# PART-1 : PHYSICS

SECTION-I

1) If $y = x^2 \sin x$, then $\frac{dy}{dx}$ will be

(A) $x^2 \cos x + 2x \sin x$

(B) $2x \sin x$

(C) $x^2 \cos x$

(D) $2 x \cos x$

2) $y = \sin x$ then the value of $\int_0^{2\pi} y dx$

(A) $\frac{\pi}{4}$

(B) 0

(C) $\pi$

(D) $\frac{\pi}{5}$

3) If $v = 3t^2 - 2t + 1$, find the value of t for which $\frac{dv}{dt} = 0$.

(A) $\frac{1}{2}$

(B) $\frac{2}{3}$

(C) $\frac{1}{3}$

(D) None

4) Find the minimum value of the function
$y = 3x^3 - 9x^2 + 2$, for $x \in [0, 3]$

(A) 0

(B) –10

(C) 2

(D) None of these

5) $\int_0^1 \left(t^2 + 9t + c\right) dt = \frac{9}{2}$. Find the value of 'c'

(A) $-\frac{1}{3}$

(B) Zero

(C) 3

(D) 2

6) A particle is moving towards east with velocity 8 m/s and acceleration 4 m/s$^2$ directed towards west. Find the distance travelled in 6 seconds.

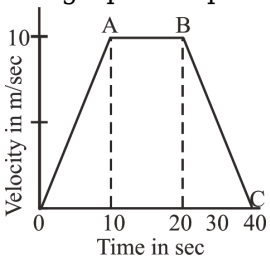
(A) 40 m

(B) 24 m

(C) 32 m

(D) 16 m

7) The adjoining curve represents the velocity–time graph of a particle, its acceleration values along OA, AB and BC in metre/sec$^2$ are respectively :-




(A) 1, 0, –0.5

(B) 1, 0, 0.5

(C) 1, 1, 0.5

(D) 1, 0.5, 0

8) Two cars $C_1$ and $C_2$ are approaching each other on a straight track, $C_1$ has velocity 5 m/s and $C_2$ has 3 m/s. Then their relative velocity will be :

(A) 2 m/s

(B) 8 m/s

(C) 4 m/s

(D) 16 m/s

9) A particle moves in a straight line with a constant acceleration. It changes its velocity from 10 m/s to 20 m/s while passing through a distance of 135 m in t seconds. The value of t is :-

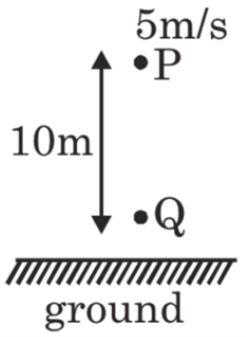
(A) 12

(B) 9

(C) 10

(D) 1.8

10) A ball is thrown vertically upwards with an initial velocity of 5 m/sec from point P as shown. Q is a point 10m vertically below the point P. Then the speed of the ball at point Q will be (in m/sec):




(take g = 10 m/s$^2$ and neglect air resistance)

(A) 15 m/s

(B) 10 m/s

(C) 12 m/s

(D) 14 m/s

11) The ratio of the distances traversed, in successive equal intervals of time by a body freely falling from rest, are:-

(A) 1:3:5:7:9:....

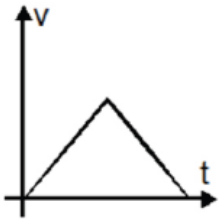
(B) 2:4:6:8:10:....

(C) 1:4:7:10:13:....

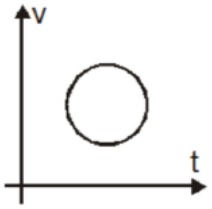
(D) None of these

12) Which one of the following curves do not represent motion in one dimension :-

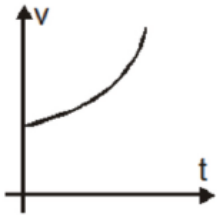
(A)

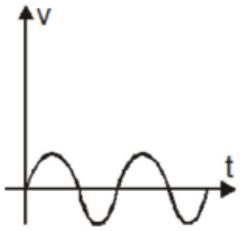



(B)




(C)



(D) 


13)

X-coordinate of a particle moving along this axis is : $x = \left(2 + t^2 + 2t^3\right)$. Here, x is in metre and t in seconds. Find the position of particle from where it started it journey and initial velocity of particle.

