PACE IIT & MEDICAL

Search

AT
Atharva

Dashboard
My Courses
Test Series
Forum
Live Class
My Tasks
My Progress
My Notes

JEE ADVANCED (2020-22)
JEE MAIN (2020-22)
3 Years 2021-24 EG
JEE Advanced-2021-23
JEE Main-2021-23
ENGG 2021-23 RMO
IJSO 2021-23
2022-24 JEE ADVANCED

Active 0
Upcoming 0
Attempted 3
Missed 4

2022-24 JEE ADVANCED - Attempted

Score Card | Answer Key | Comparison Chart | Questions List | Accuracy | Time Management | More...

You scored *155* out of *300* correctly.

51.67%

Question Results

You scored 4 of 4

This section contains 25 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which ONLY ONE option can be correct. Marking scheme: +4 for correct answer, 0 if not attempted and −1 in all other cases.

Q1. **The equation of path of projectile is $y = 0.5x - 0.04x^2$. The initial speed of projection is (g = 10 m/s^2)**

Options:

	10 m/s
	15 m/s
✔	12.5 m/s
	7.5 m/s

Solution :
(C)

$$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta} \Rightarrow \tan\theta = 0.5 \Rightarrow \cos\theta = \frac{2}{\sqrt{5}}$$

Also, $\dfrac{g}{2u^2 \times \frac{4}{5}} = 0.04 \Rightarrow y = 12.5\text{ m/s}$

Add to Favorites

You scored 0 of 4 *skipped*

Q2. A small ball rolls off the top of a stairway with a velocity of 4.5 m/s. Each step is 0.2 m high and 0.3 m wide. If g is 10 m/s^2, then ball will strike the n^{th} step. (Assume ball strikes at edge of step) n = ?

Options:

	10
✓	9
	8
	11

Solution :

(B)

$x = 0.3n;\ y = -0.2n$

Equation of trajectory : $y = -\frac{gx^2}{2u^2} \Rightarrow n = 9$

Add to Favorites

You scored 4 of 4

Q3. A projectile from ground just crosses the top of two poles of equal height, after 1 sec and 3 sec from projection. The time of flight is

Options:

	2 sec
	6 sec
	8 sec
✓	4 sec

Solution :

(D)

Time of flight = 1 + 3 = 4 sec (using symmetry)

Add to Favorites

You scored 4 of 4

Q4. The equation of trajectory of a projectile is $y = x - 0.2x^2$. Angle of projection with horizontal is

Options:

	$\tan^{-1}\left(\frac{1}{2}\right)$
✔	45°
	30°
	$\tan^{-1}(2)$

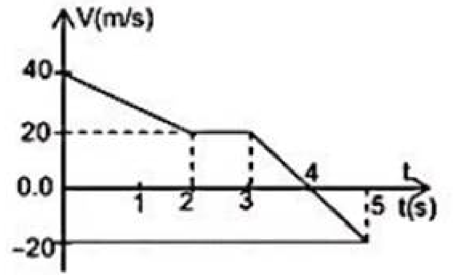
Solution :
(B)

$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta} \Rightarrow \tan\theta = 1$

Add to Favorites

You scored 0 of 4 *skipped*

Q5. In the given v-t graph, the distance travelled by the body in 5 sec will be



Options:

✔	100 m

	80 m
	40 m
	20 m

Solution :
(A)

Distance travelled = area under the v-t curve

$$=\frac{20\times 2}{2}+20\times 2+20\times 1+\frac{20\times 1}{2}+\frac{20\times 1}{2}=100\,\text{m}$$

Add to Favorites

You scored 4 of 4

Q6. A body when projected vertically up, covers a total distance *D* during its time of flight. If there were no gravity, the distance covered by it during the same time is equal to

Options:

	0
	D
✔	2*D*
	4*D*

Solution :
(C)

The displacement of the body during the time *t* as it reaches the point of projection

$$\Rightarrow\ S=0\ \Rightarrow\ v_0t-\frac{1}{2}gt^2=0\ \Rightarrow\ t=\frac{2v_0}{g}$$

During the same time *t*, the body moves in absence of gravity through a distance

$D'=v.t$, because in absence of gravity *g* = 0

$$\Rightarrow\ D'=v_0\left(\frac{2v_0}{g}\right)=\frac{2v_0}{g}\qquad ...(1)$$

In presence of gravity, the total distance covered is

$= D = 2H = 2\frac{v_0^2}{2g} = \frac{v_0^2}{g}$ ...(2)

$(1) \div (2) \Rightarrow D' = 2D$.

Add to Favorites

You scored 0 of 4 *skipped*

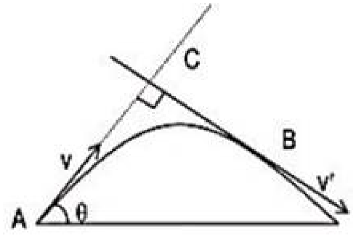
Q7. A particle is projected from a point *A* with a velocity *v* at an angle θ (upward) with the horizontal. At a certain point *B*, it moves at right angle to its initial direction. It follows that

Options:

	velocity of the particle at *B* is *v*.
	velocity of the particle at *B* is $v\cos\theta$.
	velocity of the particle at *B* is $v\tan\theta$.
✓	the time of flight from *A* to *B* is $\frac{v}{g\sin\theta}$.

Solution :
(D)

$\vec{v} = \vec{u} + \vec{a}t$



Considering along the line *AC*

$0 = v - g\sin\theta t \Rightarrow t = \frac{v}{g\sin\theta}$

Now, consider along the line *CB*

$v' = 0 + g\cos\theta\frac{v}{g\sin\theta} = v\cot\theta$

Add to Favorites

You scored 0 of 4 *skipped*

Q8. If a boat can have a speed of 4 km/hr in still water, for what values of speed of river flow, it can be managed to row boat right across the river, without any drift?

Options:

	$\geq$ 4 km/hr
✓	less than 4 km/hr
	only 4 km/hr
	none of these

Solution :
(B)

Drift $(\Delta x) = (v_{b,x})\Delta t = (v_{b,r}\cos\theta + v_r)\Delta t$

Where $v_{b,x}$ = velocity of boat w.r.t. ground

$v_{\perp,r}$ = velocity of boat w.r.t. ground

v_r = velocity of river w.r.t. ground

For $\Delta x = 0,\ v_r = -v_{br}\cos\theta$

$\Rightarrow\ (v_r)_{\max} = v_{br}$

For, $v_r > v_{br}$ we can not have zero drift.

