TARGET IIT-JEE

HINT & SOLUTIONS

ANSWER KEY WITH SOLUTION

PAPER-I CLASS XI (DATE 22-11-09)

MATHEMATICS

1.	D	2.	C	3.	D	4.	B	5.	D	6.	C	7.	A
8.	B	9.	B,C	10.	B,D	11.	B,C,D	12.	A,C,D	13.	B	14.	A
15.	A	16.	C	17.	A	18.	D						

19. (A) → Q; (B) → (S) ; (C) → P ; (D) → R

20. (A) → (P) ; (B) → (P, Q, R) ; (C) → (P, Q, R,S) ; (D) → (P)

PHYSICS

21.	D	22.	C	23.	C	24.	D	25.	B	26.	C	27.	C
28.	D	29.	A,D	30.	A,C	31.	A,C	32.	C,D	33.	B	34.	C
35.	A	36.	C	37.	B	38.	B						

39. A → Q, R ; B → Q, S ; C → P, R ; D → Q,S

40. A → R ; B → Q ; C → S ; D → P

CHEMISTRY

41.	C	42.	B	43.	A	44.	A	45.	A	46.	C	47.	B
48.	A	49.	A,B	50.	A,B,C,D	51.	A,B,C	52.	A,C,D	53.	B	54.	C
55.	D	56.	D	57.	B	58.	D						

59. (A → Q, R, S, B → S, C → R, D → S)

60. (A → P, S, B → P, R, S, C → Q, D → P,R,S)

SOLUTIONS

MATHEMATICS

1. **D**

$^{k}C_k + ^{k+1}C_k + ^{k+2}C_k + ...+ ^{n}C_k$

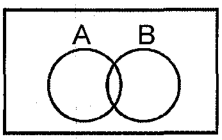
$\underbrace{^{k+1}C_{k+1} + ^{k+1}C_k} + ^{k+2}C_k + ... + ^{n}C_k$

$\underbrace{^{k+2}C_{k+1} + ^{k+2}C_k} + ^{k+3}C_k + ... + ^{n}C_k$

$\underbrace{^{k+3}C_{k+1}}$ and so on

adding upto the last term given $^{n+1}C_{k+1}$

2. **C**



A : loving
B : beautiful

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$n(A) = 9.\ 8.\ 7.6$ ☐☐☐☐ all digits distinct

$= 3024$

$n(B) = 4.5^3$ ☐☐☐☐ all even digit (0, 2, 4, 6, 8)

$= 500$

$n(A \cap B)$ = All four digit numbers with no zero. all digits different and even

$= 4(3)(2)(1)$ ☐☐☐☐ (2, 4, 6, 8)

$= 24$

$\therefore \quad n(A \cup B) = 3024 + 500 - 24 = 3500$ Ans.

3. **D**

4. **B**

$360 = 2^3 . 3^2 .5$

Any odd divisor of 360 is of the form $3^a.5^b$

$\Rightarrow S = (3^0 + 3 + 3^2) . (5^0 + 5^1) = 78$

5. **D**

6. **C**

$^9C_6 . 2 + ^9C_7 .1 + 1 = 168 + 36 + 1 = 205$ **Ans.**

7. **A**

Maximum value of $^{11}C_r$ occurs when r = 6 or 5

i.e. $^{11}C_6$ or $^{11}C_5$

maximum value of $^{10}C_p$ occurs when p = 5

now $\quad ^{11}C_6 - ^{10}C_5 = ^{10}C_6 + ^{10}C_5 - ^{10}C_5 = ^{10}C_6$ **Ans.**

8. **B**

x y z y x

First digit = x can be from 1 to 8

where as z = can be any one from 0 to 9

when x = 1, y = 2, 3..........9 — 8 digit

x = 2, y = 3, 4..........9 — 7 digit

and so on

Thus the total = (8 + 7 + 6 + ...+ 2 + 1) × 10

= 360 **Ans.**

9. **B,C**

$2^{10} - 1$; (A) $2^{10} - 2$; (B) $2^{10} - 1$; (C) $2^{10} - 1$; (D) 10

10. **B,D**

11. **B,C,D**

(A) 1st arm can move in 6 ways and so on ....

