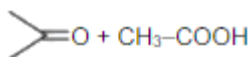
Answer: (3)

Solution:

Due to bulky base at high T first reaction is E2 and produce Hoffman alkene which further show oxidative ozonolysis.

$$CH_3-CH-CH-CH_3 \ (\overset{CH_3}{\underset{OSO_2-CH_3}{}}) \xrightarrow{tBuO^-/\Delta} CH_3-CH-CH=CH_2 \ (\overset{CH_3}{}) \xrightarrow{O_3/H_2O_2} CH_3-CH-COOH + HCOOH \ (\overset{CH_3}{})$$
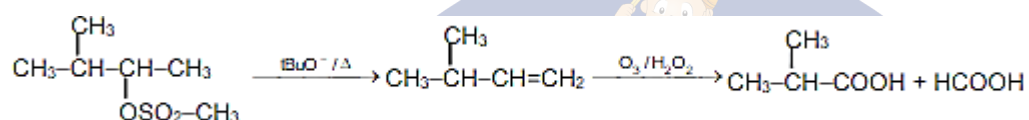
Given in option (C). So answer goes to 3

Question 11. Which can show geometrical isomer?

(1) 4-Methylpent-1-ene
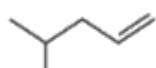
(2) 4-Methylpent-2-ene
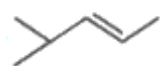
(3) 3-Methylpent-1-ene
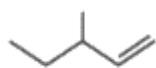
(4) 2-Methylpent-1-ene

Answer: (2)

Solution:

$$CH_3 - CH - CH = CH - CH_3$$
$$|$$
$$CH_3$$

Can show G.I. because both doubly bonded carbon have two different groups

Question 12.

Statement - 1: High density polythene (HDP) is form when addition polymerization of ethene takes place in a hydrocarbon solvent in the presence of a catalyst Ziegler-Natta catalyst at a temperature of 333K to 343K and under a pressure of 6-7 atmospheres.

Statement - 2: High density polythene (HDP) consists of linear molecules and has a high density due to closed packing and it is used for manufacturing buckets, dustbins, bottles.

Select correct option regarding these statement(s)

(1) Both statements are correct, and the statement -2 is the correct explanation for the statement-1

(2) Both statements are correct, and the statement-2 is the NOT correct explanation for the statement-1

(3) The statement-1 is incorrect, but the statement-2 is correct

(4) Both statements are incorrect

Answer: (1)

Solution:

High density polythene: It is formed when addition polymerization of ethene takes place in a hydrocarbon solvent in the presence of catalyst such as triethyl aluminium and titanium tetrachloride (Ziegler-Natta catalyst) at a temperature of 333K to 343K and under a pressure of 6-7 atmospheres. High density polythene (HDP) thus produced, consists of linear molecules and has high density due to close packing. It is also chemically inert and more tougher and harder. It is used for manufacturing buckets, dustbins, bottles, pipes, etc.

Question 13. If concentration of fluoride ion is up to 1 ppm, then which of the following options may be correct:

(1) Good for teeth

(2) Harmful for teeth and cause brown mottling of teeth

(3) Harmful for bones and teeth.

(4) Harmful for the growth of children.

Answer: (1)

Solution:

Soluble fluoride is often added to drinking water to make concentration upto 1 ppm because F- ions make the enamel

on teeth much harder. But above 2 ppm cause brown mottling of teeth. Cause harmful effect on bones and teeth

Question 14. Which of the following Lanthanides element do not show stable +4 oxidation state?

(1) Eu

(2) Dy

(3) Tb

(4) Ce

Answer: (1)

Solution:

$Cu(z = 63) = 4F_7 6s_2$

$Dy(z = 66) = 4F_{10} 6s_2$

$Tb(z = 65) = 4F_9 6s_2$

$Ce(z = 58) = 4F_{15} d_{16} s_2$
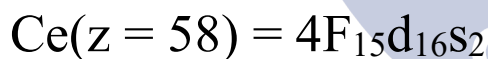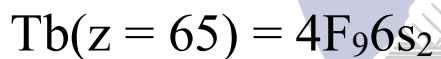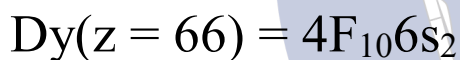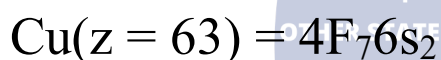
Dy, Tb and Ce show +4 oxidation state while Eu do not show +4 oxidation state.

