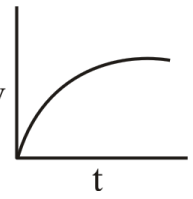
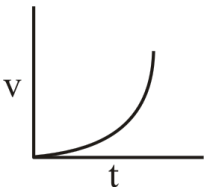
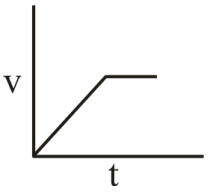
PART-A-PHYSICS

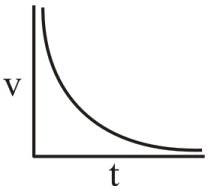
SECTION-I(i)

1) A piece of cork starts from rest at the bottom of a lake and floats up. Its velocity v is plotted against time t. Which of the following best represents the resulting curve?

(A) 

(B) 

(C) 

(D) 

2) Two drops of same radius are falling through air with steady velocity of v cm/s. If the two drops coalesce, what would be the terminal velocity?

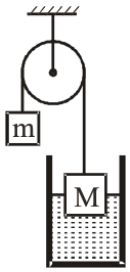
(A) 4 v

(B) $(4)^{1/3}$ v

(C) 2 v

(D) 64 v

3) To one end of thread thrown over the pulley we suspended load of mass M = 10kg, made from a material of specific gravity 2.5. The mass M is suspended in a container with water. By the other end of the thread we suspended a mass m (see figure). For what minimum value of m (in kg) if mass



M can float in liquid in equilibrium? (Friction negligible everywhere)

(A) 2

(B) 4

(C) 6

(D) 8

4) A capillary tube of radius R is immersed in water and water rises in it to a height h. Mass of water in capillary tube is M. If the radius of the tube is doubled, mass of water that will rise in the capillary tube will be

(A) 2 M

(B) M

(C) $\frac{M}{2}$

(D) 4M

5) The length of a metal wire is ℓ_1 when the tension in it is T_1 and is ℓ_2 when the tension is T_2. The natural length of the wire is :-

(A) $\frac{\ell_1 + \ell_2}{2}$

(B) $\sqrt{\ell_1 \ell_2}$

(C) $\frac{\ell_1 T_2 - \ell_2 T_1}{T_2 - T_1}$

(D) $\frac{\ell_1 T_2 + \ell_2 T_1}{T_2 + T_1}$

6) A rod of length 2m rests on a smooth horizontal floor. If the rod is heated from 0°C to 20°C. Find the longitudinal strain developed ? ($\alpha = 5 \times 10^{-5}$/°C)

(A) 10^{-3}

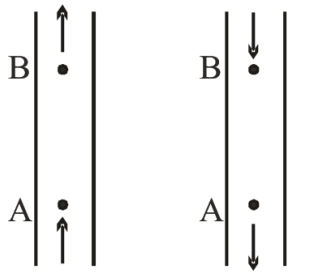
(B) 2×10^{-3}

(C) Zero

(D) None

SECTION-I(ii)

1) Two tubes of uniform cross-section are held vertically. v_A and v_B are the velocities of fluid flow at A and B respectively, and p_A and p_B are pressure at A and B respectively. Arrow show the direction of



fluid flow. Case-I Case-II

(A) In case I, $v_A > v_B$ & $p_A > p_B$

(B) In case I, $v_A = v_B$ & $p_A > p_B$

(C) In case II, $v_A > v_B$ & $p_A < p_B$

(D) In case II, $v_A = v_B$ & $p_A > p_B$

2) A solid sphere of radius r and density ρ_s is dropped in a liquid of density ρ_ℓ and coefficient of viscosity η then choose the **CORRECT** option(s) : (Depth of liquid is large enough & $\rho_s > \rho_\ell$)

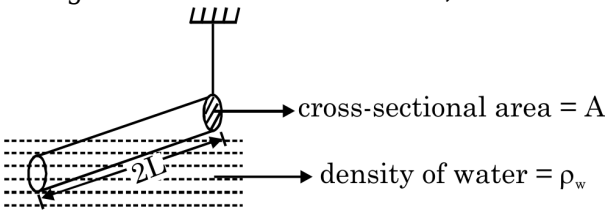
(A) Buoyant force applied by liquid on ball is $\frac{4}{3}\pi r^3 \rho_\ell g$.

(B) Viscous force applied by liquid on sphere when speed of sphere is v is $6\pi\eta rv$.

(C) Initially speed of sphere increases and then becomes constant at steady-state.

(D) Terminal velocity of sphere is $\frac{2}{9}\frac{r^2(\rho_s - \rho_\ell)g}{\eta}$

3) A cylinder homogeneous rod of length 2L floats partly immersed in water, being supported by a string fastened to one of its ends, as shown. The specific gravity of the rod is 0.75. Then –



(A) The length of rod that extends out of water is 'L'

(B) The length of rod that extends out of water is $\frac{L}{2}$

(C) Tension in the string is $\frac{1}{2}\rho_w ALg$

(D) Tension in the string is $\rho_w ALg$

4) A rod is oscillating in vertical plane such that it's time period of oscillation is 2 sec. It is hinged at it's end. It has coefficient of linear expansion 2×10^{-5}°C. If the temperature increases by 10°C, (Take $g = \pi^2$ m/s^2)

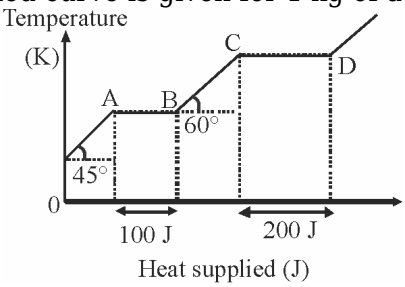
(A) It's original length is 1.5 m

(B) It's time period increases by 10^{-4} sec. (approx.)

(C) It's time period decreases by 2×10^{-4} sec. (approx.)

(D) It's original length is 3m

5) The temperature change versus heat supplied curve is given for 1 kg of a solid block. Then, which of the following statements(s) is/are correct ?



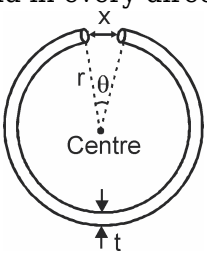
(A) Specific heat capacity of the solid is 1 J/kg K.

(B) Specific heat capacity of liquid phase is $\sqrt{3}$ J/kg K.

(C) Latent heat of vaporization is 100 J/kg.

(D) Latent heat of vaporization is 200 J/kg.

