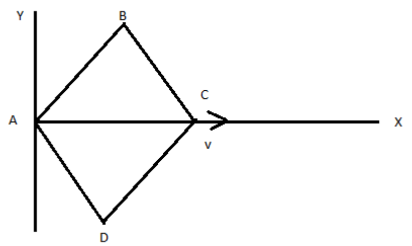
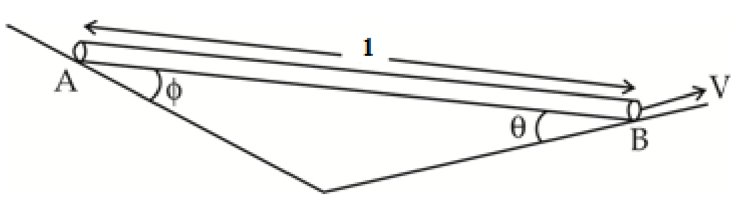
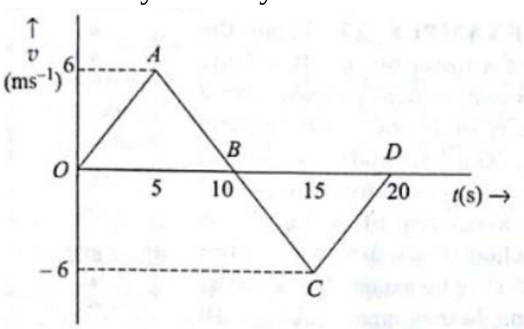
School Name:	**UDAAN**
Test Name:	**Weekly Assessment Class XI Week 4**
Total Questions:	**45**
Marks:	**45**
Duration:	**90 minutes**

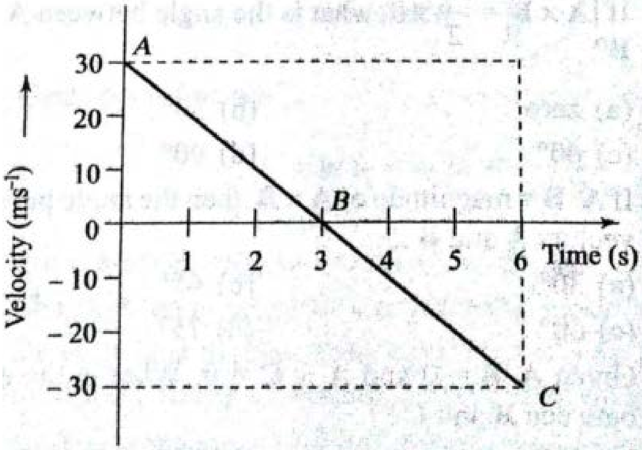
Instructions for Assessment:

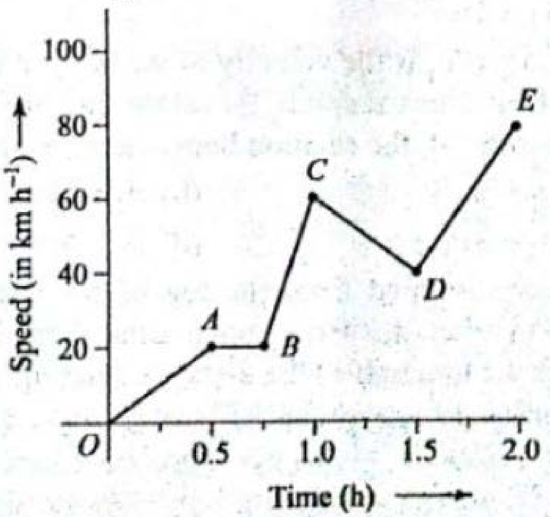
- The test is of **1 1/2 hours (90 minutes) duration.**
- The test consists of **45 questions.**
- There are three parts in the question paper **A, B, C consisting of Physics, Chemistry and Mathematics** having 15 questions in each part of equal weightage.
- There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response.
- No candidate is allowed to use any textual material, printed or written, pager, mobile, any electronic device, etc

Section: Physics	
Questions: 15	**Marks: 15**

1.	Four rods each of length l have been hinged to form a rhombus. Vertex A is fixed to a rigid support, vertex C being pulled to the right along x-axis with a uniform speed v as shown in fig. The speed with which vertex B moves toward C at the moment the rhombus takes the shape of a square is  **a.** $\frac{v}{4}$ **b.** $\frac{v}{2}$ **c.** $\frac{v}{\sqrt{2}}$ **d.** v	**1.0**
2.	A rod of length l slides down along the inclined wall as shown in fig. At the instant shown in figure, the speed of the end A is v, then the speed of B will be  **a.** $V\frac{\cos\phi}{\cos\theta}$ **b.** $V\frac{\cos\theta}{\cos\phi}$ **c.** $V\frac{\sin\phi}{\sin\theta}$ **d.** $V\frac{\sin\theta}{\sin\phi}$	**1.0**
3.	A rocket is fired vertically upwards and moves with net vertical acceleration of $20\,m/s^2$. After 1	**1.0**