(A) 2m, 0 m/s

(B) 0 m, 0 m/s

(C) 0.5 m, –1m/s

(D) None of these

14) A ball is thrown vertically upward such that it comes back to hand at same height after 4s. Find initial speed of ball by which it is thrown. ($g = 10\ m/s^2$)

(A) 10 m/s

(B) 20 m/s

(C) 5 m/s

(D) 25 m/s

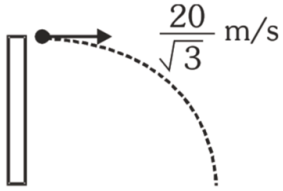
15) A particle is moving along x-axis whose instantaneous speed is $v^2 = 108 - 9x^2$. The acceleration of particle is

(A) $-9x\ m/s^2$

(B) $-18x\ m/s^2$

(C) $\frac{-9x}{2}\ m/s^2$

(D) None of these

16) A particle is projected horizontally with a speed of $\frac{20}{\sqrt{3}}$ m/s, from height at t = 0. At what time will its velocity make 60° angle with the initial velocity (in s) 


(A) 2 s

(B) 1 s

(C) 4 s

(D) 3 s

17) A projectile is given an initial velocity of $\hat{i} + 2\hat{j}$. The Cartesian equation of its path is : (g = 10 $m/s^2$) :

(A) $y = 2x - 5x^2$

(B) $y = x - 5x^2$

(C) $4y = 2x - 5x^2$

(D) $y = 2x - 25x^2$

18) An object is thrown horizontally from a tower H meter high with a velocity of $\sqrt{2gH}$ m/s. Its speed on striking the ground will be:

(A) $\sqrt{2gH}$

(B) $\sqrt{6gH}$

(C) $2\sqrt{gH}$

(D) $2\sqrt{2gH}$

19) Two projectiles of same mass with same speed are thrown at an angle 60° and 30° respectively with the horizontal, then which will remain same for both.

(A) Time of flight

(B) Range of projectile

(C) Maximum height

(D) All of them

20) A car covers the first half of the distance between two place at a speed of 40 km/h and the other half at 60 km/h. The average speed of the car is:

(A) 40 km/h

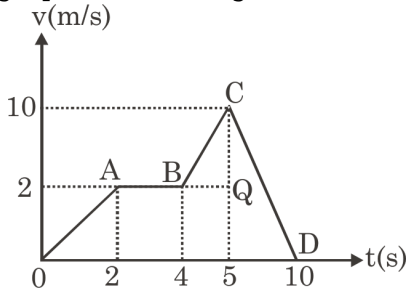
(B) 48 km/h

(C) 50 km/h

(D) 60 km/h

SECTION-II

1) A particle moves on straight line according to the velocity-time graph shown in figure. If the total distance covered in 10 sec is 100x (in meter) then the value of x is




2) If a car at rest accelerates uniformly to a speed of 144 km/h in 20 seconds, it covers a distance (in meter) of :

3) Velocity of particle depend on x as $v = 4x^2 - 4$ where x is position of the particle then find acceleration at x = 1 is

4) A stone is projected from the ground with velocity 25 m/s. two seconds later, it just clears a wall 5 m high the angle of projection of the stone is ___° (in degree). ($g = 10\ m/s^2$)

5) If a projectile is thrown at an angle of θ. Then at the uppermost point of a projectile its velocity and acceleration are at an angle of (in radian) :-

6) During an interval a particle accelerating uniformly has initial velocity 25 m/s and final velocity 35 m/s. If total displacement is 180 meters, find the time interval in seconds.

7)

The position of an object moving along a straight line is given by $x = 3 - 2t^2 + 3t^3$ where x is in meters and t in seconds. Find average velocity between t = 1 s and t = 3 s.

8) $\int_{-1}^{2} \frac{3}{2} dt$ = _____

9) If $f(x) = \frac{5}{4}x - 5$, then f '(5) is equal to ?