6) A uniform metallic object of circular shape which is free to expand in every direction is shown in figure. The parameter which will increase on heating the object is :



(A) x (gap)

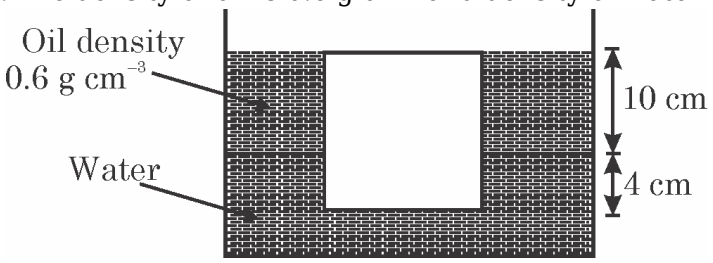
(B) r (radius of circle)

(C) q (angle formed at centre)

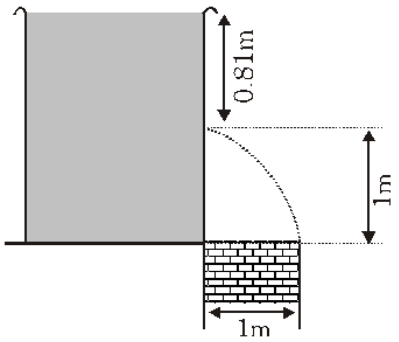
(D) t(thickness)

SECTION-III

1) A block of wood of height 14 cm and base area 100 cm^2, floats at the interface of oil and water as shown in figure. The density of oil is 0.6 g cm^{-3} and density of water is 1 g cm^{-3}. The mass of the block is :(in kg)

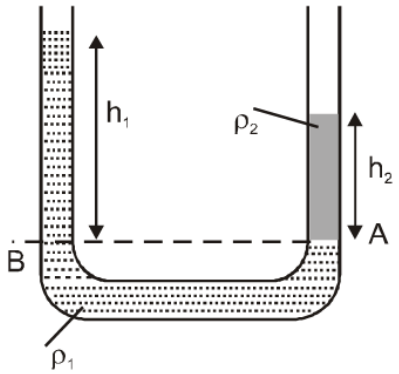


2) For the arrangement shown in the figure. The time interval in seconds after which the water jet ceases to cross the wall is found to be $(A)^3$. Area of the cross section of the tank $A = \sqrt{5}\ m^2$ and area of the orifice a=32 cm^2. [Assume that the container remaining fixed]. Find the value of A. (Take g =



10 m/s^2)

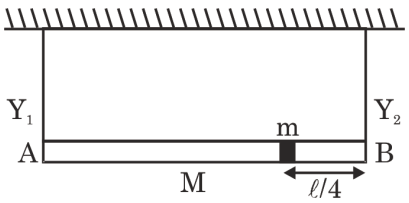
3) Two immiscible liquids are poured in a U-tube having densities $\rho_1 = 1.0 \times 10^3\,kg/m^3$ and $\rho_2 = 3.0 \times 10^3\,kg/m^3$. Find the ratio of heights (of the liquids above their interface) $\frac{h_1}{h_2}$.



4) 1 kg water of specific heat 1 cal/gm-°C is kept in a container at 10°C. If 500 gm of ice at 0°C is required to cool down the water from 10°C to 0°C, the water equivalent of container in Kg is :-
(Latent of fusion for ice = 80 cal/gm and specific heat of water is 1 cal/gm-°C)

5)

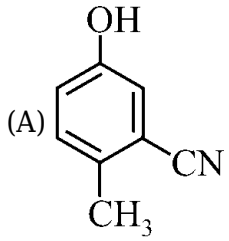
A rigid rod AB of mass M and length ℓ is suspended horizontally from two vertical wires having same length and same area of cross-section. When a mass 'm' is placed at a distance $\frac{\ell}{4}$ from end B, rod remains horizontal. if the ratio of Young modulus of two wires $\frac{Y_1}{Y_2}$ is $\left(\frac{xM+m}{2M+ym}\right)$ then find the value of x + y.

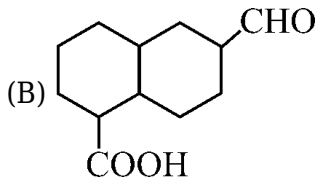


PART-B-CHEMISTRY

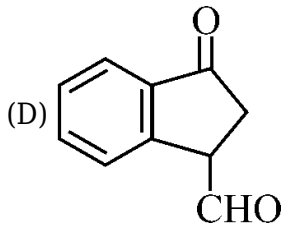
SECTION-I(i)

1) Which of the following has odd number of degree of unsaturation ?

(A) 

(B) 

(C) $H_3C–C\equiv C–Ph$

(D) 

2) The IUPAC name of C_6H_5COCl is

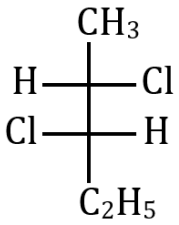
(A) Benzoyl chloride
(B) Benzene chloro ketone
(C) Benzene carbonyl chloride
(D) Chloro phenyl ketone

3)

Number of carbon(s) in 1st member of homologous series of ester is :

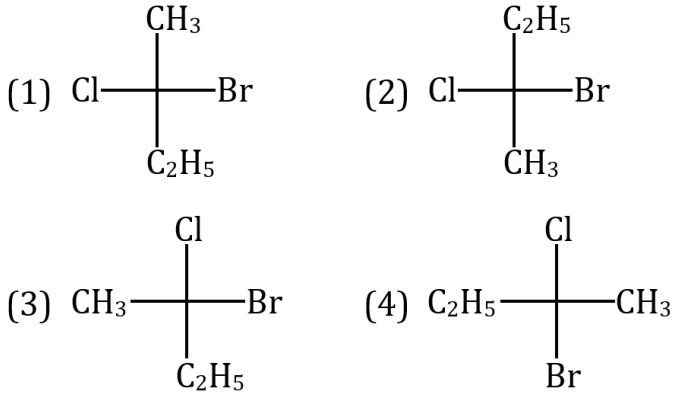
(A) 1
(B) 2
(C) 3
(D) 4

4) The absolute configuration of the following compound is :–



(A) 2S, 3R
(B) 2S, 3S
(C) 2R, 3S
(D) 2R, 3R

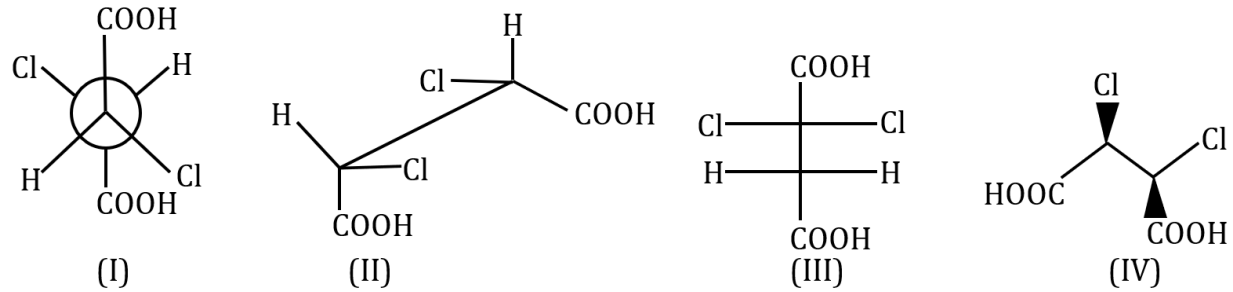
5) Consider the following structures (1), (2), (3) and (4) -