	minute the fuel is exhausted. The time taken by it to reach the highest point after the fuel is exhausted will be nearly (g = 10 m/s^2) **a.** 4 min **b.** 2 min **c.** 1 min **d.** 0.5 min	
4.	From the top of a building 40m tall, a ball is thrown vertically upwards with a velocity of 10 m/sec. After how long will the ball take to pass through the point from where it was projected? (Take g= 10 m/sec^2) **a.** 2 sec **b.** 3 sec **c.** 1 sec **d.** 4 sec	**1.0**
5.	The figure shows the velocity- time graph of a body moving in a straight line. Find the distance travelled by the body in 20 sec.  **a.** 60 m **b.** 40 m **c.** 70 m **d.** 0 m	**1.0**
6.	A body moving in a straight line covers a distance of 14 m in the 5th second and 20 m in the 8th second. How much distance will it cover in the 15th second? **a.** 34m **b.** 33m **c.** 35m **d.** 36m	**1.0**
7.	A police jeep moving at a constant speed v on a straight road chasing a thief riding on motor cycle. The thief starts from rest when the police jeep is at a distance x away and accelerates at a constant rate a. the police will be able to catch thief if (a) $v \geq \sqrt{ax}$ (b) $v \geq \sqrt{2ax}$ (c) $v \geq 2\sqrt{ax}$ (d) $v \geq \sqrt{\frac{ax}{2}}$	**1.0**

8.	A balloon is rising vertically upwards with a constant velocity of 10 m/sec. When it is at a height of 45 m above ground, a stone is dropped from it. Find the height of the balloon when the stone hits the ground? Take g = 10 m/sec^2 **a.** 80 m **b.** 82 m **c.** 37 m **d.** 45 m	**1.0**
9.	A ball is dropped from the top of a tower. In the last second of its motion, the ball covers a distance of 9/25 times the height of tower. Find the height of the tower? **a.** 112.5 m **b.** 115 m **c.** 122.5 m **d.** 125 m	**1.0**
10.	The velocity-time graph of a stone thrown vertically upward with an initial velocity of 30 ms^{-1} is shown in the Fig. 2.35. The velocity in the upward direction is taken as positive and that in the downward direction as negative. What is the maximum height to which the stone rises?  **Fig. 2.35** (a) 30 m (b) 45 m (c) 60 m (d) 90 m	**1.0**

11.	At $t = 0$, an arrow is fired vertically upwards with a speed of 98 ms^{-1}. A second arrow is fired vertically upwards with the same speed at $t = 5$ s. Then (a) the two arrows will be at the same height above the ground at $t = 10$ s (b) the two arrows will reach back their starting points at $t = 20$ s and at $t = 30$ s (c) the ratio of the speeds of the first and the second arrows at $t = 20$ s will be 2 : 1 (d) the maximum height attained by either arrow will be 980 m	**1.0**
12.	The variation in the speed of a car during its two hour journey is shown in the graph of Fig. 2.36. The magnitude of the maximum acceleration of the car occurs during the interval  **Fig. 2.36** **a.** OA **b.** BC **c.** CD **d.** DE	**1.0**
13.	A parachutist drops freely from an aeroplane for 10 s before the parachute opens out. Then he descends with a net retardation of 2.5 ms^{-2}. If he bails out of the plane at a height of 2495 m and $g = 10$ ms^{-2}, his velocity on reaching the ground will be (a) 2.5 ms^{-1} (b) 7.5 ms^{-1} (c) 5 ms^{-1} (d) 10 ms^{-1}	**1.0**

14.	A car accelerates from rest at a constant rate α for some time after which it decelerates at a constant rate β to come to rest. If the total time elapsed is t, the maximum velocity acquired by the car is given by (a) $\frac{\alpha\beta}{\alpha+\beta}t$ (b) $\frac{\alpha+\beta}{\alpha\beta}t$ (c) $\frac{\alpha^2+\beta^2}{\beta\alpha}t$ (d) $\frac{\alpha^2-\beta^2}{\beta\alpha}t$	1.0
15.	A balloon is rising vertically upwards at a velocity of 10 ms^{-1}. When it is at a height of 45 m from the ground, a parachutist bails out from it. After 3s he opens his parachute and decelerates at a constant rate of 5 ms^{-2}. What was the height of the parachutist above the ground when he opened his parachute? Take $g = 10\ ms^{-2}$. (a) 15 m (b) 30 m (c) 45 m (d) 60 m	1.0

Section: Chemistry	
Questions: 15	**Marks: 15**

16.	The energy of an electron in n^{th} orbit of hydrogen atom is **a.** $\frac{13.6}{n^4} eV$ **b.** $\frac{13.6}{n^3} eV$ **c.** $\frac{13.6}{n^2} eV$ **d.** $\frac{13.6}{n} eV$	**1.0**
17.	The value of the energy for the first excited state of hydrogen atom is **a.** $-13.6\,eV$ **b.** $-3.40\,eV$ **c.** $-1.51\,eV$ **d.** $-0.85\,eV$	**1.0**
18.	Ratio of radii of second and first Bohr orbits of H atom **a.** 2 **b.** 4 **c.** 3 **d.** 5	**1.0**
19.	Which of the following transitions are allowed in the normal electronic emission spectrum of an atom? **a.** $2s \rightarrow 1s$ **b.** $2p \rightarrow 1s$ **c.** $3d \rightarrow 2p$ **d.** $5d \rightarrow 2s$	**1.0**
20.	Which of the following has the smallest radius of the first orbit? **a.** A hydrogen atom **b.** A tritium atom **c.** Triply ionized beryllium **d.** Doubly ionized helium	**1.0**
21.	What happens, when an electron jumps from L to K shell? **a.** Energy is absorbed **b.** Energy is released **c.** Energy becomes zero **d.** Energy remains unchanged	**1.0**
22.	Which of the following relation could be drawn from Bohr theory?	**1.0**