10) If $x = \left(2 - 5t + 6t^2\right)$, then find the value of $\frac{dx}{dt}$ at t = 2

## PART-2 : CHEMISTRY

SECTION-I

1) If radius of second stationary orbit (in Bohr's atom) is R. Then radius of third orbit will be :-

(A) R/3
(B) 9R
(C) R/9
(D) 2.25 R

2) If the radius of first orbit of H atom is $a_0$, the de-Broglie wavelength of an electron in the third orbit is :-

(A) $6\ \pi\ a_0$

(B) $8\pi a_0$

(C) $2\pi a_0$

(D) $4\pi a_0$

3) The electrons, identified by n & $\ell$ ;
(i) n = 4 , $\ell$ = 1
(ii) n = 4 , $\ell$ = 0
(iii) n = 3 , $\ell$ = 2
(iv) n = 3 , $\ell$ = 1
can be placed in order of increasing energy, from the lowest to highest as:

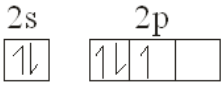
(A) (iv) < (ii) < (iii) < (i)

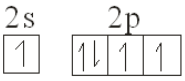
(B) (iii) < (ii) < (iv) < (i)

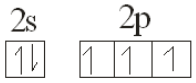
(C) (i) < (iii) < (ii) < (iv)

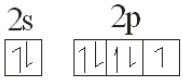
(D) (iii) < (i) < (iv) < (ii)

4) The orbital diagram in which the Auf-bau principle is violated-

(A) 


(B) 


(C) 


(D) 


5)

The de-Broglie wavelength of a particle with mass 1gm and velocity 100 m / sec is

(A) $6.63 \times 10^{-33}$m
(B) $6.63 \times 10^{-34}$m
(C) $6.63 \times 10^{-35}$m
(D) $6.65 \times 10^{-35}$m

6) The ionisation energy of a hydrogen atom is 13.6 ev. The energy of the ground level in doubly ionised lithium is

(A) –28.7 ev

(B) –54.4 ev

(C) –122.4 ev

(D) –13.6 ev

7) Find the wavelength of light emitted by an electron during a transition from n = 3 to n = 1 level in the $C^{+5}$ ion. Given $R_H = 1.097 \times 10^7\ m^{-1}$.

(A) 2.85 nm

(B) 8.76 nm

(C) 6.40 nm

(D) 12.0 nm

8) Angular momentum in $2^{nd}$ Bohr orbit of H-atom is x. Then find out the angular momentum of electron in $1^{st}$ excited state of $Li^{+2}$ :-

(A) 3x

(B) 9x

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

(D) x

9) Incorrect relation is–

(A) $E_1 < E_2 < E_3$ (E = Energy of shell)

(B) Balmer series spectral lines = $n_2 - 2$

(C) $r_n = 0.529 \frac{n^2}{Z}$ pm ($r_n$ =radius of $n^{th}$ shell)

(D) $\overline{\upsilon} = R_H Z^2 \left( \frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$

10) The correct set of quantum numbers for the unpaired electron of chlorine atom is

| | **n** | **l** | **m** |
|---|---|---|---|
| (A) | 2 | 1 | 0 |
| (B) | 2 | 1 | 1 |
| (C) | 3 | 1 | 1 |
| (D) | 3 | 0 | 0 |

(A) (A)

(B) (B)

(C) (C)

(D) (D)

11) The ratio of the difference in energy between the first and second Bohr orbits to that between the second and third Bohr orbit is :

(A) 1/2

(B) 1/3

(C) 4/9

(D) 27/5

12) Which of the following set of quantum numbers is permitted ?

(A) $n = 3\ l = 3\ m = +\frac{1}{2}\ s = +1$

(B) $n = 5\ l = 3\ m = -3\ s = +1$

(C) $n = 6\ l = 2\ m = -3\ s = +\frac{1}{2}$

(D) $n = 7\ l = 3\ m = -3\ s = +\frac{1}{2}$

13) $\Psi_{311}$ represents which orbital :-

(A) $5p_z$

(B) $3d_{yz}$

(C) $3d_{z^2}$

(D) $3p_x$

14) ('□' and 'm' are respectively the azimuthal and magnetic quantum numbers)

| Column-I | | Column-II | |
|---|---|---|---|
| (a) | Total number of values of (□) for a shell | (i) | 0, 1, 2, ...(n–1) |
| (b) | Values of (□) for a shell | (ii) | +□, ...+2, +1, 0, –1, –2, ...–□ |
| (c) | Total number of values of (m) for a subshell | (iii) | (2□ + 1) |
| (d) | Values of (m) for a subshell | (iv) | n |