Question 15. Value of Equilibrium constant at two different temperature is given as

Temperature	equilibrium constant
$T_1 = 50°C$	$k_1 = 10$
$T_2 = 100°C$	$k_2 = 100$

Then the value of ΔH of reaction, ΔG_1 and ΔG_2 (in KJ) at temperature T_1 and T_2 respectively are:

(1) 46.14, -6.2, -14.3

(2) -46.14, +6.2, +14.3

(3) +46.14, +6.2, +14.3

(4) -46.14, -6.2, +14.3

Answer: (1)

Solution:

$T_1 = 323 \text{ K} \quad T_2 = 373 \text{ K}$

$k_1 = 10 \quad k_2 = 100$

$\log\left(\dfrac{k_2}{k_1}\right) = \dfrac{\Delta H}{2.303R}\left[\dfrac{1}{T_1} \quad \dfrac{1}{T_2}\right]$

$\log\left(\dfrac{100}{10}\right) = \dfrac{\Delta H}{2.303 \times 8.314}\left[\dfrac{1}{323} - \dfrac{1}{373}\right]$

$\log 10 = \dfrac{\Delta H}{2.303 \times 8.314}\left[\dfrac{50}{323 \times 373}\right]$

$\Delta H = \dfrac{2.303 \times 8.314 \times 323 \times 373}{50} = 46136.5$

At $T_1 = 50°C = 323 \text{ K}, K_1 = 10$

$$\Delta G = -2.303RT_1 \log K_1$$

$$= -2.303 \times 8.314 \times 323 \times \log(10)$$

$$= -2.303 \times 8.314 \times 323 \times 1$$

$$= -6184.5 \text{ KJ}$$

$$= -6.2 \text{ KJ}$$

At $T_2 = 100°C = 373 \text{ K}$, $K_2 = 100$

$$\Delta G = -2.303RT_2 \log K_2$$

$$= -2.303 \times 8.314 \times 373 \times \log(10)^2$$

$$= -2.303 \times 2 \times 8.314 \times 373 \times 1$$

$$= -14283.7 \text{ KJ}$$

$$= -14.3 \text{ KJ}$$

Question 16. Identify correct set of Atomic numbers belongs to transition element series

(1) 9, 21, 25, 72

(2) 21, 25, 29, 57

(3) 21, 25, 30, 57

(4) 29, 48, 57, 72

Answer: (2)

Solution:

A transition element is defined as the one which has incompletely filled d orbitals in its ground state or in any one of the oxidation state.

Zn(z = 30), Cd(z = 48), Hg(z = 80) are not transition element.

Question 17. Micelles formation takes place.

(1) below kraft temperature.

(2) above kraft temperature

(3) below critical micelles concentration (CMC)

(4) have no relation with craft temperature.

Answer: (2)

Solution:

(1) Micelles formation take place only above a particular temperature called as kraft temperature (T_k)

(2) Concentration above which micelle formation become appreciable is critical micelles concentration.

Question 18. Following graph is obtained for four different reactions
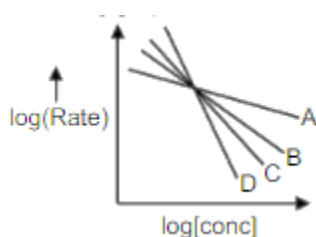
On the basis of above graph, correct increasing order of order of reaction is

(1) A < B < C < D

(2) D < C < B < A

(3) A < B < D < C

(4) D < C < A < B

Answer: (1)

Solution:

Rate = K[Conc]order

logRate = log K + order log[conc]

so slope of graph is order of reaction.

greater the slope greater is order of reaction

So order of reaction $\Rightarrow$ "A < B < C < D"

Question 19. Which of the following complex show magnetic moment (spin only) = 5.91 BM