	a. Velocity of electron $\propto \frac{1}{n}$ **b.** Frequency of revolution $\propto \frac{1}{n^3}$ **c.** Radius of orbit $\propto n^2 Z$ **d.** Force on electron $\propto \frac{1}{n}$	
23.	Which one of the following is considered as the main postulate of Bohr's model of atom? **a.** Protons are present in the nucleus **b.** Electrons are revolving around the nucleus **c.** Centrifugal force produced due to the revolving electrons balances the force of attraction between the electron and the protons **d.** Angular momentum of electron is an integral multiple of $\frac{h}{2\pi}$	**1.0**
24.	The maximum energy is present in any electron at **a.** Nucleus **b.** Ground state **c.** First excited state **d.** Infinite distance from the nucleus	**1.0**
25.	The postulate of Bohr theory that electrons jump from one orbit to the other, rather than flow is according to **a.** The quantization concept **b.** The wave nature of electron **c.** The probability expression for electron **d.** Heisenberg uncertainty principle	**1.0**
26.	Bohr's model can explain **a.** The spectrum of hydrogen atom only **b.** Spectrum of atom or ion containing one electron only **c.** The spectrum of hydrogen molecule **d.** The solar spectrum	**1.0**
27.	The radius of which of the following orbit is same as that of the first Bohr's orbit of hydrogen atom **a.** $He^{+}(n=2)$ **b.** $Li^{2+}(n=2)$	**1.0**

	c. $Li^{2+}(n=3)$ **d.** $Be^{3+}(n=2)$	
28.	Which of the following is the correct outer configuration of chromium? **a.** $\boxed{\uparrow}\boxed{\uparrow}\boxed{\uparrow}\boxed{\uparrow}\boxed{}\quad\boxed{\uparrow\downarrow}$ **b.** $\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow}\boxed{}\boxed{}\quad\boxed{}$ **c.** $\boxed{\uparrow}\boxed{\uparrow}\boxed{\uparrow}\boxed{\uparrow}\boxed{\uparrow}\quad\boxed{\uparrow}$ **d.** $\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow}\boxed{\uparrow}\boxed{\uparrow}\quad\boxed{\uparrow}$	**1.0**
29.	The number of unpaired electrons in Mn^{4+} (Z = 25) is **a.** Four **b.** Two **c.** Five **d.** Three	**1.0**
30.	The configuration $1s^2 2s^2 2p^5 3s^1$ is valid for the **a.** ground state of fluorine **b.** excited state of fluorine **c.** excited state of neon **d.** excited state of the O_2^- ion	**1.0**

Section: Mathematics	
Questions: 15	**Marks: 15**

31.	The number of points in $(-\infty, \infty)$ for which $x^2 - x\sin x - \cos x = 0$ is a. 6 b. 4 c. 2 d. 0	**1.0**
32.	The greatest value of the function $f(x) = \dfrac{\sin 2x}{\sin(x+\frac{\pi}{4})}$ in the interval $\left[0, \frac{\pi}{2}\right]$ is : a. $\dfrac{1}{\sqrt{2}}$ b. 1 c. $\sqrt{2}$ d. $2\sqrt{2}$	**1.0**
33.	If $x\cos\lambda = y\cos\left(\dfrac{2\pi}{3}+\lambda\right) = z\cos\left(\dfrac{4\pi}{3}+\lambda\right)$, then the value of [xy + yz + zx] is : a. 0 b. 1 c. 2 d. -1	**1.0**
34.	If $\sin x + \sin^2 x = 1$, then the value of $\cos^{12} x + 3\cos^{10} x + 3\cos^8 x + \cos^6 x - 1$ is : a. 0 b. 1 c. 2 d. - 2	**1.0**

35.	If sin A, cos A and tan A are in G.P., then $\cot^6 A - \cot^2 A$ equals : a. 0 b. 1 c. 2 d. 3	**1.0**
36.	The number of solutions of the equation : sin 2x + cos2x + sinx + cosx + 1 = 0 in the first quadrant are : a. 3 b. 2 c. 1 d. 0	**1.0**
37.	The number of roots of the equation : $\tan^2 \theta - 3\sec\theta + 3 = 0$ in the interval $[0, 2\pi]$ is : a. 1 b. 2 c. 3 d. 4	**1.0**
38.	Both roots of the equation; $a\cos\theta + b\sin\theta = c$ are equal if a. $a^2 + b^2 + c^2 = 1$ b. $a^2 = b^2 + c^2$ c. $b^2 = a^2 + c^2$ d. $c^2 = a^2 + b^2$	**1.0**
39.	If $\tan\alpha = n\tan\beta$, then the maximum value of $\tan^2(\alpha - \beta)$ is : a. $\frac{(n+1)^2}{4n}$ b. $\frac{(n-1)^2}{4n}$ c. $\frac{(2n+1)^2}{4n}$ d. $\frac{(2n-1)^2}{4n}$	**1.0**