Add to Favorites

You scored 0 of 4 *skipped*

Q9. A swimmer crosses a river of width *d* flowing at velocity *v*. While swimming, he keeps himself always at an angle of 120° with the river flow and on reaching the other end he finds a drift of $\frac{d}{2}$ in the direction of flow of river. The speed of the swimmer with respect to the river is

Options:

	$(2-\sqrt{3})v$
	$2(2-\sqrt{3})v$
✓	$4(2-\sqrt{3})v$

	$(2+\sqrt{3})v$

Solution :
(C)

Drift $= \frac{d}{2} = \frac{(V_r - V_s \sin 30)d}{V_s \cos 30}$

$\Rightarrow V_s = 4(2-\sqrt{3})V$

Add to Favorites

You scored 0 of 4 *skipped*

Q10. A projectile is thrown so as to have the maximum possible horizontal range equal to 400 m. Taking the point of projection as the origin, the coordinates of the point where the velocity of the projectile is minimum, are

Options:

	(400, 100)
✔	(200, 100)
	(400, 200)
	(200, 200)

Solution :
(B)

When the horizontal range is maximum, the maximum height attained is $\frac{R}{4} = 100\,\text{m}$.

The velocity of the projectile is minimum at the highest point.

$\therefore$ Required point is (200, 100).

Add to Favorites

You scored 0 of 4 *skipped*

Q11. A driver applies brakes on seeing a traffic signal 400 m ahead. At the time of applying the brakes the vehicle was moving with 15 m/s and retarding with 0.3 m/s^2. The distance of

vehicle after 1 min from the traffic light is

Options:

✔	25 m
	375 m
	360 m
	40 m

Solution :
(A)

The maximum distance covered by the vehicle before coming to rest $= \frac{v^2}{2a} = \frac{(15)^2}{2(0.3)} = 375\,\text{m}$

The corresponding time $= t = \frac{v}{a} = \frac{15}{0.3} = 50\,\text{sec}$

$\therefore$ The distance of the vehicle from the traffic signal after one minute = 400 − 375 = 25 m

Add to Favorites

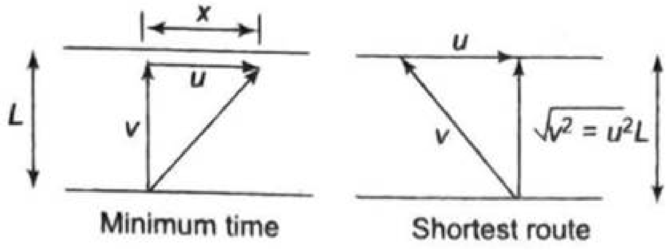
You scored 0 of 4 *skipped*

Q12. **A man wishes to cross a river in a boat. If he crosses the river in minimum time he takes 10 minutes with a drift of 120 m. If he crosses the river taking shortest route, he takes 12.5 minutes. Find velocity of the boat with respect to water.**

Options:

✔	20 m/min
	12 m/min
	10 m/min
	8 m/min

Solution :
(A)



$$10 = \frac{L}{v} \quad ...(i)$$

$$12.5 = \frac{L}{\sqrt{v^2 - u^2}} = \frac{L}{v\sqrt{1 - u^2/v^2}} \quad ...(ii)$$

From (i) and (ii),

$$\frac{1}{12.5} = \frac{L}{v} \times \frac{v\sqrt{1 - u^2/v^2}}{L}$$

$$\frac{4}{5} = \sqrt{1 - \frac{12^2}{v^2}}$$

$$\frac{16}{25} = 1 - \frac{12^2}{v^2} \Rightarrow \frac{12^2}{v^2} = 1 - \frac{16}{25} = \frac{9}{25}$$

$$\frac{12}{v} = \frac{3}{5} \Rightarrow v = \frac{12 \times 5}{3} = 20 \text{ m/s}$$

Add to Favorites

You scored 0 of 4 *skipped*

Q13. **The acceleration of a particle is increasing linearly with time *t* as *bt*. The particle starts from the origin with an initial velocity v_0. The distance travelled by the particle in time *t* will be**

Options:

✓	$v_0 t + \frac{1}{6} b t^3$
	$v_0 t + \frac{1}{3} b t^3$
	$v_0 t + \frac{1}{3} b t^2$
	$v_0 t + \frac{1}{2} b t^2$

Solution :
(A)

Given, acceleration $a = bt$

$\Rightarrow \frac{dv}{dt} = bt \Rightarrow v = \frac{bt^2}{2} + c$

At $t = 0, v = v_0 \Rightarrow c = v_0$

So, $v = \frac{bt^2}{2} + v_0$

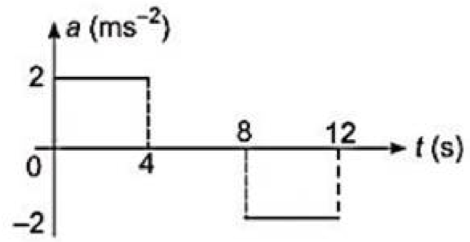
$\Rightarrow \frac{ds}{dt} = \frac{bt^2}{2} + v_0$

$\Rightarrow s = \frac{bt^3}{6} + v_0 t$

Add to Favorites

You scored 0 of 4 *skipped*

Q14. **A lift starts from rest. Its acceleration is plotted against time. When it comes to rest its height above its starting point is**



Options:

	20 m
✔	64 m
	32 m
	36 m

Solution :
(B)

At 4 s

$u = at = 8 \text{ m/s}$

$s_1 = \frac{1}{2}at^2 = \frac{1}{2} \times 2 \times 4^2 = 16\,\text{m}$

From 4 s to 8 s

$a = 0, v$ = constant = 8 m/s

$s_2 = 8 \times 4 = 32$ m

$u_t = \frac{at^2}{2}$

From 8s to 12 s

$s_3 = s_1 = 16\,\text{m}$

$\therefore\ s_{\text{Total}} = s_1 + s_2 + s_3 = 64\,\text{m}$

Add to Favorites

You scored 0 of 4 *skipped*

Q15. Two objects are moving along the same straight line. They cross a point *A* with an acceleration *a*, 2*a* and velocity 2*u*, *u* at time *t* = 0. The distance moved by the object when one overtakes the other is

Options:

✔	$\frac{6u^2}{a}$
	$\frac{2u^2}{a}$
	$\frac{4u^2}{a}$
	$\frac{8u^2}{a}$

Solution :
(A)

At the time of overtaking,

$s_1 = s_2$

$\therefore\ 2ut + \frac{1}{2}at^2 = ut + \frac{1}{2}(2a)t^2$

$\therefore\ t = \dfrac{2u}{a}$

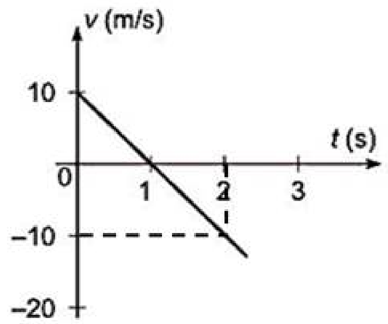
$\therefore\ s_1$ (or s_2) = $(2u)\left(\dfrac{2u}{a}\right) + \dfrac{1}{2}(a)\left(\dfrac{2u}{a}\right)^2$

$= \dfrac{6u^2}{a}$

Add to Favorites

You scored 4 of 4

Q16. The figure shows velocity-time graph of a particle moving along a straight line. Identity the correct statement.