(A) (a)-(iv); (b)-(i); (c)-(iii); (d)-ii

(B) (a)-(i); (b)-(ii); (c)-(iii); (d)-iv

(C) (a)-(ii); (b)-(i); (c)-(iv); (d)-(iii)

(D) (a)-(iii); (b)-(ii); (c)-(i); (d)-iv

15) A 5000 W gas discharge lamp emits 5.0 W of U.V radiation in narrow range centered around 198 nm wavelength. Then number of photons of this wavelength emitted in one minute :
(Given: $h = 6.6 \times 10^{-34}$ Js, $C = 3 \times 10^8$ m/s)

(A) $2 \times 10^{16}$

(B) $3 \times 10^{20}$

(C) $5 \times 10^{18}$

(D) $8.3 \times 10^{16}$

16) An increasing order (lowest first) for the values of $\left|\frac{e}{m}\right|$ for electron(e), proton(p), neutron(n) and (α) particle is :

(A) e, p, n, α

(B) n, α, p, e

(C) n, p, e, α

(D) n, p, α, e

17) Representative element are belong to :-

(A) s and p-block

(B) d-block

(C) d and f-block

(D) f-block

18) Which one is the correct order of the size of iodine species ?

(A) $I > I^+ > I^-$

(B) $I > I^- > I^+$

(C) $I^+ > I^- > I$

(D) $I^- > I > I^+$

19) Which of the following element has the highest first ionisation enthalpy :-

(A) N

(B) B

(C) C

(D) O

20) The correct order of electron gain enthalpy of F, Cl, Br and I, having atomic number 9, 17, 35 and 53 respectively, is:

(A) F > Cl > Br > I

(B) Cl > F > Br > I

(C) Br > Cl > I > F

(D) I > Br > Cl > F

SECTION-II

1) Atomic number of the element with IUPAC name "Ununnilium"

2) $4d^3 5s^2$ configuration belongs to which group :-

3) A ball of mass 100 g is moving with 100 $ms^{-1}$. Its wavelength is $x \times 10^{-25}$ Å. Find the value of x.

4) Among the following how many element example of halogen

F, Br, Ca, N, I, S, Se, O

5) The maximum number of electrons in p-orbital with n = 6 ; m = 0 is

6) According to Bohr's theory, the angular momentum of an electron in $5^{th}$ orbit is:
If your is then $\frac{xh}{\pi}$, then x = ?

7) In H-atom electron jump $n^{th}$ shell to ground state, If number of line in paschen series is 3, $n^{th}$ shell will be ?

8) A light source of wavelength λ illuminates a metal and ejects photo-electrons with $(K.E.)_{max}$ = 1 eV Another light source of wavelength λ/3 ejects photo-electrons from same metal with $(K.E.)_{max}$ = 4 eV. Find the value of work function? (in eV)

9) The ratio of wavelength of $2^{nd}$ line of Balmer series and $1^{st}$ line of Lyman series for an atom is :-

10) If the de Broglie wavelength of the electron in $n^{th}$ Bohr orbit in a hydrogenic atom is equal to $1.5\,\pi a_0$($a_0$ is Bohr radius), then the value of n/z is:

## PART-3 : MATHEMATICS

SECTION-I

1) If $x = a + a/r + a/r^2 + ....\infty$, $y = b - b/r + b/r^2 - ...\infty$ and $z = c + c/r^2 + c/r^4 + ...\infty$ then $\frac{xy}{z}$ equals $(|r| < 1)$

(A) $\frac{ab}{c}$

(B) $\frac{bc}{a}$

(C) $\frac{ca}{b}$

(D) $\frac{a}{bc}$

2) G.M. of numbers 3, $3^2$, $3^3$ ..... $3^n$ is :-

(A) $3^{2/n}$

(B) $3^{n/2}$

(C) $3^{\frac{n+1}{2}}$

(D) $3^{\frac{n-1}{2}}$

3) If 4th term of an AP is 64 and its 54th term is –61, then its common difference is