$\therefore \ 6^5 - 1$

(D) $\{n(n-1)(n-2)........... (n-r+1)(n-r)!\} / (n-r)!$

$= \dfrac{n!}{(n-r)!} = ^{n}C_r.r!$

12. **A,C,D**

(A) $r!.\ P(n, n-r) = r!.\ \dfrac{n!}{(n-n+r)!} = n! = P(n,n)$

$\Rightarrow$ (A) is correct

(B) $(n-r).\ P(n, r) = (n-r).\ \dfrac{n!}{(n-r)!} \neq P(n,n)$

$\Rightarrow$ (B) is incorrect

(C) $n.P(n-1, n-1) = n.\ (n-1)! = n!$

$\Rightarrow$ (C) is correct

(D) $P(n, n-1) = \dfrac{n!}{(n-n+1)!} = n!$

$\Rightarrow$ (D) is correct

13. **B**

Since there are 5 even places and 3 pairs of repeated letters therefore at least one of these must be at an odd place.

$\therefore$ the number of ways $= \dfrac{11!}{2!\,2!\,2!}$ **Ans.**

14. **A**

Make a bundle of both M's and another bundle of T's. Then except A's we have 5 letters remaining so M's, T's and the letters except A's can be arranged in 7 ! ways

$\therefore$ total number of arrangements $= 7! \times {}^8C_2$

15. **A**

None vowels can be placed in $\frac{7!}{2!\,2!}$ ways

Then there are 8 places and 4 vowels

$\therefore$ Number of ways = $\frac{7!}{2!\,2!} \cdot {}^{8}C_4 \frac{4!}{2!}$ **Ans.**

16. **C**

17. **A**

18. **D**

Sol. (a) dogs different $D_1, D_2, \ldots\ldots\ldots\ldots, D_{10}$

biscuits alike $\underbrace{B\,B\ldots\ldots\ldots\ldots B}_{8}$

8 alike object to be distributed in 10 different dogs

$\underbrace{0\,0\ldots\ldots\ldots0}_{8}\ \underbrace{\phi\,\phi\ldots\ldots\ldots\phi}_{9}$

Total ways = ${}^{17}C_8$ **Ans.**

when any number of biscuits can be had by any dog.

(b) dogs are different $D_1, D_2, \ldots\ldots, D_{10}$

biscuits are different $B_1, B_2, \ldots\ldots, B_8$

1st biscuits can be given in 10 ways

2nd biscuits can be given in 10 ways

hence total ways = 10^8 **Ans.**

(c) Select 8 dogs in ${}^{10}C_8$ and give them 1 biscuit each. Distribution of biscuits in 8! ways.

Total ways = ${}^{10}C_8 . 8!$ **Ans.**

19. **(A) → Q; (B) → (S) ; (C) → P ; (D) → R**

(A) $\boxed{R_1\ R_2\ R_3\ R_4}$ $\boxed{G_1\ G_2\ G_3\ G_4\ G_5}$

$= 4!\,.\,5!\,.\,2! = 8\,.6!$ ⇒ **(Q)**

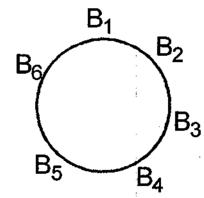
(B) $\boxed{R_1\ R_2\ R_3\ R_4}$ $G_1\ G_2\ G_3\ G_4\ G_5$

$(6!)\,(4!) = (24)\,6!$ ⇒ **(S)**

(C) $G_1 \times G_2 \times G_3 \times G_4 \times G_5$

$= 5!.\,4! = (4)\,6!$ ⇒ **(P)**

(D)



$5!.\,{}^{6}C_3.\,3! = (20)\,6!$ ⇒ **(R)**

20. **(A) → (P) ; (B) → (P, Q, R) ; (C) → (P, Q, R,S) ; (D) → (P)**

(A) Required number of ways = $(2+1)(3+1)(4+1) - 1 = 59$

(B) The number of ways of selecting 3 points out of 12 points is ${}^{12}C_3$

Three points out of 7 collinear points can be selected in ${}^{7}C_3$ ways.