(1) $[Ni(CO)_4]$

(2) $[FeF_6]^{3-}$

(3) $[Fe(CN)_6]^{3-}$

(4) $[Cr(H_2O)_6]^{3+}$

Answer: (4)

Solution:

$\Rightarrow \mu = 5.91$ BM so unpaired e- = 5

	Complex	Electronic configuration	Unpaired e-
(1)	$[Ni(CO)_4]$	$28Ni = 3d_04s_0$	0
(2)	$[FeF_6]^{3-}$	$Fe^{3+} = 3d_5 \Rightarrow t2g1,1,1, eg1,1$	5
(3)	$[Fe(CN)_6]^{3-}$	$Fe^{3+} = 3d_5 \Rightarrow t2g2,2,1, eg0,0$	1
(4)	$[Cr(H_2O)_6]^{3+}$	$Cr^{3+} = 3d_3 \Rightarrow t2g1,1,1, eg0,0$	3

Question 20. Which of the following is not correct for alloys.

(1) German Silver   Cu, Zn, Ni

(2) Brass   Cu, Zn, Ni

(3) Bronze   Cu, Sn

(4) Bell Metal   Cu, Sn

Answer: (2)

Solution:

S.No	Alloy	Composition
1.	Bronze	Cu (75 – 90%) + Sn (10, 25%)
2.	Brass	Cu (60 – 80%) + Zn (20 - 40%)
3.	German Silver	Cu (50 – 62%) + Zn (17 - 19%) + Ni (21 – 30%)
4.	Bell Metal	Cu (80%) + Sn (20%)

Question 21. How many total no of "Cl = O" bond are present in structure of per chloric acid

Answer: 03.00

Solution:

Per chloric acid $\Rightarrow HClO_4$
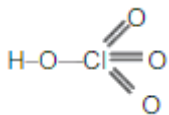
Total Cl = 0 bonds = 3

Mathematic

Question 22. If $\sum_{i=1}^{n}(x_i - a) = n$ and $\sum_{i=1}^{n}(x_i - a)^2 = na$, then the standard deviation of variate xi

(1) $\sqrt{a^2 - 1}$

(2) $\sqrt{a - 1}$

(3) $\sqrt{n^2 a - 1}$

(4) $\sqrt{a^2 n^2 - n}$

Ans.   (2)

Sol. S.D. $= \sqrt{\dfrac{\sum_{i=1}^{n} x_i^2}{n} - \left(\dfrac{\sum_{i=1}^{n} x_i}{n}\right)^2}$

$= \sqrt{\dfrac{\sum_{i=1}^{n}(x_i - a)^2}{n} - \left(\dfrac{\sum_{i=1}^{n}(x_i - a)}{n}\right)^2}$

$$= \sqrt{\frac{na}{n} - \left(\frac{n}{n}\right)^2} = \sqrt{a-1} \ .$$

Question 23. Negation of $p \vee (q \wedge \sim p)$ is

    (1) $p \wedge q$

    (2) $\sim p \vee \sim q$

    (3) $\sim p \vee q$

    (4) $\sim p \wedge \sim q$

Ans. (4)

Sol. Given statement is $p \vee (q \wedge \sim p)$

$= (p \vee q) \wedge (p \vee \sim p)$

$= (p \vee q) \wedge t$

$= p \vee q$.

$\therefore$ Negation is $\sim (p \vee (q \wedge \sim p)) = \sim (p \vee q) = \sim p \wedge \sim q$

Question 24. There are three families in which 2 families has 3 members each and third family has 4 members. They are arranged in a line, then probability that members of same family are together, is

    (1) $\dfrac{1}{700}$

(2) $\dfrac{3}{700}$

(3) $\dfrac{3}{720}$

(4) $\dfrac{9}{730}$

Ans. (1)

Sol. $P(A) = \dfrac{3! \times 3! \times 3! \times 4!}{10!} = \dfrac{6 \times 6 \times 6}{10 \times 9 \times 8 \times 7 \times 6 \times 5} = \dfrac{1}{700}$