Options:

	The particle starts from the origin
✔	The particle crosses is initial position at t = 2s
	The average speed of the particle in the time interval, $0 \le t \le 2$ s is zero
	All of the above

Solution :
(B)

s = net area of v-t graph

At 2s, net area = 0

$\therefore\ s = 0$

and the particle crosses its initial position.

Add to Favorites

You scored 0 of 4 *skipped*

Q17. A helicopter is rising vertically up with a velocity of 5 m/s. A ball is projected vertically up from the helicopter with a velocity *V* (relative to the ground). The ball crosses the helicopter 3 second after its projection. The value of *V* (in m/s) is

Options:

	10
	15
✔	20
	5

Add to Favorites

You scored 0 of 4 *skipped*

Q18. If the displacement of a particle varies with time as $\sqrt{x} = t + 3$

Options:

	velocity of the particle is inversely proportional to *t*
✔	velocity of particle varies linearly with *t*
	velocity of particle is proportional to $\sqrt{t}$
	initial velocity of the particle is zero

Solution :
(B)

$\sqrt{x} = t + 3$

$\therefore \ x = (t+3)^2$

or $v = \dfrac{dx}{dt}$

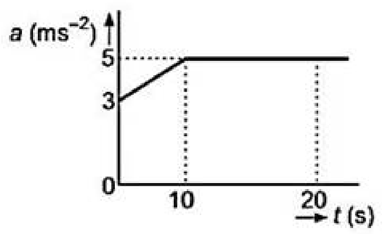
$= 2(t+3)$

$\therefore$ *v-t* equation is linear.

Add to Favorites

You scored 0 of 4 *skipped*

Q19. The graph describes an airplane's acceleration during its take-off run. The airplane's velocity when it lifts off at t = 20 s is



Options:

	40 ms^{-1}
	50 ms^{-1}
✓	90 ms^{-1}
	180 ms^{-1}

Solution :
(C)

$\Delta v = v_f - v_i =$ area under a-t graph

$v_i = 0$

$\Rightarrow \; v_f = \text{area}$

= 40 + 50

= 90 m/s

Add to Favorites

You scored 0 of 4 *skipped*

Q20. A particle moving in a straight line has velocity-displacement equation as $\upsilon = 5\sqrt{1+s}$. Here υ is in ms^{-1} and s in metres. Select the correct alternative.

Options:

	Particle is initially at rest
✓	Initially velocity of the particle is 5 m/s and the particle has a constant acceleration of 12.5 ms^{-2}

	Particle moves with a uniform velocity
	None of the above

Solution :
(B)

$v^2 = 25 + 25s$

or $v^2 = (5)^2 + 2(12.5)s$

Now compare with $v^2 = u^2 + 2as$

Add to Favorites

You scored 0 of 4 *skipped*

Q21. **From the top of a long smooth incline a body *A* is projected along (maintaining contact with) the surface with speed *u*. Simultaneously, another small object *B* is thrown horizontally with velocity *v* = 10 m/s for the same point. Body *B* hits projected (in m/s)**

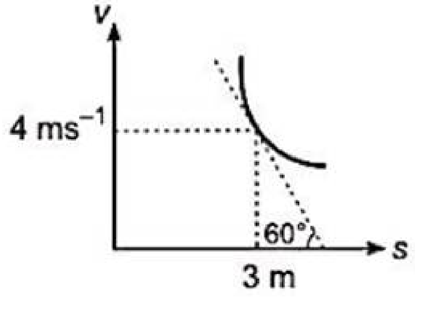
Options:

✔	8
	4
	10
	5

Add to Favorites

You scored 0 of 4 *skipped*

Q22. **A particle is moving along a straight line whose velocity-displacement graph is as shown in the figure. What is the magnitude of acceleration when displacement is 3 m?**



Options:

✔	$4\sqrt{3}$ ms^{-2}
	$3\sqrt{3}$ ms^{-2}
	$\sqrt{3}$ ms^{-2}
	$\frac{4}{\sqrt{3}}$ ms^{-2}

Solution :
(A)

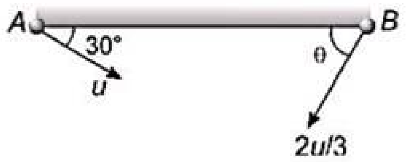
$$a = v \cdot \frac{dv}{ds} = (4)\left(-\tan 60^\circ\right)$$

$$= -4\sqrt{3}\ \text{m/s}^2$$

Add to Favorites

You scored 4 of 4

Q23. **Annop (A) hits a ball along the ground with a speed u in a direciton which makes an angle 30º with the line joining him and the fielder Babul (B). Babul runs to intercept the ball with a speed $\frac{2u}{3}$. At what angle θ should he run to intercept the ball?**



Options:

	$\sin^{-1}\left[\frac{\sqrt{3}}{2}\right]$
	$\sin^{-1}\left[\frac{2}{3}\right]$
✔	$\sin^{-1}\left[\frac{3}{4}\right]$

	$\sin^{-1}\left[\frac{4}{5}\right]$

Solution :
(C)

Relative velocity of *A* with respect to *B* should be along *AB* or absolute velocity components perpendicular *AB* should be same.

$$\therefore \frac{2u}{3}\sin\theta = u\sin 30^\circ$$

$$\therefore \theta = \sin^{-1}\left(\frac{3}{4}\right)$$

Add to Favorites

You scored 4 of 4

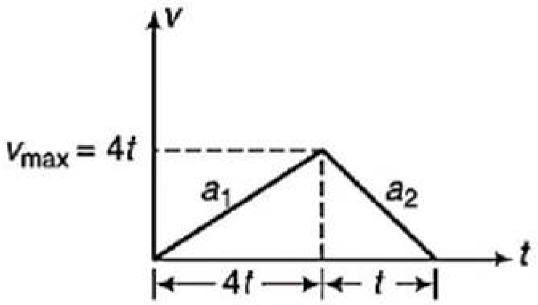
Q24. **A car is travelling on a straight road. The maximum velocity the car can attain is 24 ms^{-1}. The maximum acceleration and deceleration it can attain are 1 ms^{-2} and 4 ms^{-2} respectively. The shortest time the car takes from rest to rest in a distance of 200 m is,**

Options:

✔	22.4 s
	30 s
	11.2 s
	5.6 s

Solution :
(A)

Deceleration is four times. Therefore, deceleration time should be $\frac{1}{4}\text{th}$.