Hence, the number of triangles formed is

$${}^{12}C_3 - {}^{7}C_3 = 185$$

(C) $\underbrace{0000000000}_{10}\ \underbrace{\phi\phi\phi}_{3}$

total ways = ${}^{13}C_3 = 286$

(D) Factorizing the given number, we have

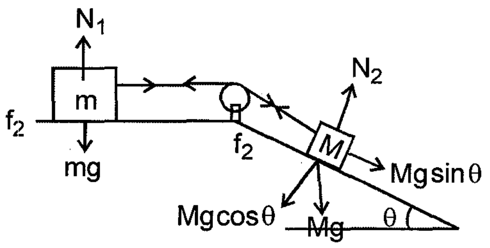
$$38808 = 2^3.\,3^2.\,7^2.11$$

The total number of divisors of this number is same as the number of ways of selecting some or all of two 2's, two 3's, two 7's and one 11. Therefore, the total number of divisors

$$= (3+1)(2+1)(2+1)(1+1) = 72$$

Hence, the required number of divisors = $72 - 2 = 70$

21. **D**



The system is at rest ($F_{net} = 0$)

For maximum M/m; Limiting friction will be acting on both the blocks (at contact surfaces)

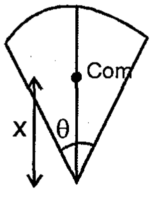
$F_{L_1} + F_{L_2}$ = Net pulling force on the whole system

$\mu mg + \mu Mg\cos\theta = Mg\sin\theta$

$Mg(\sin\theta - \mu\cos\theta) = \mu mg$

$$\frac{M}{m} = \frac{\mu}{(\sin\theta - \mu\cos\theta)}$$

22. **C**



Greater the value of θ, lesser the value of x, hence for the sector of angle θ position of COM will be farther than the semicircle (sector of angle π)

23. **C**

$W_g + W_f = \Delta KE$

$$v = \sqrt{\frac{2Fd - 2Mgd}{M}}$$

24. **D**

After some time force on A become constant when relative motion starts but on B is going on increasing.

On B $a_B = \frac{F}{m} - \frac{f}{m}$ (–ve interseption)

25. **B**

Speed = $\sqrt{13}$ m/s and constant, so distance = $10\sqrt{13}$ m

26. **C**

$a_{net} = \sqrt{a_r^2 + a_t^2}$

$\because a_{net} = \mu g = 5$

$\therefore 5 = \sqrt{9 + a_t^2} \Rightarrow a_t = 4 \text{m/s}^2$

27. **C**

28. **D**

Initial velocity may be different

29. **A,D**

Sol. (A) $10\cos 60° = 5$ m/s

(B, C) $\sqrt{5^2 + 3^2} = \sqrt{34}$ m/s

(D) $\sqrt{5^2 + 5^2} = 5\sqrt{2}$ m/s

30. **A,C**

V is maximum when a changes its sign.

Area of a - t graph = 0

31. **A,C**

By symmetry velocity of each is 5 m/s

$$T = \frac{mv^2}{R} = \frac{75 \times 25}{5} = 375\text{N}$$

$$\text{Acceleration} = \frac{v^2}{R} = \frac{25}{5} = 5 \text{ m/s}^2$$

32. **C,D**

33. **B**

On system of particle and wedge net force is vertically downwards that is force of gravity.

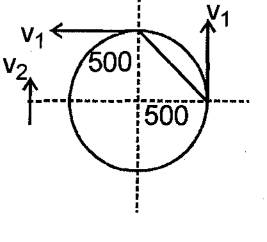
34. **C**

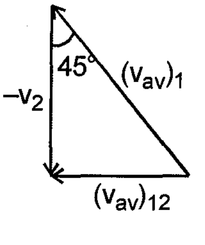
v_p in x-axis with respect to ground is $v_1 - v_2\cos\theta$

35. **A**

v_p in x-axis with respect to ground is $v_1 - v_2\cos\theta$

36. **C**





Average velocity of car - 1

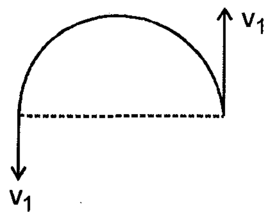
$$|\vec{v}_{av}| = \frac{500\sqrt{2}}{25} = 20\sqrt{2}\,m/s$$