Which of the following statements is not correct

(A) (2) and (3) are identical
(B) (1) and (2) are enantiomers
(C) (1) and (3) are enantiomers
(D) (2) and (4) are enantiomers

6) For the given configuration :



Which of the compound/configuration are optically active :

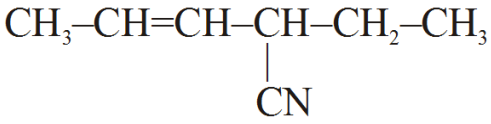
(A) I
(B) II
(C) III
(D) IV

SECTION-I(ii)

1) Which of the following is/are **INCORRECT** IUPAC names

(A) 2-Ethyl-3-methyl pentane
(B) 1-amino butane-1-one
(C) 3-Methyl pentane
(D) 4-(1, 1-dimethyl ethyl)-2-methyl pentane

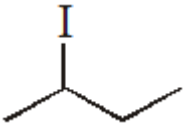
2) What is the incorrect IUPAC name of the following :

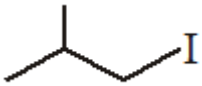


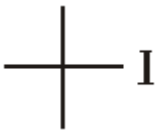
(A) 4-Cyano hex-2-ene
(B) Hex-4-ene-3-nitrile
(C) 2-Ethyl pent-3-ene nitrile
(D) 2-(prop-1-enyl) butane nitrile

3) Which of the following represent t-butyl iodide :

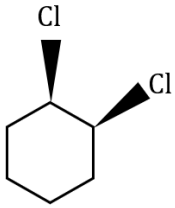
(A) 

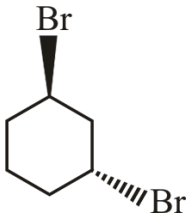
(B) 

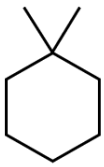
(C) 

(D) 

4) Which of the following compounds has one of the stereoisomer as a meso compound?

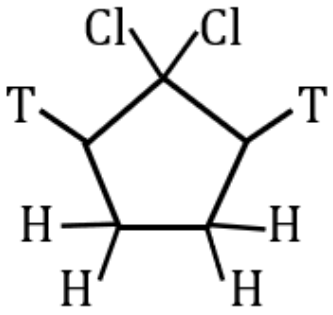
(A) 

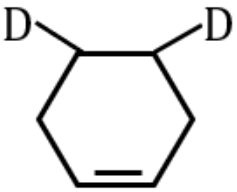
(B) 

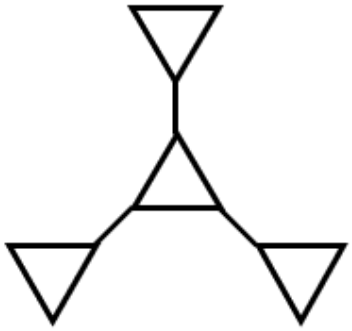
(C) 

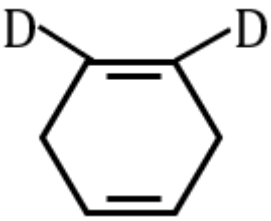
(D) 

5) Which will show geometrical isomerism -

(A) 

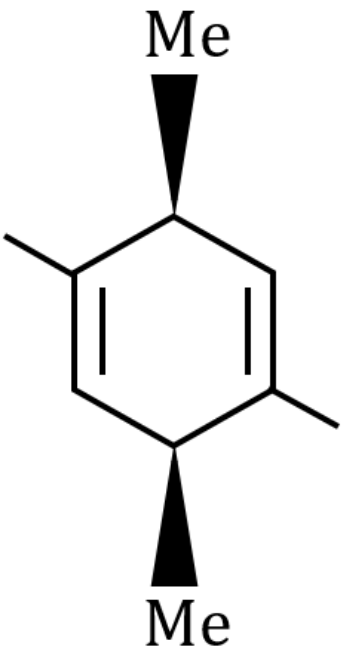
(B) 

(C) 

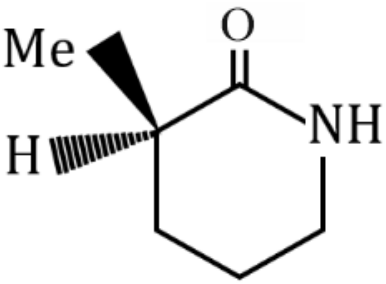
(D) 

6) Which of the following compounds is chiral ?

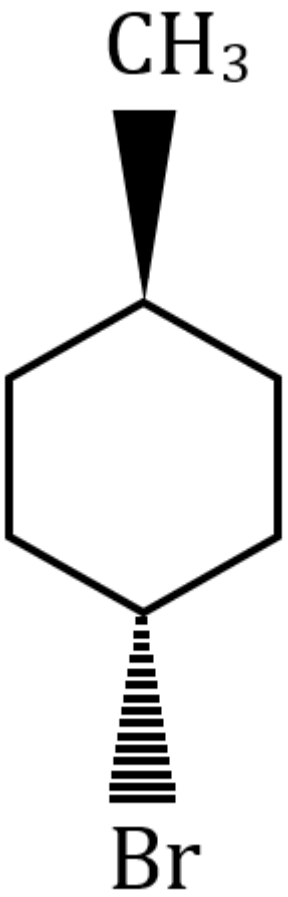
(A)

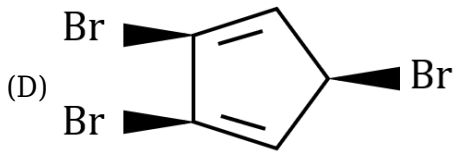


(B)



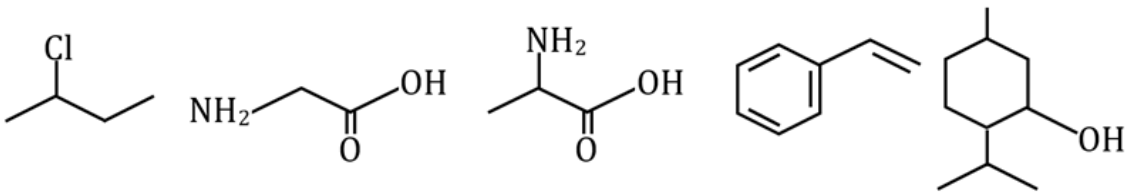
(C)



(D) 

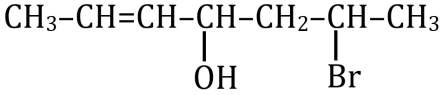
SECTION-III

1) Observe structures of the following compound



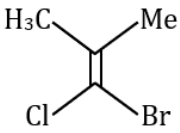
The total number of structures/compounds which possess asymmetric carbon atoms is _____.

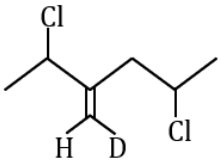
2) Calculate the total number of stereoisomers for the given compound :

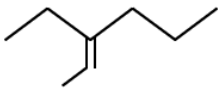


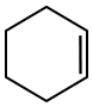
3) Find the total number of isomers of C_7H_{14} (only 5-membered ring).