$v_{max} = (a_1)(4t) = (1)(4t) = 4t$

Area of *v-t* graph = displacement

$\therefore\ 200 = \frac{1}{2}(5t)(4t)$

or $t = \sqrt{20}\,\text{s}$

Total journey time $= 5t = 22.4\,\text{s}$

Add to Favorites

You scored 0 of 4 *skipped*

Q25. **A car is travelling on a road. The maximum velocity the car can attain is 24 ms^{-1} and the maximum deceleration is 4 ms^{-2}. If car starts from rest and comes to rest after travelling 1032 m in the shortest time of 56 s, the maximum acceleration that the car can attain is**

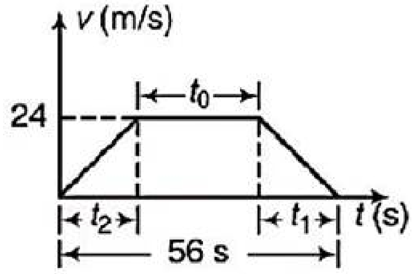
Options:

	6 ms^{-2}
✔	1.2 ms^{-2}
	12 ms^{-2}
	3.6 ms^{-2}

Solution :
(B)

Area of *v-t* graph = displacement

$\therefore\ 1032 = \frac{1}{2}(56 + t_0)(24)$ or $t_0 = 30\,\text{s}$



Deceleration time $t_1 = \frac{24}{4} = 6\,\text{s}$

$\therefore$ Acceleration time $t_2 = 56 - t_0 - t_1 = 20\,\text{s}$

$\therefore$ Acceleration $= \frac{24}{20} = 1.2 \text{ m/s}^2$

Add to Favorites

You scored 4 of 4

This section contains 25 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which ONLY ONE option can be correct.
Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

Q26. Rakesh needs 1.71 g of sugar ($C_{12}H_{22}O_{11}$) to sweeten his tea. What would be the number of carbon atoms added in his tea?

Options:

✔	3.6×10^{22}
	7.2×10^{21}
	0.05×10^{23}
	6.6×10^{22}

Solution :
(A)

Molar mass of $C_{12}H_{22}O_{11}$ = 342 g

342 g sugar has = 12 *N* atoms of C

$\therefore$ 1.71 g sugar has $= \frac{12 \times 6.02 \times 10^{23} \times 1.71}{342}$ atoms

$= 3.6 \times 10^{22}$ atoms

Add to Favorites

You scored 4 of 4

Q27. The percentage of oxygen in NaOH is:

Options:

✓	40
	16
	8
	1

Solution :
(A)

Per cent of oxygen in NaOH $= \frac{16 \times 100}{40} = 40$.

Add to Favorites

You scored 4 of 4

Q28. **One mole of P_4 molecules contain :**

Options:

	1 molecule
	4 molecule
	$\frac{1}{4} \times 6.022 \times 10^{23}$ atoms
✓	24.088×10^{23} atoms

Solution :
(D)

1 mole P_4 = N molecules of P_4 = 4 N atoms of P_4.

Add to Favorites

You scored 4 of 4

Q29. **10^{24} molecules of solute are dissolved in 10^{25} molecules of solvent, the mole fraction of solute in solution are :**

Options:

✔	0.09
	0.08
	0.07
	0.05

Solution :
(A)

Mole fraction $= \frac{n_1}{n_1 + n_2} = \frac{\text{Molecules of solute}}{\text{Total molecules of solute and solvent}}$

$= \frac{10^{24}}{10^{24} + 10^{25}} = \frac{1}{11} = 0.09$

Add to Favorites

You scored 4 of 4

Q30. **0.50 mole of $BaCl_2$ is mixed with 0.20 mole of Na_3PO_4, the maximum number of moles of $Ba_3(PO_4)_2$ that can be formed is:**

Options:

	0.70
	0.50
	0.20
✔	0.10

Solution :
(D)

$3BaCl_2 + 2Na_3PO_4 \rightarrow Ba_3(PO_4)_2\downarrow + 6NaCl$

0.50 0.20 0 0

0.20 0.00 0.10 0.60

Add to Favorites

You scored 4 of 4

Q31. A molal solution in one that contains one mole of solute in :

Options:

✓	1000 g of the solvent
	1 litre of the solvent
	1 litre of solution
	22.4 litre of solution

Solution :
(A)

Molality $= \frac{\text{Moles of solute}}{\text{wt . of solvent in kg}}$

Add to Favorites

You scored 4 of 4

Q32. The molarity of a solution obtained by mixing 750 mL of 0.5 *M* HCl with 250 mL of 2 *M* HCl will be:

Options:

	1.75 M
	0.975 M
✓	0.875 M
	1.00 M

Solution :
(C)

milli mole of solution I = $750 \times 0.5 = 375$

milli mole of solution II = $250 \times 2 = 500$

total milli mole in mixture = 375 + 500 = 875

$\therefore$ Molarity $= \frac{875}{1000} = 0.875\ \text{M}$

Add to Favorites

You scored 4 of 4

Q33. The least number of molecules are contained in:

Options:

	2 g hydrogen
	8 g hydrogen
✓	4 g nitrogen
	16 g CO_2

Solution :
(C)

Mole of N_2 is $= \frac{4}{28} = \frac{1}{7}$(the lowest value)

Add to Favorites

You scored 4 of 4

Q34. How many moles of electrons weigh one kilogram ?