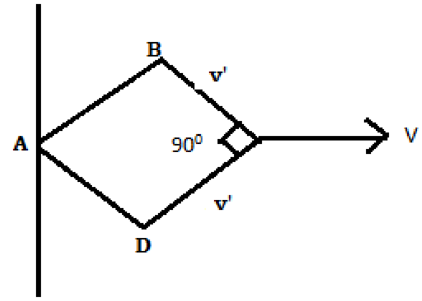
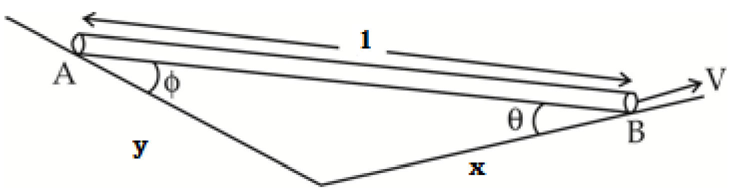
40.	The general solution of the equation $\sin^{50} x - \cos^{50} x = 1$ is : a. $2n\pi + \frac{\pi}{2}$ b. $2n\pi + \frac{\pi}{3}$ c. $n\pi + \frac{\pi}{2}$ d. $n\pi + \frac{\pi}{3}$	**1.0**
41.	If the equation cos 2x + a sin x = 2a – 7 possess a real solution, then 'a' lies in the interval a. $(-\infty, 2)$ b. $[2,\ 6]$ c. $(6,\ 9)$ d. $(9, \infty)$	**1.0**
42.	The perimeter of a triangle is 6 times the Arithmetic Mean of the sines of its angles. If side a = 1, then $\angle A$ is equal to : a. $\frac{\pi}{6}$ b. $\frac{\pi}{4}$ c. $\frac{\pi}{3}$ d. $\frac{\pi}{2}$	**1.0**
43.	Solution of the system of equations $x + y = \frac{\pi}{4},\ \tan x + \tan y = 1$ is a. $x = \frac{\pi}{2} - n\pi, y = n\pi$ b. $x = \frac{\pi}{4} - n\pi, y = n\pi$ c. $x = \frac{\pi}{4} - n\pi, y = 2n\pi$ d. None of these	**1.0**

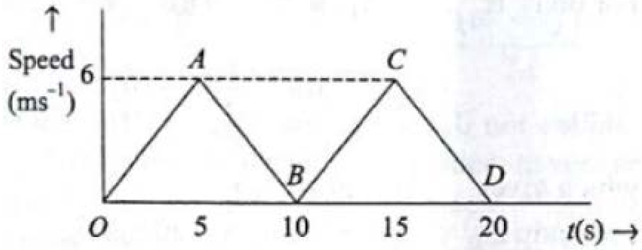
44.	The values of x between 0 & 2π which satisfy the equation $\sin x\sqrt{8\cos^2 x}=1$ are in A.P. The common difference of the A.P. is a. $\frac{\pi}{8}$ b. $\frac{\pi}{4}$ c. $\frac{3\pi}{8}$ d. $\frac{5\pi}{8}$	**1.0**
45.	The equation $\sin^4 x-(K-2)\sin^2 x-(K+3)=0$ possesses a solution if : a. K > -3 b. K < -2 c. -3 < K < -2 d. K is any positive integer	**1.0**

Key

Question Number	Correct Option	Question Number	Correct Option	Question Number	Correct Option
1.	C	16.	C	31.	C
2.	B	17.	B	32.	C
3.	B	18.	B	33.	A
4.	A	19.	A	34.	A
5.	A	20.	C	35.	B
6.	A	21.	B	36.	D
7.	B	22.	A	37.	C
8.	B	23.	D	38.	D
9.	C	24.	D	39.	B
10.	B	25.	A	40.	C
11.	C	26.	B	41.	B
12.	B	27.	D	42.	A
13.	C	28.	C	43.	B
14.	A	29.	D	44.	B
15.	B	30.	C	45.	C

Explanation

Question Number	Explanation
1.	Using vector addition of two vectors  $v'^2 + v'^2 = v^2$ $\quad (\theta = 90^0)$ $2\,v'^2 = v^2$ $v' = \frac{v}{\sqrt{2}}$
2.	 $l = Ax' + B'P$ $l = y\cos\phi + x\cos\theta$ $\frac{dl}{dt} = \cos\phi\frac{dy}{dy} + \cos\theta\frac{dx}{dy}$ $0 = v_Q\cos\phi + v_P\cos\theta$ $v_Q\cos\phi = -v_P\cos\theta$ $\because v_P = v$ $v_Q = \frac{v\cos\theta}{\cos\phi}$
3.	v = u + at ⇒ v = 0 + 20 x 60 = 1200 m/s v = u – gt (when fuel is exhausted) 0 = 1200 – 10 x t t = 120 s = 2 min