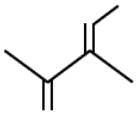
4) How many number of molecules which usually can show geometrical isomerism (at room temperature)

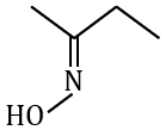
(I) 

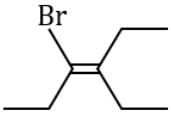
(II) 

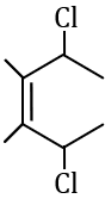
(III) 

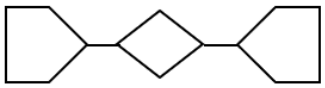
(IV) 

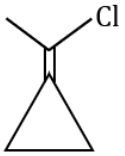
(V) 

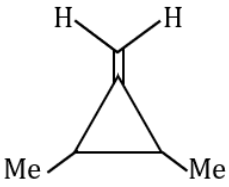
(VI) 

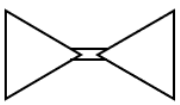
(VII) 

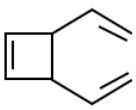
(VIII) 

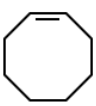
(IX) 

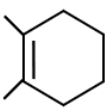
(X) 

(XI) 

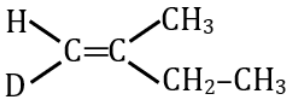
(XII) 

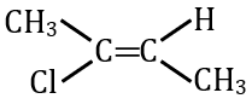
(XIII) 

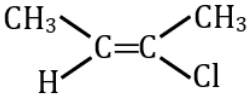
(XIV) 

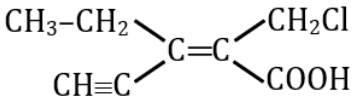
(XV) 

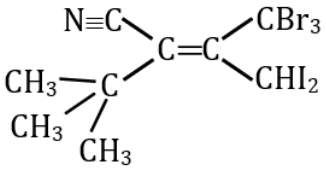
5) Number of compounds having z-configuration:

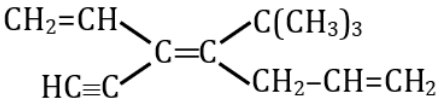
(i) 

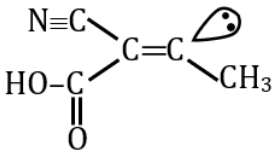
(ii) 

(iii) 

(iv) 

(v) 

(vi) 

(vii) 

PART-C-MATHEMATICS

SECTION-I(i)

1)

If (201)! is divided by 24^k, then the largest value of k is

(A) 98

(B) 65

(C) 49

(D) 66

2) A grid is formed by taking x, y ∈ I such that $|x| \leq 5$, $|y - 1| \leq 6$ and $xy \geq 0$, then number of ways of reach from (–5, –5) to (5, 7) by using shortest path is

(A) $\frac{\lfloor 10}{\lfloor 5 \lfloor 5} \times \frac{\lfloor 12}{\lfloor 7 \lfloor 5}$

(B) $\frac{\lfloor 22}{\lfloor 10 \lfloor 12}$

(C) $\frac{\lfloor 9}{\lfloor 4 \lfloor 4} \times \frac{\lfloor 11}{\lfloor 6 \lfloor 4}$

(D) $\frac{\lfloor 20}{\lfloor 9 \lfloor 11}$

3) The total number of positive integral solution of $15 < x_1 + x_2 + x_3 \leq 20$ is equal to

(A) 685

(B) 785

(C) 1125

(D) None of these

4) The unit place digit of the number $(1! + 2! + 3! + ... + 2005!)^{500}$ is

(A) 3
(B) 9
(C) 1
(D) 7

5) Let S ={1,2,3,....9}. For k = 1, 2, ...5, let N_k be the number of subsets of S, each containing five element out of which exactly k are odd. Then $N_1 + N_2 + N_3 + N_4 + N_5$ =

(A) 125
(B) 252
(C) 210
(D) 126

6) If all the words with or without meaning made using all the letters of the word "NAGPUR" are arranged as in a dictionary, then the word at 315^{th} position in this arrangement is

(A) NRAGUP
(B) NRAGPU
(C) NRAPGU
(D) NRAPUG

SECTION-I(ii)

1) For the word "Platonic" which of the following are correct ?

(A) Number of four letter words with no letter being repeated formed is 336.
(B) Number of four letter words with no letter being repeated formed is 1680.
(C) Number of four letter words with no letter being repreated formed such that the letter P always appear in every word is 840.
(D) Number of four letter words with no letter being repeated formed such that the letter P always appear in every word is 210.

2) All possible words are formed from the letters of the word **INTEGER**. Let m_1 be the number of such words in which I and N are never together and m_2 be the number of such words which begin with I and end with R, then

(A) $m_1 = 1800$
(B) $m_1 = 60$
(C) $m_2 = 60$
(D) $m_2 = 30$

3) If 'N' denotes number of ways in which 15 identical coins can be distributed among A, B, C, D

such that Mr. 'A' must get atleast '2' coins and Mr. D must get atleast '4' coins, then

(A) Number of divisors of '2N' are '16'

(B) Number of divisors of '2N' are '18'

(C) Number of even divisors of '2N' are '12'

(D) Number of divisors of '2N' which are divisible by 2 but not divisible by 5 are '6'

4) A shopkeeper places before you 41 different toys out of which 20 toys are to be purchased. Suppose m = number of ways in which 20 toys can be purchased without any restriction and n = number of ways in which a particular toy is to be always included in each selection of 20 toys, then (m - n) can be expressed as

(A) $\frac{2^{10}}{20!}(1.3.5....39)$

(B) $\frac{2^{20}(1.3.5....19)}{10!}$

(C) $\prod_{r=0}^{19}\left(\frac{4r+2}{20-r}\right)$

(D) $\left(\frac{21}{1}\right)\left(\frac{22}{2}\right)\left(\frac{23}{3}\right)....\left(\frac{40}{20}\right)$

5) 5 friends can be accommodated in 5 different rooms of a hotel in N ways such that there are not more than 2 friends in any of the rooms, then

(A) N is a perfect square

(B) Sum of digits of N is 6

(C) N is not divisible by 7

(D) N has 24 factors

6) All the 7-digit Numbers containing each of the digits 1, 2, 3, 4, 5, 6, 7 exactly once, and not divisible by 5, are arranged in increasing order. Then which of the following is/are **CORRECT** ?

(A) 1993rd number in the list is 4312567

(B) 1996th number in the list is 4312756

(C) 2000th number in the list is 4315672

(D) 1999th number in the list is 43152763

SECTION-III

1) Value of $\frac{{}^{100}C_7 + 2.{}^{100}C_6 + {}^{100}C_5}{{}^{102}C_7}$ is

2) In a plane there are '4' circle & '6' straight lines and maximum number of their intersection points is N then, $\frac{N}{15}$ is equal to

3) We have 19 identical gems available with us which are needed to be distributed among A,B and C such that A always gets an even number of gems. If the number of ways this can be done is K then find the value of $\left(\frac{K}{22}\right)$?