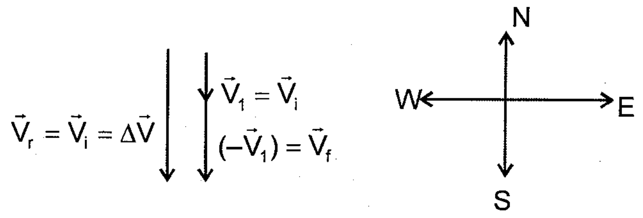
Average velocity of Car - 1 as seen by Car - 2

$$(\vec{v}_{av})_{12} = (\vec{v}_{av})_1 - \vec{v}_2$$

From vector triangle $(v_{av})_{12}$ = 20 m/s towards west.

37. **B**





Average acceleration of Car - 1

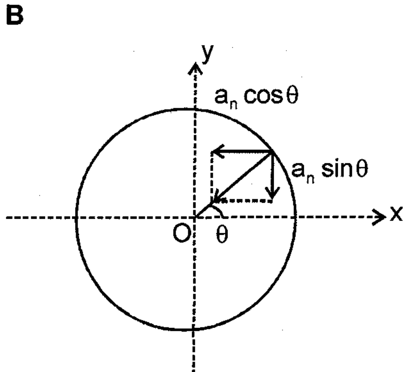
$$\vec{a}_{av} = \frac{\vec{v}_f - \vec{v}_i}{\Delta t} = \frac{\Delta\vec{v}}{\Delta t}$$

$$|\vec{a}_{av}| = \frac{2v_1}{\Delta t} = \frac{2\times 2\pi R}{50\times 100} = \frac{\pi\times 500}{50\times 25}$$

$|\vec{a}_{av}|_1 = 2\pi/5$; towards south

Since the average acceleration of Car - 2 is zero therefore average accleration of Car - 1 as seen by Car - 2 is $2\pi/5$, toward south.

38. **B**



Acceleation of Car-2 as seen by Car - 1

$$\vec{a}_{21} = \vec{a}_2 - \vec{a}_1$$

$$\vec{a}_{21} = 0 - \vec{a}_1$$

For Car - 1 : $a_n = \frac{v^2}{R} = \frac{(10\pi)^2}{500} = \frac{100\pi^2}{500} = \frac{10}{5} = 2\ m/s^2$

$$\vec{a}_1 = a_n\cos\theta(-\hat{i}) + a_n\sin\theta(-\hat{j})$$

$$\vec{a}_1 = -2\left[\cos\left(\frac{\pi}{50}\right)\hat{i} + \sin\left(\frac{\pi}{50}\right)\hat{j}\right]$$

$$\vec{a}_{21} = -\vec{a}_1 = 2\left[\cos\left(\frac{\pi}{50}\right)\hat{i} + \sin\left(\frac{\pi}{50}\right)\hat{j}\right]$$

39. **A → Q, R ; B → Q, S ; C → P, R ; D → Q,S**

Since velocity of CM will never be zero.

Since v_{cm} never be zero and some part of initial KE converted in spring potential energy.

At the time when spring is in its natural length potential energy is zero and at maximum extension U_s is maximum.

40. **A → R ; B → Q ; C → S ; D → P**

Vehicle is stopped, but due to inertia bob will acquire the velocity v_0 w.r.t. vehicle

$$h = l - l\cos 60° = \frac{l}{2} = 2.5\ m$$

$$mgh = \frac{1}{2}mv_0^2$$

$$v_0 = \sqrt{2gh} = \sqrt{2\times 10\times 2.5} = 5\sqrt{2}\,m/s$$

Net force at the lowest point is

$$\frac{mv_0^2}{l} = \frac{2\times(5\sqrt{2})^2}{5} = 20N$$

Acceleration of the bob at the lowest point.