4.	$s = 0$, $u = +10\ \text{ms}^{-1}$ and $a = -10\ \text{ms}^{-2}$. Therefore $0 = 10t - 5t^2 \Rightarrow t = 2\ \text{s}$
5.	Distance = area under speed – time graph which is shown in Fig. 2.17.  **Fig. 2.17** ∴ Distance travelled in 20 s = area of OAB + area of BCD $= \frac{1}{2} \times 6 \times 10 + \frac{1}{2} \times 6 \times 10 = 60\ \text{m}$
6.	$S_n = u + \frac{a}{2}(2n - 1)$ $S_5 = u + \frac{9a}{2} \quad (1)$ $S_8 = u + \frac{15a}{2} \quad (2)$ Solving (1) and (2), we get $a = 2\ \text{ms}^{-2}$ and $u = 5\ \text{ms}^{-1}$. ∴ $S_{15} = u + \frac{29a}{2} = 5 + \frac{29 \times 2}{2} = 34\ \text{m}$

7.

SOLUTION Suppose the thief is caught at a time t after the starting of the motorcycle. The distance travelled by the motorcycle in this time t is

$$S = \frac{1}{2}at^2 \qquad \text{(i)}$$

During this time, the jeep must travel a distance

$$S + x = vt \qquad \text{(ii)}$$

Using (i) and (ii)

$$\frac{1}{2}\,at^2 + x = vt$$

$$\Rightarrow \qquad at^2 - 2vt + 2x = 0$$

The roots of this quadratic equation are

$$t = \frac{v \pm \sqrt{v^2 - 2ax}}{a}$$

Since t must be real and positive, we must have

$$v^2 \geq 2\,ax \Rightarrow v \geq \sqrt{2ax}$$

8.

SOLUTION At time $t = 0$ (when the stone is dropped), its velocity is $u = +\,10\ \text{ms}^{-1}$ (vertically upwards). Displacement $s = -\,45$ m (vertically downwards) and $a = -\,g = -\,10\ \text{ms}^{-2}$

Using $S = ut + \frac{1}{2}\,at^2$, we have

$$-\,45 = 10\,t + \frac{1}{2}(-\,10)t^2$$

$$-\,45 = 10t - 5t^2$$

$$\Rightarrow \qquad t^2 - 2t - 9 = 0$$

The two roots of t are

$$t = \frac{1 \pm \sqrt{4 + 36}}{2} = \frac{1 \pm 6.32}{2}$$

$$= -\,2.7\ \text{s or } 3.7\ \text{s}$$

The negative value of t is not possible. Therefore $t = 3.7$ s. During this time the balloon has moved up a distance $= ut = 10 \times 3.7 = 37$ m. Hence the balloon is at a height of $45 + 37 = 82$ m above the ground.

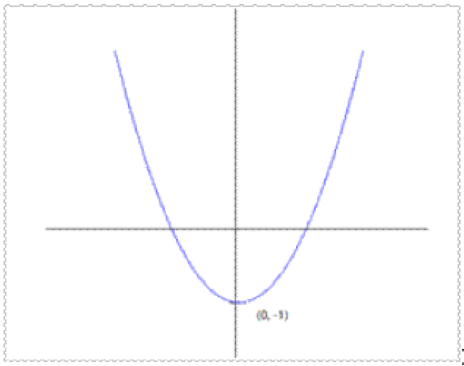
from the top of

9.	height of the tower. **SOLUTION** Let h be the height of the tower. If t is the time taken by the ball to reach the ground, then $h = \frac{1}{2} gt^2$ (i) The distance covered in $(t-1)$ seconds is $h' = \frac{1}{2} g(t-1)^2$ Given $h' = h - \frac{9}{25} h = \frac{16h}{25}$ $\therefore \frac{16h}{25} = \frac{1}{2} g(t-1)^2$ (ii) Dividing (ii) by (i) $\frac{16}{25} = \frac{(t-1)^2}{t^2}$ or $\frac{4}{5} = \frac{t-1}{t} \Rightarrow t = 5\text{s}$ Using $t = 5$ s in Eq (i), we get $h = \frac{1}{2} \times 9.8 \times (5)^2 = 122.5$ m
10.	Given $u = 30\ \text{ms}^{-1}$. From Fig. 2.35, the acceleration a = slope of line $AB = \frac{30\ \text{ms}^{-1}}{-3s} = -10\ \text{ms}^{-2}$. The maximum height is reached when final velocity $v = 0$. Using the values of u, v and a in relation $v^2 - u^2 = 2as$, we have $0 - 30 \times 30 = 2 \times -10 \times s$ or $s = \frac{30 \times 30}{20} = 45$ m
11.	The two arrows will be at the same height at $t = n$ if $98 - 4.9n^2 = 98(n-5) - 4.9(n-5)^2$. This gives n = 12.5 s. The time to reach the highest point is given by $0 = 98 - 9.8t$ i.e., $t = 10$ s. therefore, time of flight is 2×10 s or 20 s. The speed of the first arrow at t = 20 s is 98 ms^{-1} again while that of the second arrow is $(98 - 9.8 \times 0.5)\ \text{ms}^{-1}$ *i.e.* 49 ms^{-1}. The maximum heights attained are 490 m each. Hence the correct choice is (c)