4) Four horses compete in a race. Let N be the total number of different orders in which the horses can cross the finish line. Assume that all four horses finish the race and two or more horses can cross the finishing line together. The value of $\left[\frac{N}{10}\right]$ is (where [.] denotes greatest integer function)

5) If n is the number of numbers divisible by 5 between 3000 to 6000 that having different digits, then $\frac{n}{35}$ is

ANSWER KEYS

PART-A-PHYSICS

SECTION-I(i)

Q.	1	2	3	4	5	6
A.	A	B	C	A	C	C

SECTION-I(ii)

Q.	7	8	9	10	11	12
A.	B,D	A,B,C,D	A,C	A	A,D	A,B,D

SECTION-III

Q.	13	14	15	16	17
A.	1	5	3	3	5

PART-B-CHEMISTRY

SECTION-I(i)

Q.	18	19	20	21	22	23
A.	D	C	B	B	D	B

SECTION-I(ii)

Q.	24	25	26	27	28	29
A.	A,B,D	A,B,D	D	A,B	A,B,C	A,B

SECTION-III

Q.	30	31	32	33	34
A.	3	8	8	9	3

PART-C-MATHEMATICS

SECTION-I(i)

Q.	35	36	37	38	39	40
A.	B	A	A	C	D	C

SECTION-I(ii)

Q.	41	42	43	44	45	46
A.	B,C	A,C	A,C,D	C,D	B,C,D	A,B,C

SECTION-III

Q.	47	48	49	50	51
A.	**1**	**5**	**5**	**7**	**8**

SOLUTIONS

PART-A-PHYSICS

1) As the cork moves up, the force due to buoyancy remains constant. As its speed increases, the retarding force due to viscosity increases, being proportional to the speed. Thus the acceleration gradually decreases. The acceleration is variable, and hence the relation between velocity and time is not linear.

2) $\frac{4\pi r^3}{3} \times 2 = \frac{4}{3}\pi R^3$

$V_T = \frac{2R^2 g}{9n}(\delta_S - \delta_L)$

$2^{1/3} r = R$

$v \propto r^2$

$V_T = 2^{2/3} v$

$V_T = 4^{1/3} v$

3) $Mg = mg + B$

$Mg = mg + p_2 \times \frac{M}{p_1} g$

$M\left(1 - \frac{p_2}{p_1}\right) = m = 6 \text{ kg}$

4) $h = \left[\frac{2T\cos\theta}{\rho g r}\right]$

if radius = 2r

then height = $\frac{h}{2}$

$M = (\pi r^2) h\rho$

$M' = \pi[2r]^2 \frac{h}{2}\rho$

$M' = 2M$

5) Let the natural length of wire = □

Change in length (□₁ – □) when tenstion T_1.

and cange in length (□₂ – □) when tenstion T_2.

□ (□₁ – □) = $\frac{T_1 \ell}{YA}$ ...(i)

l2 – □ = $\frac{T_2 \ell}{YA}$ ...(ii)

$\frac{\ell_1 - \ell}{\ell_2 - \ell} = \frac{T_1}{T_2}$ ⇒ □₁T₂ – □T₂ = □₂T₁ –□T

$\ell = \frac{\ell_1 T_2 - \ell_2 T_1}{\ell_2 - \ell_1}$

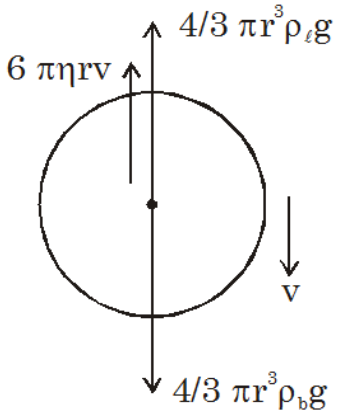
6) strain = 0

7)

In both cases $V_A = V_B$

$$\frac{p_A}{p_g} + \frac{v^2}{y} = \frac{p_B}{p_g} + \frac{v^2}{y} + h$$

$p_A > p_B$ in both cases.

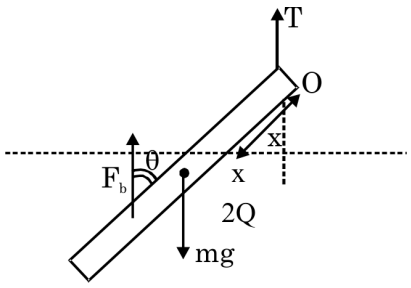


8)

Buoyant Force = $v_{in}r_{□}g$

viscous force = 6πηrv

when speed becomes constant $\vec{F}_{net}$ must be zero



9)

Take torque about O,

$$mgL\sin q - F_b\left(L + \frac{x}{2}\right)\sin\theta = 0$$

$$0.75\rho_w(A)(2L)gL = \rho_w(A)(2L-x)g\left(L + \frac{x}{2}\right)$$

[x = L]

⇒ Net force on rod = 0

$T + F_b = mg$

$T + \rho_l V_S g = \rho_B V g$

$T = \rho_B V g - \rho_l V_s g$

$T = \rho_B (A2L)\, g - \rho_l (ALg)$

$$T = \frac{3\rho_l A\,(2L)\,g - \rho_l A\,lg}{4}$$

$$T = \frac{1}{2}\rho_l ALg$$

10) **New Ans. (A,C) By Hemant Sahu Sir**

11)

$\Delta Q = mS\Delta T$

$\left(\Delta T = \frac{1}{ms}\Delta Q\right)$

slope of T – Q curve = $\frac{1}{ms}$

$mL_V = 200$

$mL_f = 100$

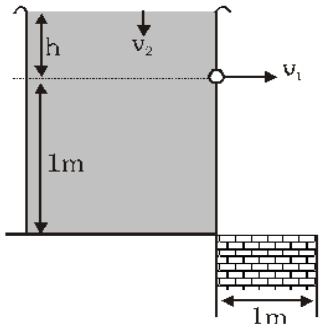
12) $\theta = \frac{x}{r} \Rightarrow \theta' = \frac{x + \Delta x}{R + \Delta R} = \frac{x(1 + \alpha\Delta T)}{R(1 + \alpha\Delta T)} = \frac{x}{R}$

13) P_{bottom} $0.6 \times 1 \times g \times 10 + 1 \times g$ 4]

10g

$F = 10\cancel{g}(10 \times 10) = m\cancel{g}$

m = 1000 gm = 1 kg



14)

For minimum velocity at orifice

$\Rightarrow (v_{min}) \times \sqrt{\frac{2h}{g}} = 1 \Rightarrow v_{min} = \sqrt{5}$ m/s

This will give us minimum height for this velocity

$\Rightarrow \sqrt{2gh_{min}} = \sqrt{5} \Rightarrow h_{min} = \frac{1}{4}m = 0.25m$