Question 25. If roots of quadratic equation $x^2 - 64x + 256 = 0$ are $\alpha \,\&\, \beta$ then $\left(\dfrac{\alpha^3}{\beta^5}\right)^{\frac{1}{8}} + \left(\dfrac{\beta^3}{\alpha^5}\right)^{\frac{1}{8}} =$

(1) 2

(2) 6

(3) -2

(4) 5

Ans. (1)

Sol. $\alpha + \beta = 64,\ \alpha\beta = 256$

$\left(\dfrac{\alpha^3}{\beta^5}\right)^{\frac{1}{8}} + \left(\dfrac{\beta^3}{\alpha^5}\right)^{\frac{1}{8}}$

$$= \frac{\alpha^{\frac{3}{8}+\frac{5}{8}} + \beta^{\frac{3}{8}+\frac{5}{8}}}{(\alpha\beta)^{5/8}} = \frac{\alpha+\beta}{(\alpha\beta)^{5/8}}$$

$$= \frac{64}{(256)^{5/8}} = \frac{64}{32} = 2$$

Question 26. $\lim\limits_{x \to 1} \dfrac{\int\limits_{0}^{(x-1)^2} t\cos t\, dt}{(x-1)\sin(x-1)}$ is equal to

   (1) 2

   (2) 0

   (3) 1

   (4) Does not exist

Ans. (2)

Sol. $\lim\limits_{x \to 1} \dfrac{2(x-1)\cdot(x-1)^2\cos(x-1)^2 - 0}{\operatorname{Sin}(x-1)+(x-1)\cos(x-1)}$

$$= \lim\limits_{x \to 1} \frac{2(x-1)^3\cos(x-1)^2 - 0}{(x-1)\left(\dfrac{\operatorname{Sin}(x-1)}{x-1}+\cos(x-1)\right)} = \frac{0}{1+1} = 0$$

Question 27. If $I_1 = \int\limits_0^1 \left(1-x^{50}\right)^{100} dx$ and $I_2 = \int\limits_0^1 \left(1-x^{50}\right)^{101} dx$ and $I_1 = \lambda I_2$, then λ is

(1) $\dfrac{5051}{5050}$

(2) $\dfrac{5050}{5051}$

(3) 1

(4) $\dfrac{5049}{5050}$

Ans. (1)

Sol. $\lambda = \dfrac{I_1}{I_2} = \dfrac{\int\limits_0^1 \left(1-x^{50}\right)^{100} dx}{\int\limits_0^1 \left(1-x^{50}\right)^{101} dx}$

$I_2 = \int\limits_0^1 \left(1-x^{50}\right)\left(1-x^{50}\right)^{100} dx$

$I_2 = I_1 - \int\limits_0^1 x.x^{49}\left(1-x^{50}\right)^{100} dx$

$I_2 = I_1 - \left[\dfrac{-x\left(1-x^{50}\right)^{101}}{5050}\right]_0^1 - \int\limits_0^1 \dfrac{\left(1-x^{50}\right)^{101}}{5050} dx$

$I_2 = I_1 - \dfrac{I_2}{5050}$

$\Rightarrow \lambda = \dfrac{I_1}{I_2} = \dfrac{5051}{5050}$.

Question 28. If $\vec{a}, \vec{b}, \vec{c} \ \& \ \vec{d}$ and position vector of point A, B C and D respectively in 3-D space. No three of A, B, C, D are collinear and satisfy the relation $3\vec{a} - 2\vec{b} + \vec{c} - 2\vec{d} = 0$ then

    (1) A, B, C and D coplanar

    (2) the line joining points B and D divides the line joining points A and C in the ratio 2: 1

    (3) the line joining point A and C divides the line joining points B and D in the ratio 1: 2

    (4) the four vectors $\vec{a}, \vec{b}, \vec{c} \ \& \ \vec{d}$ are linearly independent

Ans. (1)

Sol. $3\vec{a} + \vec{c} = 2\left(\vec{b} + \vec{d}\right)$

$$\Rightarrow \frac{3\vec{a} + \vec{c}}{3 + 1} = \frac{\vec{b} + \vec{d}}{2}$$

Point P divides the line joining A and C in ration 1:3 and bisects the line joining B and D