12.	The acceleration is given by the slope of the speed—time graph. The slope of the graph is maximum during the interval BC. Hence the correct choice is (b).
13.	The velocity of the parachutist at the end of 10 seconds = 10 g = 10 × 10 = 100 ms^{-1} and the distance fallen in 10 seconds = $v^2/2g$ = 100 × 100/2 × 10 = 500 m. The distance travelled after he bails out is s = 2495 – 500 = 1995 m. For this distance u =100 ms^{-1} and a = – 2.5 ms^{-2}. Therefore, the final velocity v is given by $v^2 - u^2 = 2as$ or $v^2 = u^2 + 2as$ $= (100)^2 - 2 \times 2.5 \times 1995$ which gives $v = 5\ \text{ms}^{-1}$. Hence, the correct choice is (c).
14.	Let t_1 be the time during which the car accelerates at a rate α. The velocity at the end of time t_1 will be v at $t_1 = u + \alpha t_1 = 0 + \alpha t_1 = \alpha t_1 \quad (\because\ u = 0)$ The time during which the car decelerates is $t_2 = t - t_1$. For this time t_2, the initial velocity is αt_1 and the final velocity is zero and the acceleration is $-\beta$. Therefore $0 = \alpha t_1 - \beta (t - t_1)$ which gives $t_1 = \dfrac{\beta t}{\alpha + \beta}$. Therefore, maximum velocity = v at $t_1 = \alpha t_1 = \dfrac{\alpha\beta t}{\alpha + \beta}$. Hence the correct choice is (a).

15.	When the parachutist bails out, he shares the velocity of the balloon and has an upward velocity of $10\ ms^{-1}$, *i.e.* $u = +10\ ms^{-1}$. Also $g = -10\ ms^{-2}$ (acting downwards). The displacement in $t = 3s$ is given by $s = ut + \frac{1}{2} gt^2$ $= 10 \times 3 + \frac{1}{2} \times (-10) \times (3)^2$ $= -15$ m Since the displacement is negative, it is directed downwards. So the height from the ground when he opened his parachute = 45 – 15 = 30 m. Thus, the correct choice is (b).
16.	According to Bohr's theory $E_n = -\frac{13.6}{n^2} eV$
17.	In first exited state n=2 because in one excitation electron jumps to 2nd energy level. Hence, $E_n = -\frac{13.6}{n^2} eV = E_n = -\frac{13.6}{2^2} eV$ = -3.40 eV
18.	$r_n = a_0 n^2 / z$, where a_0 and z are constants For radii of first orbit $r_1 = 1(given)$, $r_2 = 2^2(given)$ hence, $r_2 / r_1 = r_n = \frac{a_0 2^2 / z}{a_0 1^2 / z} = 2^2 / 1^2 = 4$
19.	Because, there are no orbitals in between.
20.	Radius of an atom is given by $r_n = \frac{n^2}{Z} \times 0.529 \overset{0}{\mathrm{A}}$ Beryllium have atomic no.(z)= 4 As atomic number is maximum, it would have smallest radius.
21.	Electron is moving from higher to lower energy level. $\therefore$ Energy is absorbed.

22.	$V_n = \frac{2.188\times10^8 Z}{n} cm.\sec^{-1}$
23.	The electron can move only in these circular orbits where the angular momentum is a whole number multiple of $\frac{h}{2\pi}$ or it is quantized.
24.	As the distance increases, energy increases. At infinite distance increases from the Nucleus therefore energy increases.
25.	The quantization concept explains that electron have particle nature and when electron jumps from one orbit of higher energy to another lower one, it loses energy in the form of quantum. The energy of quantum is equal to the difference of energy of orbitals
26.	Bohr's model is applicable to one electron system only, that can be neutral atom or ion.
27.	$r_n = \frac{n^2}{Z} \times 0.529 \mathring{A}$ For Hydrogen atom: $r_1 = 0.529\mathring{A}$ $For\ Be^{3+} ion\ r_2 = \left(2^2/4\right) \times 0.529 \overset{0}{A} = 0.529 \overset{0}{A}$
28.	The electronic configuration of chromium is [Ar] $4s^1$, $3d^5$, hence it has 6 unpaired electron with parallel spin.
29.	The electronic configuration of Mn^{4+}=$1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^3$. Hence no. of unpaired electrons = 3
30.	Here in the electronic configuration total electron is 10. i.e. atomic no. of Ne. Hence it is exited state of Ne.