(A) $-\frac{5}{2}$

(B) $\frac{5}{2}$

(C) $\frac{3}{50}$

(D) $-\frac{3}{50}$

4) The Harmonic mean of the roots of equation $x^2 - 10x + 11 = 0$ is

(A) $\frac{1}{5}$

(B) $\frac{5}{21}$

(C) $\frac{21}{20}$

(D) $\frac{11}{5}$

5) If $19^{th}$ term of an A.P is zero, then its ($49^{th}$ term) : ($29^{th}$ term) is (where common difference of A.P. is non-zero)

(A) 1 : 3

(B) 2 : 1

(C) 3 : 1

(D) 4 : 1

6)

The maximum value of the sum of the A.P. 50, 48, 46, 44, ..... is

(A) 325

(B) 648

(C) 650

(D) 652

7)

Let $S = \frac{4}{19} + \frac{44}{(19)^2} + \frac{444}{(19)^3} +$ ..... $\infty$ terms

Then S is equal to

(A) $\frac{40}{9}$

(B) $\frac{38}{81}$

(C) $\frac{36}{171}$

(D) $\frac{20}{81}$

8)

If the sides of a right triangle are in A.P. then the ratio of its smallest side to the greatest side is

(A) 3 : 4

(B) 3 : 5

(C) 4 : 5

(D) None of these

9) Suppose 'a' is a fixed real number such that $\frac{a-x}{px} = \frac{a-y}{qy} = \frac{a-z}{rz}$ if p, q, r are in AP then x, y, z are in

(A) A. P.

(B) G. P.

(C) H. P.

(D) None of these

10) If $|x| < 1$, then the sum of series
$1 + 2x + 3x^2 + 4x^3 + \ldots \infty$ will be

(A) $\frac{1}{1-x}$

(B) $\frac{1}{1+x}$

(C) $\frac{1}{(1+x)^2}$

(D) $\frac{1}{(1-x)^2}$

11) $6^{\log_6 5} + 3^{\log_9 16} =$

(A) 9

(B) 21

(C) 7

(D) 1

12) Number of integral values of 'x' which satisfy the equation $5^{\log_5 x} + 4x + 20 = 0$, is

(A) 0

(B) 1

(C) 2

(D) 3

13) Find the value of $\log_2 4.\log_4 5.\log_5 10.\log_{10} 32$ is

(A) 2

(B) 5

(C) 4

(D) 3

14) The greatest value of $(4\log_{10} x - \log_x(.0001))$ for $0 < x < 1$ is

(A) 4

(B) –4

(C) 8

(D) –8

15) If $\log_k A.\log_5 k = 3$, then A is equal to
(where $k > 0,\ k \neq 1$)

(A) $5k^3$

(B) $k^3$

(C) 125

(D) 243

16) Find the solution of the equation given by
$\log_2(25^{x+3} - 1) = 2 + \log_2(5^{x+3} + 1)$

(A) –1

(B) 5

(C) –2

(D) –3

17)

If $\log_{0.3}(x - 1) < \log_{0.09}(x - 1)$ then x lies in the interval is

(A) $(2,\ \infty)$

(B) (-2, -1)

(C) (1, 2)

(D) $(0,\ \infty)$

18) The value of $\frac{1}{\log_{ab} abc} + \frac{1}{\log_{bc} abc} + \frac{1}{\log_{ac} abc}$ is

(A) 1

(B) 2

(C) 3

(D) 4

19) The value of $2^{\log_{\sqrt{5}}\left(\frac{10}{4}+\frac{10}{8}+\frac{10}{16}+.....\infty\right)}$ is

(A) 1

(B) 2

(C) $\frac{1}{2}$

(D) 4

20) If $\log_a\left(1-\sqrt{1+x}\right)=\log_{a^2}\left(3-\sqrt{1+x}\right)$
then the set of values of x is (where $a>0,\ a\neq 1$)

(A) {0}

(B) {0,3}

(C) {3}

(D) $\phi$

SECTION-II

1) The number of real solution of the equation,
log(− 2x) = 2 log (x + 1) is (where base of log is 10)

2) What is the absolute value of $\log_{0.001}1000$ ?