$v_1 = \sqrt{2gh}$ & $v_2 = -dh/dt$

By equation of continuity $av_1 = Av_2$

$\Rightarrow a\sqrt{2gh} = A\left(-\frac{dh}{dt}\right) \Rightarrow \int_{0.81}^{0.25} \frac{dh}{\sqrt{h}} = \int_0^t \frac{\left(a\sqrt{2g}\right)}{A}dt$

$\Rightarrow t = 125$ sec $= (5)^3 = (A)^3 \Rightarrow a = 5$

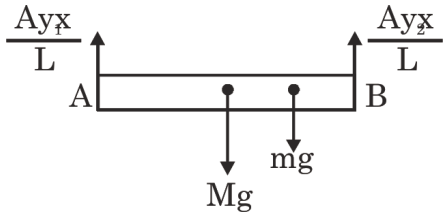
15) $p_0 + \rho_1 g h_1 = p_0 + \rho_2 g h_2$

$\Rightarrow \frac{h_1}{h_2} = \frac{\rho_2}{\rho_1} = 3$

16) $(m + 1000) \times 1 \times 10 = 50 \times 80$

$(m + 1000) = 4000$

m = 3000 gm = 3 kg



17)

$$\frac{Ax}{L}(Y_1 + Y_2) = (M + m)g$$

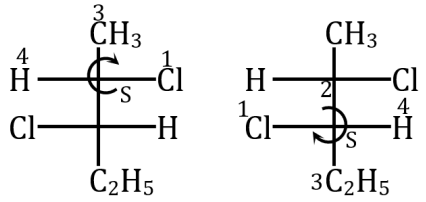
$$\left(\frac{Ay_1x}{L}\right)\frac{\ell}{2} + mg \times \frac{\ell}{4} = \left(\frac{Ay_2x}{L}\right)\frac{\ell}{2}$$

$$\frac{Y_1}{Y_2} = \frac{2M + m}{2M + 3m}$$

PART-B-CHEMISTRY

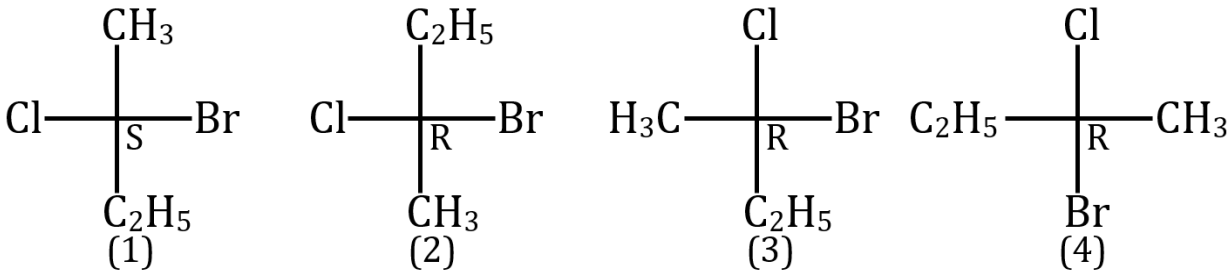
18) DU

(A) 6
(B) 4
(C) 6
(D) 7



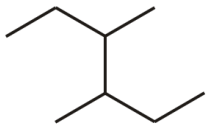
21)
2S, 3S

22)

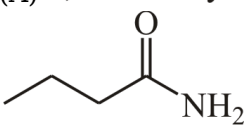


⇒ (2) & (4) are not enantiomers, they are identical.

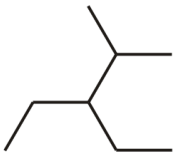
23) (I), (IV) have centre of symmetry and (iii) have plane of symmetry.
II) have no plane of symmetry , no centre of symmetry and no alternate axis of symmetry.



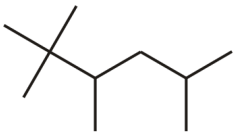
24) (A) 3,4-dimethyl hexane



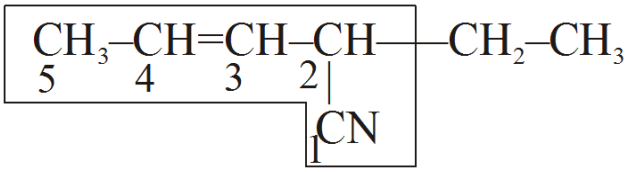
(B) butanamide



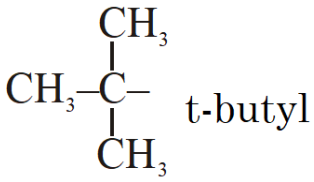
(C) 3-ethyl-2-methyl pentane



(D) 2,2,3,5-tetramethyl hexane

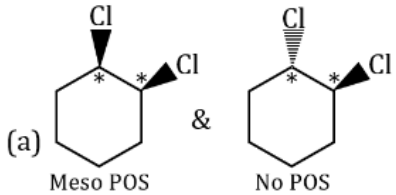


25)
2-Ethyl pent-3-ene nitrile

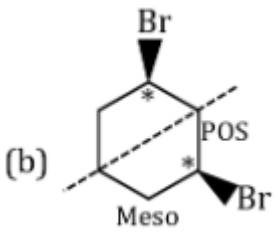


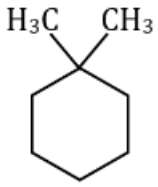
t-butyl

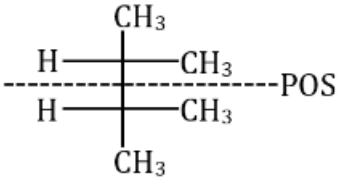
26)



27)



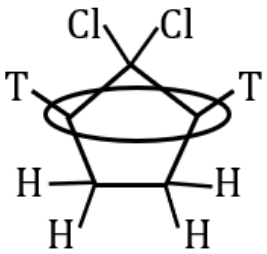
(c) 

(d) 

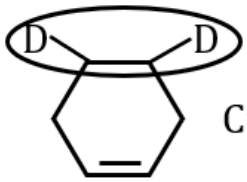
No chiral center

⇒ No chiral centre ⇒ Not meso (c) and (d) so no meso compound

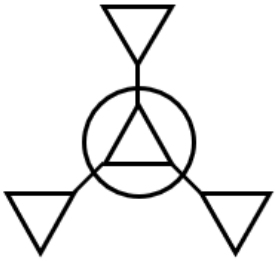
28)

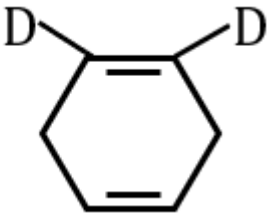
(A) 