31.	We have $f(x)=x^2-x\sin x-\cos x$ Put x=0,we get f(0)=-1$\Rightarrow$ f is intersecting y-axis at $(0,-1)$ Consider $f'(x)=x(2-\cos x)$ Clearly $f'(x)=$ $\begin{cases}>0 & \forall x>0\\ 0 & \forall x=0\\ <0 & \forall x<0\end{cases}$  $\Rightarrow$ f is increasing in $(0,\ \infty)$& f is decreasing in $(-\infty,\ 0)$Now, consider$\lim\limits_{x\to\infty} f(x)=\infty$ $\lim\limits_{x\to-\infty} f(x)=\infty$ $\Rightarrow$ There are two points where the function vanishes.
32.	sin 2x attains greatest value 1 at $x=\frac{\pi}{4}\in\left[0,\frac{\pi}{2}\right]$; and $\sin\left(x+\frac{\pi}{4}\right)$ attains minimum value $\frac{1}{\sqrt{2}}$ at x = 0 or x = $\frac{\pi}{2}$ Thus, greatest value of $f(x)=\frac{\sin 2x}{\sin\left(x+\frac{\pi}{4}\right)}$ in the interval $[0,\frac{\pi}{2}]=\frac{1}{\frac{1}{\sqrt{2}}}=\sqrt{2}$

33.	Let $x\cos\lambda = t\cos\left(\frac{2\pi}{3}+\lambda\right) = z\cos\left(\frac{4\pi}{3}+\lambda\right) = k\,(\text{say})$ Then, $x = \frac{k}{\cos\lambda}, y = \frac{k}{\cos\left(\frac{2\pi}{3}+\lambda\right)}, z = \frac{k}{\cos\left(\frac{4\pi}{3}+\lambda\right)}$ $\Rightarrow xy + yz + zx = xyz\left[\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right]$ $= \frac{xyz}{k}\left[\cos\lambda + \cos\left(\frac{2\pi}{3}+\lambda\right) + \cos\left(\frac{4\pi}{3}+\lambda\right)\right]$ $= \frac{xyz}{k}[\cos\lambda + 2\cos\frac{2\pi+2\lambda}{2}\cos\frac{2\pi}{6}]$ $= \frac{xyz}{k}[\cos\lambda + 2\cos(\pi+\lambda)\cos\frac{\pi}{3}]$ $= \frac{xyz}{k}[\cos\lambda - 2\cos\lambda \times \frac{1}{2}] = 0$
34.	$\sin x + \sin^2 x = 1$ gives $\cos^2 x = \sin x$ Now, $\cos^{12}x + 3\cos^{10}x + 3\cos^8 x + \cos^6 x - 1$ $= \cos^6 x(\cos^6 x + 3\cos^4 x + 3\cos^2 x + 1) - 1$ $= \cos^6 x(\cos^2 x + 1)^3 - 1$ $= \sin^3 x(\sin x + 1)^3 - 1$ $= (\sin^2 x + \sin x)^3 - 1$ $= 1 - 1 = 0$

35.	Since sin A, cos A and tan A are in G.P., $\cos^2 A=\sin A\tan A$ $\Rightarrow \cot^2 A = \sec A$ $\Rightarrow \cot^4 A=\sec^2 A$ $\Rightarrow \cot^4 A=1+\tan^2 A$ $\Rightarrow \cot^4 A-\tan^2 A=1$ $\Rightarrow \cot^4 A-\dfrac{1}{\cot^2 A}=1$ $\Rightarrow \cot^6 A\text{-}\cot^2 A=1$
36.	$\sin 2x+\cos 2x+\sin x+\cos x+1=0$ $\Rightarrow 2\sin x\cos+2+2\cos^2 x-1+\sin x+\cos x+1=0$ $\Rightarrow (2\cos x+1)(\sin x+\cos x)=0$ $\Rightarrow 2\cos x+1=0$ or $\sin x+\cos x=0$ $\Rightarrow \cos x=-\dfrac{1}{2}$ or tan x = - 1 Since both cos x and tan x are positive in the first quadrant, the given equation has no solution.
37.	$\tan^2\theta-3\sec\theta+3=0$ is equivalent to $\sec^2\theta-3\sec\theta+2=0$ $\Rightarrow (\sec\theta-1)(\sec\theta-2)=0$ $\Rightarrow \sec\theta=1 \text{ or } \sec\theta=2$ $\Rightarrow \theta=0°, 60° \text{ and } 300°$
38.	$a\cos\theta+b\sin\theta=c$ implies $a^2\cos^2\theta=(c-b\sin\theta)^2$ $\Rightarrow a^2(1-\sin^2\theta)=c^2+b^2\sin^2\theta-2bc\sin\theta$ $\Rightarrow (a^2+b^2)\sin^2\theta-2bc\sin\theta+(c^2-a^2)=0$ Since both the roots are equal, the discriminant is zero. Thus, $4b^2c^2=4(a^2+b^2)(c^2-a^2)$ $\Rightarrow c^2=a^2+b^2$