3) If $\log_{10}2 = .3010$, $\log_{10}3 = .4771$, then number of digits in $4^8.3^7.5^3$ is 'P', then $\frac{P-1}{2}$ is

4) Let $a, b \in R^+$ satisfying $\log_9 a = \log_{15} b = \log_{25}(2a + b)$, then $\frac{b}{a}$ =

5) Value of $\log_{\left(\sqrt{5}+1\right)}\left(6+2\sqrt{5}\right)$ is equal to

6) The product of three geometric means between 4 and $\frac{1}{4}$ will be

7) If a, b, c ∈ $R^+$ such that a + b + c = 18 then maximum value of a.b.c is N then, $\frac{N}{36}$ equals to

8) If the sum of n terms of an A.P. is $3n^2 + 5n$ and $t_m = 164$, then m =

9) If a, b, c are positive real numbers such that $ab^2c^3 = 64$ then minimum value of $\left(\frac{1}{a} + \frac{2}{b} + \frac{3}{c}\right)$ is

10) Find the sum of an infinitely decreasing GP. with the common ratio r such that $0 < |r| < 1$, if the ratio of the fourth term to the second term is $\frac{1}{16}$ and the ratio of the third term to the square of the second term is $\frac{1}{9}$.

ANSWER KEYS

# PART-1 : PHYSICS

## SECTION-I

| Q. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A. | A | B | C | B | A | A | A | B | B | A | A | B | A | B | A | A | A | C | B | B |

## SECTION-II

| Q. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|
| A. | 0.37 | 400.00 | 0.00 | 30.00 | 1.57 | 6.00 | 31.00 | 4.50 | 1.25 | 19.00 |

# PART-2 : CHEMISTRY

## SECTION-I

| Q. | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A. | D | A | A | B | A | C | A | D | C | C | D | D | D | A | B | B | A | D | A | B |

## SECTION-II

| Q. | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
|---|---|---|---|---|---|---|---|---|---|---|
| A. | 110.00 | 5.00 | 6.63 | 3.00 | 2.00 | 2.5 | 6.00 | 0.5 | 4.00 | 0.75 |

# PART-3 : MATHEMATICS

## SECTION-I

| Q. | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A. | A | C | A | D | C | C | B | B | C | D | A | A | B | D | C | C | A | B | D | D |

## SECTION-II

| Q. | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| A. | 1.00 | 1.00 | 5.00 | 2.00 | 2.00 | 1.00 | 6.00 | 27.00 | 3.00 | 12.00 |

SOLUTIONS

PART-1 : PHYSICS

3)

$y = 3t^2 - 2t + 1$

$\frac{dy}{dt} = 6t - 2 = 0$

$t = \frac{1}{3}$

6)

$v = u + at$

$v = 0$ at $t = 2$ sec

$t = 0$ to $t = 2$

$S = ut + 1/2\ at^2$

$= 8(2) + 1/2\ (-4)(2)^2 = 8$ m

$t = 0$ to $t = 6$

$S = ut + 1/2\ at^2$

$= 0 + 1/2\ (4)\ (4)^2 = 32$ m.

7)

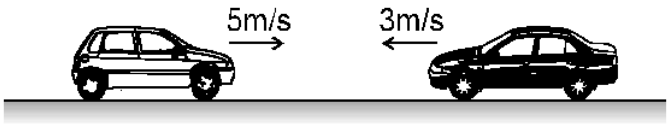
(Acceleration) = $\text{Slope} = \frac{\Delta v}{\Delta t}$

$OA \rightarrow \frac{10}{10} = 1$

$AB \rightarrow 0 = 0$

$BC \rightarrow \frac{-10}{20} = -0.5$

8)




Let $\vec{V}_{C_1} = 5\,m/s\,\hat{i}$ then, $\vec{V}_{C_2} = 3\,m/s\,(-\hat{i})$

Hence $\vec{V}_{C_1C_2} = \vec{V}_{C_1} - \vec{V}_{C_2} = 5\,m/s\,(\hat{i}) - 3\,m/s\,(-\hat{i}) = 8\,m/s\,\hat{i}$ Ans.