Cis and Trans

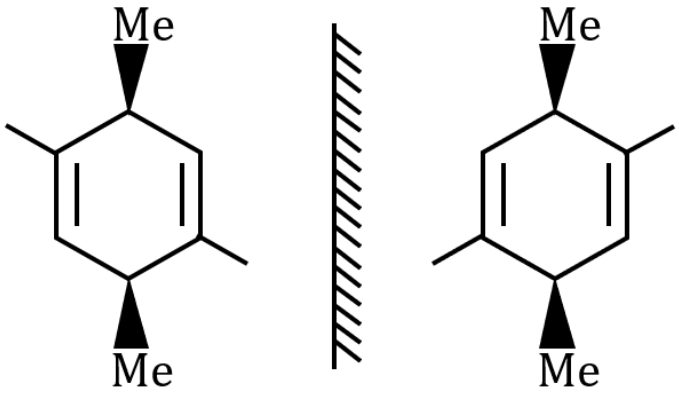
(B) 

Cis and Trans

(C) 
Cis and Trans

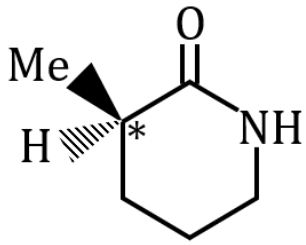
(D) 

No. Geometrical isomerism is possible for the given compound



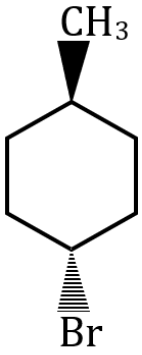
No plane of symmetry
no center of symmetry
chiral molecule

Non superimposable
mirror image

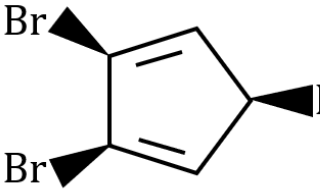


I chiral centre optically active

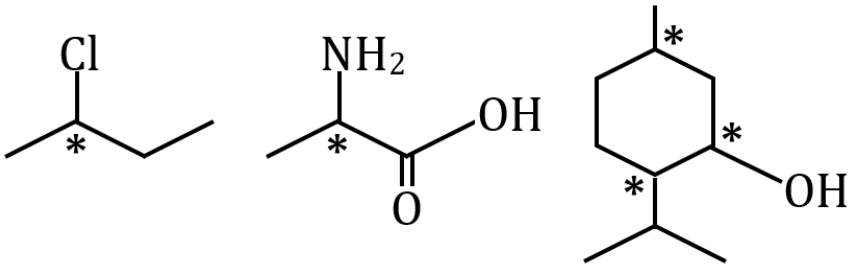
29)



POS is present optically inactive compound.



POS is present optically inactive



30)

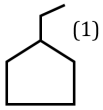
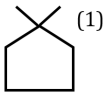
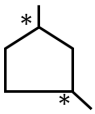
Number of compounds containing asymmetric carbons are three.

31) $CH_3-CH=CH-\underset{\underset{OH}{|}}{CH}-CH_2-\underset{\underset{Br}{|}}{CH}-CH_3$

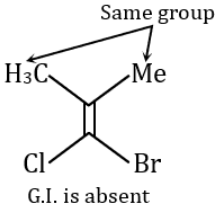
⇒ n = 3 & unsymmetrical

⇒ Total stereoisomers = $2^n = 2^3 = 8$

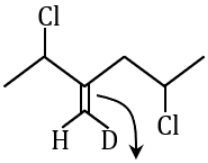
32) $[C_7H_{14}]$

(1)  (2)  (3)  (4) 

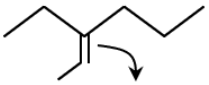
S.I = 3 (symmetrical) S.I = 3

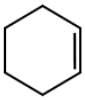
(I) 

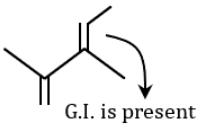
G.I. is absent

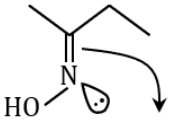
(II) 

G.I. is present

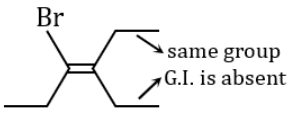
(III) 
G.I. is present

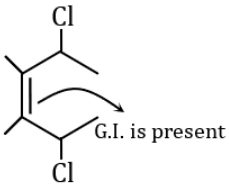
(IV) 
G.I. is absent

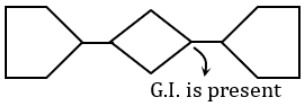
(V) 
G.I. is present

(VI) 

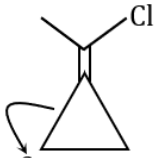
G.I. is present

(VII) 

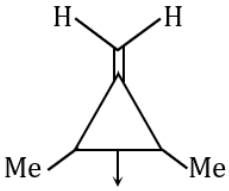
(VIII) 

(IX) 
G.I. is present

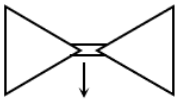
33)

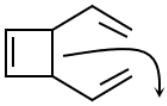
(X) 

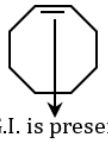
G.I. is absent

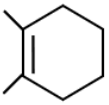
(XI) 

G.I. is present

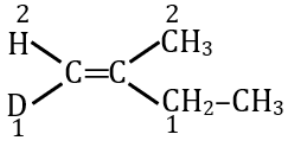
(XII) 
G.I. is absent

(XIII) 
G.I. is present

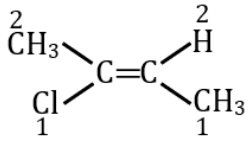
(XIV) 
G.I. is present

(XV) 
G.I. is absent

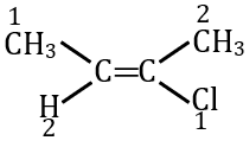
34)

(i) 

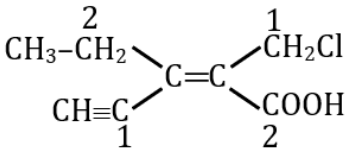
Z

(ii) 

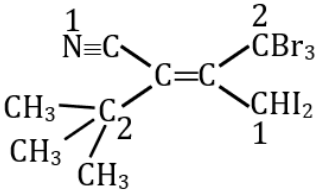
Z

(iii) 

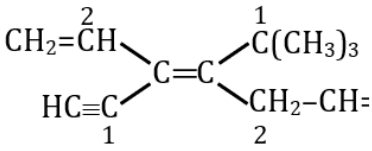
E

(iv) 

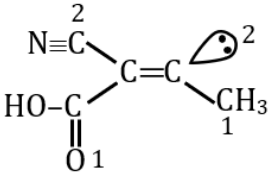
E

(v) 

E

(vi) 