$$\frac{v_0^2}{l} = \frac{(5\sqrt{2})^2}{5} = 10\,m/s^2$$

At point B : $T = mg\cos 60°$

Net force = $mg\sin 60° = 2\times 10\times\frac{\sqrt{3}}{2} = 10\sqrt{3}\,N$

Acceleration = $g\sin 60° = 10\times\frac{\sqrt{3}}{2} = 5\sqrt{3}\,m/s^2$

41. **C**

$$\begin{matrix} CH_2COOAg \\ | \\ CH_2COOAg \end{matrix} \xrightarrow{\Delta} Ag\downarrow$$

2 × no of moles of silver salt = moles of silver

$$2 \times \frac{W_{salt}}{332} = \frac{W_{Ag}}{108} \Rightarrow W_{salt} = 1.537\, W_{Ag}$$

y = mx + C

C = 0, m = 1.537

42. **B**

$E = K.E_{max}$ + work Function

$\frac{hc}{\lambda} = \phi + ev_0$ where v_0 stopping potential

$$v_0 = \frac{hc}{e}\left[\frac{1}{\lambda}\right] - \frac{\phi}{e}$$

$$\text{Slope} = \frac{hc}{e} = \frac{6.65 \times 10^{-34} \times 3 \times 10^8}{1.6 \times 10^{-19}} = 1.242 \times 10^{-6}$$

J m coulomb^{-1}

For metal I ϕ_1 = 0.24 ev (given)

$$\text{Hence } V_{O_1} = 1.242 \times 10^{-6} \times \frac{1}{100 \times 10^{-9}} - 0.24$$

= 12.18 V

From graph work function of metal II is greater then form the slopping potential of metal I is greater then II.

43. **A**

At Boyle's temp real gas behaves as ideal gas Hence z = 1, B = 0, B/Z = 0

44. **A**

$$E_{total} = \frac{-2\pi^2 mk^2e^4}{h^2} = 13.6$$

45. **B**

46. **C**

Total translational K.E. = $\frac{3}{2}$nRT

47. **B**

$P \propto T$ at V constant.

Frequency of collision $\propto \sqrt{T}$

48. **A**

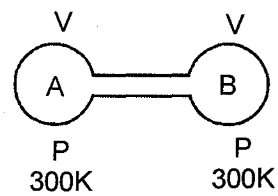
$$\text{frequency } \frac{C}{\lambda} = Rz^2c\left[\frac{1}{1} - \frac{1}{\infty}\right]$$

$$\nu_1 = Rz^2c, \quad \nu_2 = Rz^2c\left[\frac{1}{4} - \frac{1}{\infty}\right]$$

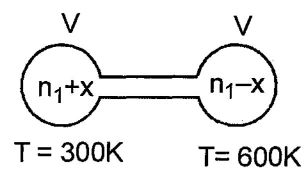
$$\nu_1 - \nu_2 = Rz^2c\left[1 - \frac{1}{4}\right] = Rz^2c\left[1 - \frac{1}{2^2}\right]$$

49. **A,B**

(I)



$$n_1 = \frac{PV}{300R}$$



Stage – II

$$n_1 + x = \frac{P' \times V}{300R}$$

$$n_1 - x = \frac{P'V}{600R} \Rightarrow 2n_1 = \frac{P'V}{300R} + \frac{P'V}{600R}$$

$$2 \times \frac{PV}{300R} = \frac{P'V}{300R} + \frac{P'V}{600R}$$

$$\frac{2P}{3} = \frac{P'}{3} + \frac{P'}{6} \Rightarrow 2P = P' + \frac{P'}{2}$$

$$\frac{3P'}{2} = 2P \qquad \Rightarrow \qquad P' = \frac{4P}{3}$$

$$2x = \frac{P'V'}{300R} - \frac{P'V}{600R} = \frac{P'V}{300R}\left[1 - \frac{1}{2}\right]$$

$$x = \frac{P'V}{600R} = \frac{4PV}{3 \times 600R}$$

$$P' = \frac{4P}{3}$$

Total moles = $n_1 + x$

$$2x = \frac{P'V}{300R} - \frac{P'V}{600R} = \frac{P'V}{600R}$$

$$2x = \frac{4P}{3} \times \frac{V}{300R}$$

$$= \frac{4}{6}\frac{PV}{300R} = \frac{2}{3}n_1$$

$$2x = \frac{2}{3}n_1 \;\; \Rightarrow \;\; x = \frac{1}{3}n_1$$

Hence total moles = $n_1 + x = n_1 + \frac{1}{3}n_1$

Total moles = $\frac{4}{3}n_1$

50. **A,B,C,D**

51. **A,B,C**

52. **A,C,D**

53. **B**

a is directly depends an alt. form and from

$NH_3 > CH_4 > CO > He > H_2$

54. **C**

For $z < 1$ $\Rightarrow$ $PV = zRT$

$$V = \frac{zRT}{P}$$

$\frac{RT}{P}$ = 22.4 ltr. at S.T.P.