10)

$v^2 = u^2 + 2as$

$v^2 = (5)^2 + 2 \times 10 \times 10$

$v^2 = 25 + 200 \Rightarrow 225$
$v = 15$ m/sec

16)

$$\tan 60^\circ = \frac{v_y}{v_x} \Rightarrow v_y = v_x\sqrt{3} = 20 \text{ m/s}$$
$$v_y = 0 + gt \quad t = \frac{20}{g} = 2 \text{ sec.}$$

22)

$$v = 144 \times \frac{5}{18} = 40 \text{ m/s}$$
$$a = \frac{40-0}{20} = 2 \text{ m/s}^2$$
$$s = \frac{1}{2}at^2 = \frac{1}{2}(2)(20)^2 = 400\text{m}$$

23)

$v = 4x^2 - 4$

$$\frac{dv}{dx} = 8x - 4$$
at $x = 1$
$$\frac{dv}{dx} = 4$$
at $x = 1$
$v = 0$
$$a = v\frac{dv}{dx} = 0 \times 4 = 0$$

29) $f(x) = x - 5$
$f'(x) = 1$
$f'(5) = 1$

PART-2 : CHEMISTRY

33) $12C(s) + 11\ H_2(g) + \frac{11}{2}O_2 \rightarrow C_{12}H_{22}O_{11}\ (s)$

| | | | |
|---|---|---|---|
| Moles taken | $\frac{78}{12}$ | $\frac{11}{2}$ | $\frac{67.2}{22.4}$ |
| | $= 6.5$ | $= 5.5$ | $= 3$ |
| $\frac{\text{moles taken}}{\text{stoich. coeff.}}$ | $\frac{6.5}{12}$ | $\frac{5.5}{11}$ | $\frac{3}{5.5}$ |
| | $= 0.54$ | $= 0.5$ | $= 0.545$ |
| | (L.R.) | | |

 Moles of $C_{12}H_{22}O_{11}$ formed = $\frac{5.5}{11} = 0.5$

Mass of sucrose obtained = 0.5 × 342 = 171 gm

35) 1 gm = $10^{-3}$ kg

38)

Angular momentum postulate,

$mvr = \frac{nh}{2\pi}$

for H-atom, $\frac{2h}{2\pi} = x$

for $Li^{+2}$ ion, 1st excited state is n = 2

So, $mvr = \frac{2h}{2\pi} = x$

45)

Total energy in 1 min = 5 × 60 = 300 J

Total energy = n × $\frac{hc}{\lambda}$

$n = \frac{300 \times \lambda}{hc} = \frac{300 \times 198 \times 10^{-9}}{6.6 \times 10^{-34} \times 3 \times 10^{8}}$

$n = 3 \times 10^{20}$

46)

Charge on neutron is zero

$m_e = \frac{1}{1836} m_p$ $m_\alpha = 4m_p$

Charge on α = 2 × charge on p

47)

Representative element belong to s- and p-block

53)

$\lambda = \frac{h}{mu} = \frac{6.626 \times 10^{-34}}{0.1 \times 100}$

or l = 6.62 × $10^{-35}$ m = 6.626 × $10^{-25}$Å

59)

$$\frac{1}{\lambda_{2B}} = R_H\left(\frac{1}{2^2} - \frac{1}{4^2}\right) = R_H \times \frac{3}{16}$$

$$\frac{1}{\lambda_{1L}} = R_H\left(\frac{1}{1^2} - \frac{1}{2^2}\right) = R_H \times \frac{3}{4}$$

$$\frac{\lambda_{2B}}{\lambda_{1L}} = \frac{\left(R_H \times \frac{3}{4}\right)}{\left(R_H \times \frac{3}{16}\right)} = 4$$

PART-3 : MATHEMATICS

62)

G.M. $= \left(3.3^2.3^3.....3^n\right)^{\frac{1}{n}} = \left(3^{\frac{n(n+1)}{2}}\right)^{\frac{1}{n}} = 3^{\frac{n+1}{2}}$

64) Let $\alpha, \beta$ are the roots, then
$\alpha\beta = 11$ and $\alpha + \beta = 10$

Now H.M. of $\alpha, \beta = \frac{2\alpha\beta}{\alpha+\beta} = \frac{2 \times 11}{10} = \frac{11}{5}$

65)

**(Reference to Ex.4(a), Question-31)**

$T_{19} = 0$

$\Rightarrow a + 18d = 0$

$\Rightarrow a = -18d$

$\Rightarrow \frac{T_{49}}{T_{29}} = \frac{a+48d}{a+28d} = \frac{-18d+48d}{-18d+28d}$