Options:

	6.023×10^{23}
	$\frac{1}{9.108} \times 10^{31}$
	$\frac{6.023}{9.108} \times 10^{54}$

✓	$\frac{1}{9.108\times 6.023}\times 10^{8}$

Add to Favorites

You scored 4 of 4

Q35. The number of atoms in 558.5 g of Fe (at. Wt. 55.85) is

Options:

✓	twice that in 60 g carbon
	6.022×10^{22}
	half in 8 g He
	$558.5\times 6.023\times 10^{23}$

Solution :
(A)

558.5 g Fe $\frac{558.5}{55.85}$ mole Fe = 10 mole Fe

= 2 × 5 mole C = 2 × 60 g C

Add to Favorites

You scored 4 of 4

Q36. 6.02×10^{20} molecules of urea are present in 100 mL of its solution. The molarity of urea solution is:

Options:

	0.1
✓	0.01
	0.02
	0.001

Solution :
(B)

$$M=\frac{\text{moles of urea}}{\text{volume in litre}}=\frac{6.02\times10^{20}}{6.02\times10^{23}\times\frac{100}{1000}}=0.01\,\text{M}$$

Add to Favorites

You scored 4 of 4

Q37. Density of a 2.05 *M* solution of acetic acid in water is 1.02 g/mL. The molality of the solution is:

Options:

	1.14 mol kg^{-1}
	3.28 mol kg^{-1}
✓	2.28 mol kg^{-1}
	0.44 mol kg^{-1}

Solution :
(C)

$$m=\frac{\text{moles of }CH_3COOH}{\text{wt. of solvent in kg}}=\frac{2.05\times1000}{897}=2.285$$

Wt. of solvent = wt. of solution − wt. of solute

= [1000 × 1.02 − 2.05 × 60] = 897 g

Add to Favorites

You scored 4 of 4

Q38. A gaseous hydrocarbon given upon combustion 0.72 g of water and 3.08 g of CO_2. The empirical formula of the hydrocarbon is :

Options:

	C_6H_5

✓	C_7H_8
	C_2H_4
	C_3H_4

Solution :

(B)

Let the formula of hydrocarbon be C_aH_b

$$C_aH_b + \left(a+\frac{b}{4}\right)O_2 = aCO_2 + \frac{b}{2}H_2O$$

mole of CO_2 (a) formed $= \frac{3.08}{44} = 0.07$

mole of H_2O formed $\left(\frac{b}{2}\right) = \frac{0.72}{18} = 0.04$

$\therefore \frac{a}{b/2} = \frac{0.07}{0.04}$

or $\frac{a}{b} = \frac{0.07}{0.08} = \frac{7}{8}$

$\therefore$ mole ratio of C and H : : 7 : 8

Thus empirical formula is C_7H_8.

Add to Favorites

You scored 4 of 4

Q39. **Atomic mass of Ne is 20.2. Ne is a mixture of Ne^{20} and Ne^{22}. Relative abundance of heavier isotope is:**

Options:

	90
	20
	40
✓	10

Solution :
(D)

Average isotopic wt. $= \Sigma\% \times$ isotopic wt.

$$= \frac{(\text{per cent} \times \text{wt. of isotope}) + (\text{per cent} \times \text{wt. of other isotope})}{100}$$

$$\therefore \quad 20.2 = \frac{a \times 20 + (100 - a) \times 22}{100}$$

$$\therefore \quad a = 90$$

Per cent of heavier isotope = 100 − 90 = 10

Add to Favorites

You scored 4 of 4

Q40. If the series limit of wavelength of the Lyman series for the hydrogen atom is 912 Å, then the series limit of wavelength for the Balmer series of the hydrogen atom is:

Options:

	912 Å
	912×2 Å
✓	912×4 Å
	912/2 Å

Solution :
(C)

$$\frac{1}{\lambda_{\text{Lyman}}} = R_H\left[\frac{1}{1^2} - \frac{1}{\infty^2}\right] = R_H$$

$$\frac{1}{\lambda_{\text{Balmer}}} = R_H\left[\frac{1}{2^2} - \frac{1}{\infty^2}\right] = \frac{R_H}{4}$$

$$\frac{\lambda_{\text{Balmer}}}{\lambda_{\text{Lyman}}} = 4 \text{ or } \lambda_B = 4 \times 912 \text{ Å}$$

Add to Favorites

You scored 4 of 4

Q41. The difference in angular momentum associated with the electron in two successive orbits of hydrogen atom is:

Options:

	h/π
✓	$h/2\pi$
	$h/2$
	$(n-1)h/\pi$

Solution :
(B)

Angular momentum for *n* and (*n* + 1) shells are $\frac{nh}{2\pi}$ and $(n+1)\frac{h}{2\pi}$.

Thus, difference in angular momentum of two successive orbitsl is $(n+1)\frac{h}{2\pi}-\frac{nh}{2\pi}=\frac{h}{2\pi}$

Add to Favorites

You scored 4 of 4

Q42. The longest λ for the Lyman series is ……… (Given R_H = 109678 cm^{-1}):

Options:

✓	1215 Å
	1315 Å
	1415 Å
	1515 Å

Solution :
(A)

For longest λ of Balmer series $n_1 = 1$ and $n_2 = 2$,

$$\frac{1}{\lambda}=R_H\left[\frac{1}{n_1^2}-\frac{1}{n_2^2}\right]$$

Because $\Delta E = \frac{hc}{\lambda}$ is minimum when λ is longest.

Thus, $\Delta E = E_2 - E_1$.

Thus, $\frac{1}{\lambda} = R_H \times \left[\frac{1}{1^2} - \frac{1}{2^2}\right] = \frac{3}{4} \times 109678$

$\therefore \ \lambda = 1.215 \times 10^{-15}\ \text{cm} = 1215\ \text{Å}$

Add to Favorites

You scored 4 of 4

Q43. A ball of mass 200 g is moving with a velocity of 10 m sec^{-1}. If the uncertainity of velocity is 0.1%, the uncertainty in it position is :

Options:

	3.3×10^{-31} m
	3.3×10^{-27} m
	5.3×10^{-25} m
✔	2.64×10^{-32} m

Solution :
(D)

$\Delta u = \frac{0.1}{100} \times 10 = 10^{-2}\ \text{m sec}^{-1}$; Now $\Delta u \cdot \Delta X = \frac{h}{4\pi m}$

$\therefore \ \Delta X = \frac{6.625 \times 10^{-34}}{4 \times 10^{-2} \times 3.14 \times 200 \times 10^{-3}} = 2.64 \times 10^{-32}\ \text{m}$

Add to Favorites

You scored 4 of 4

Q44. In absence of Pauli exclusion principle, the electronic configuration of Li in ground state may be:

Options:

	$1s^2, 2s^1$
✓	$1s^3$
	$1s^1, 2s^2$
	$1s^2, 2s^1 2p^1$

Solution :
(B)

All the three electrons are to be kept in 1*s*.

Add to Favorites

You scored -1 of 4

Q45. Which one is odd one?