E

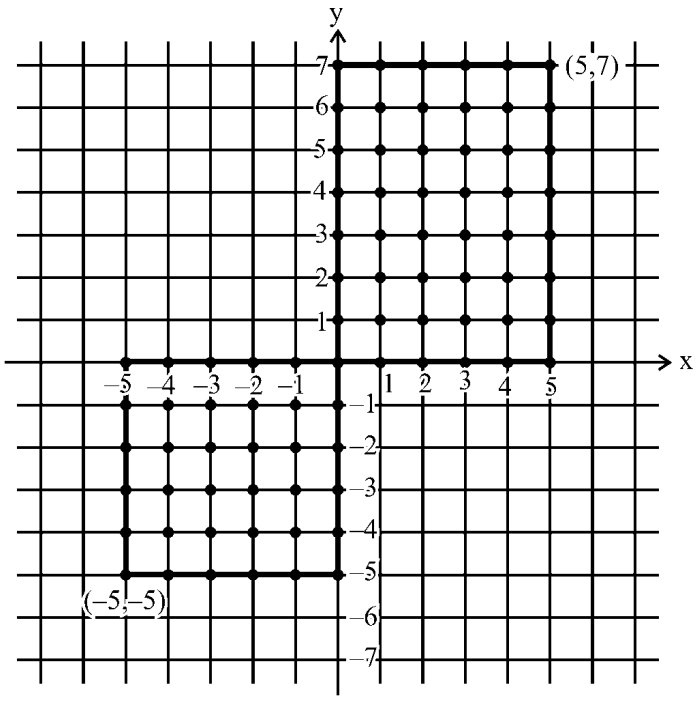
(vii) 

Z

PART-C-MATHEMATICS

35)

Number of 8's in (201) ! = 65
Number of 3's in (201)! = 98.
Hence, number of 24's in (201)! = 65

36) 

37)

$15 < x_1 + x_2 + x_3 \le 20$
$\Rightarrow x_1 + x_2 + x_3 = 16 + r,\ r = 0, 1, 2, 3, 4$
Now, the number of positive integral solutions of $x_1 + x_2 + x_3 = 16 + r$ is ${}^{13+r+3-1}C_{13+r}$, i.e., ${}^{15+r}C_{13+r} = {}^{15+r}C_2$.
Thus, the total number of solutions is

$$\sum_{r=0}^{4} {}^{15+r}C_2 = {}^{15}C_2 + {}^{16}C_2 + {}^{17}C_2 + {}^{18}C_2 + {}^{19}C_2$$

$$= \frac{1}{2}(15 \times 14 + 16 \times 15 + 17 \times 16 + 18 \times 17 + 19 \times 18)$$
$= 685$

38) $(1! + 2! + 3! + 4! + 5! + \ldots\ldots + 2005!) = (1 + 2 + 6 + 24 + 120 + \ldots\ldots)$ Last digit will be $= 3$
Now 3^{500} will have it's last digit = 1

39)
$$N_1 = {}^5C_1 \times {}^4C_4 = 5$$
$$N_2 = {}^5C_2 \times {}^4C_3 = 40$$
$$N_3 = {}^5C_3 \times {}^4C_2 = 60$$
$$N_4 = {}^5C_4 \times {}^4C_1 = 20$$
$$N_5 = {}^5C_5 = 1$$
$$N_1 + N_2 + N_3 + N_4 + N_5 = 126$$

40) NAGPUR
A → 5! = 120
G → 5! = 120 240
NA → 4! = 24 264
NG → 4! = 24 288
NP → 4! = 24 312
NRAGPU = 1 313
NRAGUP 314
NRAPGU 315

41) (B) ${}^8C_4.4!$
(C) ${}^7C_4.4!$

42) m_1 = X.T X E X G X E X R X
$$= {}^6C_2.2! \times \frac{5!}{2!} = 15 \times 120 = 1800$$
m_2 = I N T E G E R
$$= \frac{5!}{2!} = 60$$

43) A + B + C + D = 15

$A \geq 2,\quad B \geq 0,\quad C \geq 0,\quad D \geq 4$
Number of solutions = $^{12}C_3 = 220$
N = 220
'2N' = $2^3 5^1 11^1$

44) $m = {}^{41}C_{20}; \quad n = {}^{40}C_{19}$

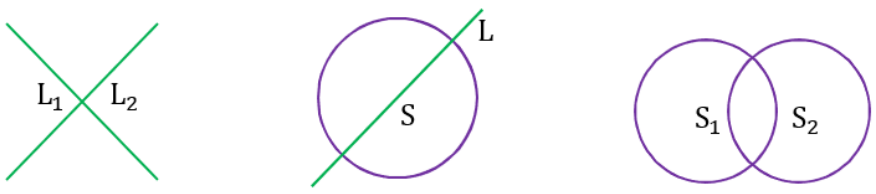
$m - n = {}^{41}C_{20} - {}^{40}C_{19} = {}^{40}C_{20} + {}^{40}C_{19} - {}^{40}C_{19}$

$= {}^{40}C_{20} = \frac{40!}{20!.20!}$ (Now verify each alternative)

45) 3 cases possible:
Case I : (1, 1, 1, 1, 1) $\rightarrow$ 5! ways
Case II : (1, 1, 1, 2) $\rightarrow {}^5c_4 \times {}^4c_1 \times {}^5c_2 \times 3!$
Case III : (1, 2, 2) $\rightarrow {}^5c_3 \times {}^3c_1 \times \frac{5!}{(2!)^2} \times \frac{1}{2!} \times 2!$
Total number of ways = 2220

46) no. starting with
1_ _ _ _ _ _ _ _ _ = 5! × 5 = 600 which are not divisible by '5' same no. starting with
2_ _ _ _ _ _ _ _ _ = 600
starting with
3_ _ _ _ _ _ _ _ _ = 600
total no. which starting with 1 or 2 or 3 is 1800 which are not divisible by '5'
starting with
4 1 _ _ _ _ _ _ _ = 4! × 4 = 96
4 2 _ _ _ _ _ _ _ = 4! × 4 = 96
Total 1992 no. are arranged now 1993rd no. (4312567)
just like other no.'s

47) $^{100}C_7 + {}^{100}C_6 + {}^{100}C_6 + {}^{100}C_5 = {}^{101}C_7 + {}^{101}C_6$
$= {}^{102}C_7$

48) 

$\left({}^6C_2 \times 1\right) + \left({}^4C_1 . {}^6C_1 \times 2\right) + \left({}^4C_2 \times 2\right)$

49)

Case -I : If A = 0 then number of ways = $^{20}C_1$
Case -II : If A = 2, then number of ways = $^{18}C_1$
:

Case X : If A = 18 then number of ways = $^{2}C_{1}$

$\Rightarrow$ Total number of ways = $^{20}C_{1} + {}^{18}C_{1} + ... + {}^{2}C_{1}$

Hence, K = 110

50) $H_1 - H_2 - H_3 - H_4 = \underline{|4} = 24$ $\boxed{H_1H_2} - H_3 - H_4 = {}^{4}C_{2}\,\underline{|3} = 36$

$\boxed{H_1H_2} - \boxed{H_3H_4} = \frac{^{4}C_{2}}{2}\,\underline{|2} = 6$

$\boxed{H_1H_2H_3} - H_4 = {}^{4}C_{3}.\,\underline{|2} = 8$

$H_1H_2H_3H_4 = 1 \Rightarrow 75$

51) Numbers end at 0

3	8	7	1	$=168$

Numbers end at 5

2	8	7	1	$=112$

Total = 280