$\therefore \frac{T_{49}}{T_{29}} = \frac{3}{1}$

The maximum value will correspond to n terms when the $n^{th}$ term is either zero or the smallest positive number of the series

i.e. $50 + (n-1)(-2) = 0$ when $n = 26$

$\therefore \quad S_{26} = \frac{26}{2}(a+\ell) = 13(50+0) = 650$

66)

Let the sides be a – d, a, a + d

Since the triangle is right angled

$(a + d)^2 = a^2 + (a - d)^2$

68) $\Rightarrow 2ad = a^2 - 2ad \qquad \Rightarrow a = 4d$

$\therefore$ Ratio of smallest side to the greatest side

$$= \frac{a-d}{a+d} = \frac{4d-d}{4d+d} = \frac{3}{5}$$

72)

$\Rightarrow 5^{\log_5 x} + 4x + 20 = 0$
$\Rightarrow x + 4x + 20 = 0$
$\Rightarrow x = -4$
{log x is defined for x > 0}
x = –4 is rejected
$x = \phi$
$\Rightarrow$ no. of solution is zero

73)

We have, $\log_2 4.\log_4 5.\log_5 10.\log_{10} 32$.
$= \log_2(32)$
$= \log_2(2^5)$
$= 5$

75)

By base change theorem $\log_5 A = 3$
$\therefore A = 5^3 = 125$

78)

$\log_{abc} ab + \log_{abc} bc + \log_{abc} ac$
$= \log_{abc}(abc)^2 = 2$

80)

$$\Rightarrow \log_a\left(1-\sqrt{1+x}\right) = \frac{1}{2}\log_a\left(3-\sqrt{1+x}\right)$$
$$\Rightarrow \log_a\left(1-\sqrt{1+x}\right) = \log_a\left(\sqrt{3-\sqrt{1+x}}\right)$$
$$\Rightarrow 1-\sqrt{1+x} = \sqrt{3-\sqrt{1+x}}$$
$$\Rightarrow \left(1-\sqrt{1+x}\right)^2 = 3-\sqrt{1+x}$$

x = 0, 3
but both value are rejected
$\therefore x \in \phi$

82)

$\log_{10} 1000 = 3\log_{10} 10 = 3$

83)

$N = 2^{16}3^7 5^3$

$\log_{10}N = 16\log2 + 7\log3 + 3\log5 = 16\log2 + 7\log3 + 3\log\left(\frac{10}{2}\right)$
$= 16\log2 + 7\log3 + 3 - 3\log2 = 13\log2 + 7\log3 + 3$
$= 3 + 13 \times .3010 + 7 \times 0.4771 = 3 + 3.9130 + 3.2397$
$= 6.9130 + 3.2397$
$\log_{10}N = 10.1527$
$\Rightarrow$ characteristic = 10
$\Rightarrow$ Number of digits = P = 10 + 1 = 11

84)

Let $\log_9 a = \log_{15} b = \log_{25}(2a + b) = t$
$a = 9^t$, $b = 15^t$, $2a + b = 25^t$
$a(2a + b) = 9^t .25^t = (15^t)2 = b^2$
$\Rightarrow 2a^2 + ab - b^2 = 0$
$\Rightarrow b^2 - ab - 2a^2 = 0$
$\Rightarrow b2 - 2ab + ab - 2a2 = 0$
$\Rightarrow (b - 2a)(b + a) = 0$
$\Rightarrow b/a = 2 \quad \Rightarrow b/a = -1$
but (a, b > 0)
so, b/a = 2

85)

$$E = \log_{\left(\sqrt{5}+1\right)}\left(\sqrt{5}+1\right)^2 = 2$$

87)

$$\frac{a+b+c}{3} \geqslant (abc)^{\frac{1}{3}}$$
$$\frac{18}{3} \geqslant (abc)^{\frac{1}{3}}$$
$$6^3 \geqslant abc$$
$$abc \leqslant 216$$
$$N = 216$$

88)

$t_m = S_m - S_{m-1}$
$\Rightarrow 164 = 3m^2 + 5m - 3(m-1)^2 - 5(m-1) = 6m + 2$
$\Rightarrow 6m = 162 \quad$ or $\quad m = 27$