Options:

	$4f$
	$5d$
✓	$3s$
✗	$6p$

Solution :
(C)

($n + l$) for rest all is = 7;

For 3*s* it is 3 + 0 = 3.

Add to Favorites

You scored 4 of 4

Q46. The ratio of the energy of the electron in ground state of hydrogen to the electron in first excited state of Be^{3+} is:

Options:

✔	1 : 4
	1 : 8
	1 : 16
	16 : 1

Solution :
(A)

$E_{2(Be^{3+})} = E_{2(H)} \times Z^2$; Also $E_{2(H)} = \frac{E_{1(H)}}{2^2}$

$\therefore \; E_{2(Be^{3+})} = \frac{E_{1(H)}}{2^2} \times 4^2 = 4 \times E_{1(H)}$

Add to Favorites

You scored 4 of 4

Q47. If the radius of first Bohr orbit is *x* then de Broglie wavelength of electron in 3rd orbit is nearly:

Options:

	$2\pi x$
✔	$6\pi x$
	$9x$
	$\frac{x}{3}$

Solution :
(B)

$r_n = r_1 \times n^2$

$r_3 = 3^2 x = 9x$

Also, $mvr_3 = \frac{3h}{2\pi}$

or $mu = 3\frac{h}{2\pi \cdot 9x} = \frac{h}{6\pi x}$

or $\lambda = \frac{h}{mu} = \frac{h \cdot 6\pi x}{h} = 6\pi x$

Add to Favorites

You scored 4 of 4

Q48. How many electrons in an atom with atomic number 105 can have ($n + l$) = 8 ?

Options:

	30
✓	17
	15
	Unpredictable

Solution :

(B)

Electronic configuration of atom with atom no. 105 is : $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^{10}, 4s^2 4p^6 4d^{10}, 5s^2 5p^6 5d^{10} \underline{5f^{14}}$, $6s^2 6p^6 \underline{6d^3}, 7s^2$.

The underlined orbitals have ($n + l$) = 8.

Add to Favorites

You scored 4 of 4

Q49. The electronic configuration of $_{46}$Pd is :

Options:

✓	$_{36}$[Kr] $4d^{10}$
	$_{36}$[Kr] $4d^8, 5s^2$
	$_{36}$[Kr] $4d^9, 5s^1$

	$_{18}$[Kr] $4d^{10}$

Solution :
(A)

Pd : [Kr]$4d^{10}$. An exception.

Add to Favorites

You scored 4 of 4

Q50. Which electronic level would allow the hydrogen atom to absorb a photon but not to emit a photon?

Options:

	$3s$
	$2p$
	$2s$
✔	$1s$

Solution :
(D)

Ground state of hydrogen atom, *i.e.*, $1s$

Add to Favorites

You scored 4 of 4

This section contains 25 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which ONLY ONE option can be correct.
Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

Q51. If $2^a = 3$ and $9^b = 4$ then value of (ab) is -

Options:

✓	1
	2
	3
	4

Solution :
(A)

$a = \log_2 3$

$b = \log_9 4$

$\Rightarrow \ ab = \log_2 3 \log_3 2 = 1$.

Add to Favorites

You scored 4 of 4

Q52. **If** $\log_2\left(4+\log_3(x)\right)=3$ **, then sum of digits of *x* is -**

Options:

	3
	6
✓	9
	18

Solution :
(C)

Let $4+\log_3(x)=N \ \Rightarrow \ \log_2 N = 3 \ \Rightarrow \ N = 2^3$

$N = 4+\log_3 x = 8$

$\therefore \ N = 8$

$\log_3 x = 4 \ \Rightarrow \ x = 81$.

Sum of digits of *x* = 9.

Add to Favorites

You scored -1 of 4

Q53. Sum of all the solution(s) of the equation $\log_{10}(x)+\log_{10}(x+2)-\log_{10}(5x+4)=0$ **is -**

Options:

	−1
✗	3
✓	4
	5

Solution :
(C)

Using $\log_{10} p+\log_{10} r-\log_{10} s=\log_{10}\left(\frac{pr}{s}\right)$

$\log_{10}\left(\frac{x(x+2)}{5x+4}\right)=0$

$\Rightarrow\ x^2+2x=5x+4$

$\Rightarrow\ x=4,\ x=-1$

(reject)

Add to Favorites

You scored 0 of 4 *skipped*

Q54. The product of all the solutions of the equation $x^{1+\log_{10} x}=100000x$ **is -**

Options:

	10
	10^5
	10^{-5}

✔	1

Solution :
(D)

$x^{(1+\log_{10} x)} = 10^5 \cdot x$

Taking log on both sides to base 10 :

$(1+\log_{10} x)(\log_{10} x) = 5 + \log_{10} x$

$\log_{10} x = t \Rightarrow t(1+t) = 5+t$

$\Rightarrow t^2 + t = 5 + t$

$\Rightarrow t = 5^{1/2}$ or $t = -5^{1/2}$

$\Rightarrow \log_{10} x = 5^{1/2};\ \log_{10} x = -5^{1/2}$

$\Rightarrow x = 10^{5^{1/2}};\ x = 10^{-5^{1/2}}$

Product = 10° = 1

Add to Favorites

You scored 0 of 4 *skipped*

Q55. If x_1 and x_2 are the roots of equation $e^{3/2} \cdot x^{2\ln x} = x^4$, then the product of the roots of the equation is -

Options:

✔	e^2
	e
	$e^{3/2}$
	e^{-2}

Solution :
(A)

Take log on both sides

$\frac{3}{2} + 2(\ln x)^2 = 4\ln x$

$t = \ln x \qquad ...(1)$

$$2t^2 - 4t + \frac{3}{2} = 0 \begin{cases} t_1 \to t_1 \ln x_1 \\ t_2 \to t_2 \ln x_2 \end{cases}$$

$t_1 + t_2 = 2$

$\ln x_1 + \ln x_2 = 2$ (from Eqs. (1))

$\ln(x_1 x_2) = 2 \Rightarrow x_1 x_2 = e^2$

Note: $\log_e x = \ln x$; where 'e' is Napier's constant. Its irrational quantity.