39.	$\tan\alpha = n\tan\beta$ gives $\tan(\alpha-\beta) = \dfrac{\tan\alpha - \tan\beta}{1+\tan\alpha\tan\beta} = \dfrac{(n-1)\tan\beta}{1+n\tan^2\beta}$ $\Rightarrow \tan(\alpha-\beta) = \dfrac{(n-1)}{\cot\beta + n\tan\beta}$ $\Rightarrow \tan^2(\alpha-\beta) = \dfrac{(n-1)^2}{\cot^2\beta + n^2\tan^2\beta + 2n}$ For $\tan^2(\alpha-\beta)$ to be maximum, $(\cot^2\beta + n^2\tan^2\beta + 2n)$ to be minimum, which will be when $\tan^2\beta = \dfrac{1}{n}$ Thus, the maximum value of $\tan^2(\alpha-\beta)$ is $\dfrac{(n-1)^2}{0+4n}$, i.e., $\dfrac{(n-1)^2}{4n}$
40.	$\sin^{50}x - \cos^{50}x = 1$ gives $\sin^{50}x = \cos^{50}x + 1$ ----(1) Now, $\sin^{50}x \le 1$ and $\cos^{50}x + 1 \ge 1$ (1) gives $\sin^{50}x = 1$ and $\cos^{50}x + 1 = 1$ $\Rightarrow \sin^{50}x = 1$ and $\cos^{50}x = 0$ $\Rightarrow x = n\pi + \dfrac{\pi}{2}, n \in Z$

41.	cos 2x + a sin x = 2a – 7 gives $1-2\sin^2 x+a\sin x=2a-7$ $\Rightarrow 2\sin^2 x-a\sin x+(2a-8)=0$ $\Rightarrow \sin^2 x-\frac{a}{2}\sin x+(a-4)=0$ $\Rightarrow \sin x=\dfrac{\frac{a}{2}\pm\sqrt{\frac{a^2}{4}-4(a-4)}}{2}$ $=\dfrac{a\pm\sqrt{a^2-16(a-4)}}{4}$ $\Rightarrow \quad =\dfrac{a\pm(a-8)}{4}$ $\Rightarrow \sin x=2,\dfrac{a-4}{2}$ As sin x cannot be 2, Therefore,we have $\sin x=\dfrac{a-4}{2}$ It means, $-1\le\dfrac{a-4}{2}\le 1,$ $\text{i.e.}\ 2\le a\le 6$ $a\in[2,6]$
42.	Here $a+b+c=6\dfrac{\sin A+\sin B+\sin C}{3}$ $=2(\sin A+\sin B+\sin C)$ Let by sine formula, $\sin A=a\lambda$, sin B = $b\lambda$, sin C = $c\lambda$. Then 2λ = 1 i.e., $\lambda=\dfrac{1}{2}$ so, sinA =a $\dfrac{1}{2}$ Thus, $\sin A=\dfrac{1}{2}$,as a=1 $\Rightarrow A=\dfrac{\pi}{6}$

43.	Given : $x+y=\frac{\pi}{4}, \tan x+\tan y=1$ Now, $\tan x+\tan y=\tan(x+y)(1-\tan x\tan y)=1$ $\Rightarrow \tan(x+y)(1-\tan x\tan y)=1$ Now $x+y=\frac{\pi}{4}$ $\therefore \tan\left(\frac{\pi}{4}\right)(1-\tan x\tan y)=1$ $\Rightarrow 1-\tan x\tan y=1$ $\Rightarrow \tan x\tan y=0$ $\Rightarrow$ either $\tan x=0$ or $\tan y=0$ $\Rightarrow$ either $x=n\pi$ and so $y=\frac{\pi}{4}-x=\frac{\pi}{4}-n\pi$ OR $y=n\pi$ & so $x=\frac{\pi}{4}-n\pi$
44.	Given : $\sin x\sqrt{8\cos^2 x}=1$ $\Rightarrow 2\sqrt{2}\sin x\,\lvert\cos x\rvert=1$ $\Rightarrow 2\sin x\,\lvert\cos x\rvert=\frac{1}{\sqrt{2}}$ $\Rightarrow \sin 2x=\frac{1}{\sqrt{2}}$ if $\cos x>0$ or $\sin 2x=-\frac{1}{\sqrt{2}}$ if $\cos x<0$ (i) when $\cos x>0$, $\sin 2x=\frac{1}{\sqrt{2}}\Rightarrow x=\frac{\pi}{8},3\frac{\pi}{8}$ (ii) when $\cos x<0$, $\sin 2x=\frac{-1}{\sqrt{2}}\Rightarrow x=\frac{5\pi}{8},\frac{7\pi}{8}$ $\therefore$ The desired values of x are : $\frac{\pi}{8},\frac{3\pi}{8},\frac{5\pi}{8},\frac{7\pi}{8}$ This is an A.P. with common difference $\frac{\pi}{4}$.

45.	We have, $\sin^4 x-(K-2)\sin^2 x-(K+3)=0$ $\Rightarrow \sin^2 x=\dfrac{(K+2)\pm\sqrt{(K+2)^2+4(K+3)}}{2}$ $=\dfrac{(K+2)\pm(K+4)}{2}$ $\Rightarrow \sin^2 x=K+3$ or $\sin^2 x=-1$ $\sin^2 x=-1$ is not possible $\therefore \sin^2 x=K+3$ Now $0\le\sin^2 x\le 1$ $\Rightarrow 0\le K+3\le 1$ $-3 < K < -2$