Hence, $\frac{zRT}{P} < 22.4$ ltr.

55. **D**

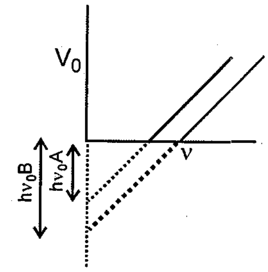
From graph H_2

56. **D**

$ev_0 = h\nu - h\nu_0$

$$V_0 = \frac{h\nu}{e} - \frac{h\nu_0}{e}$$

slope = $\frac{h}{e}$



57. **B**

work function of B is greatest then the work functions of A.

58. **D**

$$\frac{hc}{\lambda} = 2E - E$$

$$\lambda = \frac{hc}{E} \;,\;\; \Delta E = \frac{4E}{3} - E$$

$$\frac{hc}{\lambda_1} = \frac{E}{3}$$

$$\frac{hc}{\lambda_1} = \frac{hc}{3\lambda} \;\Rightarrow\; \lambda_1 = 3\lambda$$

59. **(A → Q, R, S, B → S, C → R, D → S)**

$\bar{N}_3 \to sp$, Linear

$\bar{I}_3 \to sp^3d \to$ Linear

$O_3 \to sp^2 \to$ v – shaped

$\bar{I}Cl_2 \to sp^3d$ Linear

60. **(A → P, S, B → P, R, S, C → Q, D → P,R,S)**

Easy, Every thing is clear from graph.

$= \frac{4}{5}\frac{PV}{300R} = \frac{2}{3}n_1$

$2x = \frac{2}{3}n_1 \Rightarrow x = \frac{1}{3}n_1$

Hence total moles $= n_1 + x = n_1 + \frac{1}{3}n_1$

Total moles $= \frac{4}{3}n_1$

50. A,B,C,D

51. A,B,C

52. A,C,D

53. B

a is directly depends on att. form and from $NH_3 > CH_4 > CO > He > H_2$

54. C

For z < 1 ⇒ $PV = zRT$

$V = \frac{zRT}{P}$

$\frac{RT}{P} = 22.4$ ltr. at S.T.P.

Hence, $\frac{zRT}{P} < 22.4$ ltr.

55. D

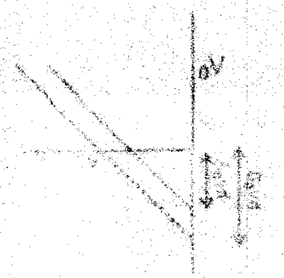
From graph H_2

56. C

$eV_0 = hv - hv_0$

$V_0 = \frac{hv}{e} - \frac{hv_0}{e}$

slope $= \frac{h}{e}$



57. B

work function of B is greater than the work functions of A.

58. D

$\frac{hc}{\lambda} = 2E - E$

$\lambda = \frac{hc}{E}$, $\Delta E = \frac{4E}{3} - E$

$\frac{hc}{\lambda_1} = \frac{E}{3}$

$\frac{hc}{\lambda_1} = \frac{hc}{3\lambda} \Rightarrow \lambda_1 = 3\lambda$

59. (A → Q, R, S, B → S, C → R, D → S)

$N_3^- \rightarrow sp$, Linear

$I_3^- \rightarrow sp^3d \rightarrow$ Linear

$O_3 \rightarrow sp^2 \rightarrow$ v - shaped

$ICl_2^- \rightarrow sp^3d$ Linear

60. (A → P, S, B → P, R, S, C → Q, D → P, R, S)

Easy, Every thing is clear from graph