Add to Favorites

You scored -1 of 4

Q56. Solution set of $\sqrt{7x-6} < x$ is

Options:

	$(6, \infty)$
✗	$(1, 6)$
	$\left[\frac{6}{7}, 6\right)$
✓	$\left[\frac{6}{7}, 1\right) \cup (6, \infty)$

Add to Favorites

You scored 4 of 4

Q57. Number of positive integral solution of $\frac{x^2(3x-4)^3(x-2)^4}{(x-5)^5(2x-7)^6} \le 0$ is

Options:

	4
✓	3
	2

	1

Solution :
(B)

Wavy curve method

Add to Favorites

You scored 0 of 4 *skipped*

Q58. **If $\log_a\left(1-\sqrt{1+x}\right)=\log_{a^2}\left(3-\sqrt{1+x}\right)$, then number of solutions of the equations is -**

Options:

✔	0
	1
	2
	infinitely many

Solution :
(A)

Domain: $1-\sqrt{1+x}>0$ & $3-\sqrt{1+x}>0$

$\Rightarrow \sqrt{1+x}<1$

Put $\sqrt{1+x}=t \Rightarrow t\geq 0$

$(1-t)^2=3-t$

$t^2-t-2=0$

$t=2,-1$ (both rejected)

$\Rightarrow$ No real solution

Add to Favorites

You scored 0 of 4 *skipped*

Q59. The number of solution(s) of $\sqrt{\log_3(3x^2).\log_9(81x)} = \log_9 x^3$ is -

Options:

	0
✔	1
	2
	3

Solution :
(B)

$t = \log_3 x$

$\sqrt{(1+2t)\left(2+\frac{t}{2}\right)} = \frac{3}{2}t$

$t > 0$

Squaring

$2+\frac{t}{2}+4t+t^2 = \frac{9}{4}t^2$

$5t^2 - 18t - 8 = 0$

$5t^2 - 20t + 2t - 8 = 0$

$(5t+2)(t-4) = 0$

$\Rightarrow\ t = 4$

$\Rightarrow\ \log_3 x = 4$

$x = 81$

Add to Favorites

You scored 0 of 4 *skipped*

Q60. If x_1 and x_2 are the two values of x satisfying the equation $7^{2x^2} - 2\left(7^{x^2+x+12}\right) + 7^{2x+24} = 0$, then $(x_1 + x_2)$ equals -

Options:

	0

✓	1
	−1
	7

Solution :
(B)

$7^{x^2} = a,\ 7^{x+12} = b$

$a^2 - 2ab + b^2 = 0$

$(a-b)^2 = 0$

$\Rightarrow\ a = b$

$\Rightarrow\ \ x^2 = x + 12$

$x^2 - x - 12 = 0$

$x^2 - 4x + 3x - 12 = 0$

$(x+3)(x-4) = 0$

$x = 4, -3.$

Add to Favorites

You scored 4 of 4

Q61. **Solution set of** $\sqrt{\frac{x-3}{11-x}} \geq -1$ **is**

Options:

	(4, 10)
	(3, 11)
	$(-\infty, \infty)$
✓	[3, 11)

Solution :
(D)

$$\frac{x-3}{11-x} \geq 0$$

$$\frac{x-3}{x-11} \leq 0$$

Add to Favorites

You scored -1 of 4

Q62. **Number of integral values of *x* satisfying** $\log_{1/2}\left(x^2-5x+6\right) \geq -1$ **is**

Options:

✗	4
✓	2
	6
	None

Solution :
(B)

$$0 < x^2 - 5x + 6 \leq 2$$

Add to Favorites

You scored 4 of 4

Q63. **If** $x = \log_2\left(\sqrt{56+\sqrt{56+\sqrt{56+\sqrt{56+......\infty}}}}\right)$**, then which of the following statements holds good ?**

Options:

	$x < 0$
	$0 < x < 2$
✓	$2 < x < 4$

	$3 < x < 4$

Solution :
(C)

$$x = \log_2 \sqrt{56+\sqrt{56+\sqrt{56+\sqrt{56+\ldots\infty}}}}$$

$$2^x = \sqrt{56+\sqrt{56+\sqrt{56+\ldots}}}$$

$$2^x = \sqrt{56+2^x}$$

$$2^{2x} - 2^x = 56 \Rightarrow 2^{2x} - 2^x - 56 = 0$$

Let $2^x = t$ $\therefore t^2 - t - 56 = 0$

$t = 8$ & $t = -7x$

$2^x = 8 \therefore 2^x = 2^3 \Rightarrow x = 3$

$\therefore 2 < x < 4$

Add to Favorites

You scored 0 of 4 *skipped*

Q64. Solution set of $-1 \le |x-5| < 2$ is

Options:

	[6, 9)
	[4, 7)
✔	(3, 7)
	None

Solution :
(C)

$-2 < x-5 < 2$

$3 < x < 7$

Add to Favorites

You scored 0 of 4 *skipped*

Q65. The number $\log_2 7$ is -

Options:

	an integer
	a rational number
✓	an irrational number
	a prime number

Solution :
(C)

Let $\log_2 7$ be rational then $\log_2 7 = \frac{p}{q}$ $(q \neq 0)$

$7 = 2^{p/q} \Rightarrow 2^p = 7^q$

Here all power of 2 is even but 7 is odd.

$\therefore$ our assumption is wrong

$\therefore$ $\log_2 7$ is irrational.

Add to Favorites

You scored 0 of 4 *skipped*

Q66. The number of integral solutions of $|\log_5 x^2 - 4| = 2 + |\log_5 x - 3|$ is -

Options:

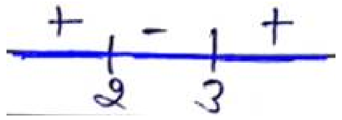
✓	1
	2
	3
	0

Solution :
(A)

Case (1) : $t < 2$

$-2t + 4 = 2 - t + 3$

$t = -1$

 $\log_5 x = -1$

$\Rightarrow\ x = \frac{1}{5}$

Case (2) : $2 \le t < 3$

$2t - 4 = 2 - t + 3$

$3t = 9$

$t = 3$

$\log_5 x = 3$

Case (3) : $t \ge 3$

$2t - 4 = 2 + t - 3$

$t = 3$

$\log_5 x = 3$

$x = 125$

Add to Favorites

You scored 0 of 4 *skipped*

Q67. Find the value of $3^{\sqrt{\log_3 5}} - 5^{\sqrt{\log_5 3}}$ is

Options:

	$\sqrt{5} - \sqrt{3}$
	$\sqrt{2}$
	2
✔	0

Add to Favorites

You scored 0 of 4 *skipped*

Q68. Solution set for $(0.5)^{1/x} \geq 0.0625$ is

Options:

	$[4, \infty)$
	$(-\infty, 0)$
✓	$(-\infty, 0) \cup [4, \infty)$
	None

Add to Favorites

You scored 0 of 4 *skipped*

Q69. If α and β are the roots of the equation $(\log_2 x)^2 + 4(\log_2 x) - 1 = 0$, then the value of $\alpha\beta$ equals

Options:

	$\frac{1}{8}$
	8
	16
✓	$\frac{1}{16}$

Solution :

(D)

$(\log_2 x)^2 + 4(\log_2 x)^2 - 1 = 0$

Let $\log_2 x = t$

$t^2 + 4t - 1 = 0$

$t = \frac{-4 \pm \sqrt{16+4}}{2}$

$t = -2 \pm \sqrt{5}$

$\log_2 x = -2 \pm \sqrt{5}$

$x = 2^{-2\pm\sqrt{5}}$

$\therefore \quad \beta = 2^{-2-\sqrt{5}}$

$\alpha = 2^{-2+\sqrt{5}}$

$\alpha\beta = 2^{-4} = \frac{1}{16}$

Add to Favorites

You scored 4 of 4

Q70. If $\log_{0.3}(x-1) < \log_{0.09}(x-1)$, then *x* lies in the interval

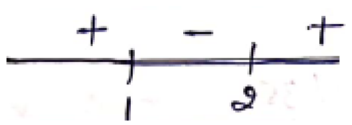
Options:

✔	$(2, \infty)$
	$(1, 2)$
	$(1, \infty)$
	none of these

Solution :

(A)

$\log_{0.3}(x-1) < \frac{1}{2}\log_{0.3}(x-1)$



$x-1 > (x-1)^{1/2}$

$x^2 + 1 - 2x > x - 1$

$x^2 - 3x + 2 > 0 \Rightarrow (x-2)(x-1) > 0$

$x \in (-\infty, 1) \cup (2, \infty) \qquad ...(1)$

$\& \ x - 1 > 0 \Rightarrow x > 1 \Rightarrow x \in (1, \infty) \qquad ...(2)$

$\therefore$ (1) & (2)

$\Rightarrow (2, \infty)$

Add to Favorites

You scored 4 of 4

Q71. $\sqrt{x^2-5x+6} \le \sqrt{x^2+x+1}$ **solution set is ?**

Options:

	$(-\infty, 2]$
	$\left[\frac{5}{6}, \infty\right)$
	$[3, \infty)$
✓	None

Solution :
(D)

$-5x+6 \le x+1 \qquad x \ge \frac{5}{6}$

$x^2-5x+6 \ge 0 \quad x \in (-\infty, 2] \cup [3, \infty)$

Intersection

$\left[\frac{5}{6}, 2\right] \cup [3, \infty)$ Ans.

Add to Favorites

You scored -1 of 4

Q72. **The number of solutions of the equation** $\log_{x-3}\left(x^3-3x^2-4x+8\right)=3$ **is equal to**

Options:

	4
	3
✗	2
✓	1

Solution :
(D)

Domain: $x-3>0,\ x-3\neq 1\ \&\ x^3-3x^2-4x+8>0$

$x^3-3x^2-4x+8=(x-3)^3$

$6x^2-31x+35=0$

$$x=\frac{31\pm\sqrt{(31)^2-4(6)(35)}}{12}$$

$$\Rightarrow x=\frac{31\pm 11}{12} \quad \Rightarrow x=\begin{cases}\frac{42}{12}=\frac{7}{2}\\ \frac{20}{12}=\frac{5}{3}\end{cases}$$

$\therefore$ No. of solution = 1 as $x=\frac{5}{3}$ is rejected

Add to Favorites

You scored 0 of 4 *skipped*

Q73. **Sum of the roots of the equation** $9^{\log_3(\log_2 x)}=\log_2 x-(\log_2 x)^2+1$ **is equal to**

Options:

✔	2
	4
	6
	8

Solution :

(A)

Domain: $\log_2 x>0$ i.e. $x > 1$

$9^{\log_3(\log_2 x)}=\log_2 x-(\log_2 x)^2+1$

$3^{2^{\log_3(\log_2 x)}}=\log_2 x-(\log_2 x)^2+1$

$(\log_2 x)^2+(\log_2 x)^2-(\log_2 x)-1=0$

$\therefore$ By property $a^{\log_a}=1$

Let $\log_2 x=t$

$\therefore\ 2t^2-t-1=0$

$2t(t-1)+1(t-1)=0$

$t=1,-\frac{1}{2} \Rightarrow$ only t = 1 acceptable

$\Rightarrow \log_2 x = 1 \Rightarrow x = 2 \Rightarrow$ Sum of roots = 2

Add to Favorites

You scored 4 of 4

Q74. **If *x* satisfies the inequality** $\log_{25} x^2 + (\log_5 x)^2 < 2$**, then** $x \in$

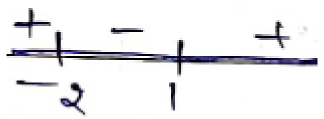
Options:

✔	$\left(\frac{1}{25}, 5\right)$
	(1, 2)
	(4, 5)
	(0, 1)

Solution :

(A)

$\frac{1}{2}\log_5 x^2 + (\log_5 x)^2 - 2 < 0$



Let $\log_5 x = t$

$\log_5 x + (\log_5 x)^2 - 2 < 0$

$t^2 + t - 2 < 0$

$(t+2)(t-1) < 0$

$t \in (-2, 1)$

$\therefore \log_5 x \in (-2, 1)$

$\therefore x \in \left(\frac{1}{25}, 5\right)$

Add to Favorites

You scored 4 of 4

Q75. **If** $1, \log_9\left(3^{1-x}+2\right)$ **and** $\log_3\left(1.3^x-1\right)$ **are in A.P. then** ***x*** **can be**

Options:

	$\log_4 3$
	$\log_3 4$
✔	$1-\log_3 4$
	$\log_3 0.25$

Solution :

(C)

$2\cdot\log_9\left(3^{1-x}+2\right)=1+\log_3\left(4\cdot3^x-1\right)$

$\frac{2}{2}\cdot\log_3\left[\frac{3}{3^x}+2\right]=\log_3 3+\log_3\left(4\cdot3^x-1\right)$

Let $3^x=t \Rightarrow t>0$

$\log_3\left[\frac{3}{t}+2\right]=\log_3\left[3\cdot\left(4\cdot3^x-1\right)\right]$

$3+2t=12t^2-3t$

$12t^2-5t-3=0$

$(4t-3)(3t+1)=0$

$t=\frac{3}{4}, \frac{-1}{3} \therefore 3^x=\frac{3}{4}$

$x\log 3=\log 3-\log 4$

$\Rightarrow x=1-\log_3 4$

Add to Favorites