School Name:	**UDAAN**
Test Name:	**Weekly Assessment Class XI Week 3**
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.	Given $\mathbf{P} = \mathbf{A} + \mathbf{B}$ and $\mathbf{Q} = \mathbf{A} - \mathbf{B}$. If the magnitudes of vectors **P** and **Q** are equal, what is the angle between vectors **A** and **B**? (a) zero (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{2}$ (d) π	1.0
2.	If $\lvert\mathbf{A} \times \mathbf{B}\rvert = \frac{1}{2} AB$, what is the angle between **A** and **B**? (a) zero (b) 30° (c) 60° (d) 90°	1.0
3.	Given $\mathbf{A} \cdot \mathbf{B} = 0$ and $\mathbf{A} \times \mathbf{C} = 0$. What is the angle between **B** and **C**? (a) 45° (b) 90° (c) 135° (d) 180°	1.0
4.	Vector **C** is the sum of two vectors **A** and **B** and vector **D** is the cross product of vectors **A** and **B**. What is the angle between vectors **C** and **D**? (a) zero (b) 60° (c) 90° (d) 180°	1.0
5.	The resultant of two vectors of magnitudes 3 units and 4 units is 1 unit. What is the value of their dot product? (a) – 12 units (b) – 7 units (c) – 1 unit (d) zero	1.0

6.	The resultant of two vectors of magnitudes 3 units and 4 units is 1 unit. What is the magnitude of their cross product? (a) 12 units (b) 7 units (c) 1 unit (d) zero	1.0
7.	Three vectors **A**, **B** and **C** are related as $\mathbf{A} + \mathbf{B} = \mathbf{C}$. If vector **C** is perpendicular to vector **A** and the magnitude of **C** is equal to the magnitude of **A**, what will be the angle between vectors **A** and **B**? (a) 45° (b) 90° (c) 135° (d) 180°	1.0
8.	If $\hat{i}$ and $\hat{j}$ are unit vectors along x-axis and y-axis respectively, the magnitude of vector $\hat{i} + \hat{j}$ will be (a) 1 (b) $\sqrt{2}$ (c) $\sqrt{3}$ (d) 2	1.0
9.	the angle subtended by vector $\hat{i} + \hat{j}$ with the x-axis is (a) 30° (b) 45° (c) 0° (d) 75°	1.0
10.	If $\hat{i}$, $\hat{j}$ and $\hat{k}$ are unit vectors along x, y and z-axes respectively, the angle θ between the vector $\hat{i} + \hat{j} + \hat{k}$ and vector $\hat{i}$ is given by (a) $\theta = \cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (b) $\theta = \sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (c) $\theta = \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ (d) $\theta = \sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$	1.0

11.	Given that $0.2\,\hat{i} + 0.6\,\hat{j} + a\hat{k}$ is a unit vector. What is the value of a? (a) $\sqrt{0.3}$ (b) $\sqrt{0.4}$ (c) $\sqrt{0.6}$ (d) $\sqrt{0.8}$	1.0
12.	Given $\mathbf{A} = \hat{i} + \hat{j}$ and $\mathbf{B} = \hat{i} + \hat{k}$. What is the value of the scalar product of **A** and **B**? (a) 1 (b) $\sqrt{2}$ (c) $\sqrt{3}$ (d) 2	1.0
13.	Given $\mathbf{A} = 2\hat{i} + 3\hat{j}$ and $\mathbf{B} = \hat{i} + \hat{j}$. The component of vector **A** along vector **B** is (a) $\frac{1}{\sqrt{2}}(\hat{i}+\hat{j})$ (b) $\frac{3}{\sqrt{2}}(\hat{i}+\hat{j})$ (c) $\frac{5}{\sqrt{2}}(\hat{i}+\hat{j})$ (d) $\frac{7}{\sqrt{2}}(\hat{i}+\hat{j})$	1.0
14.	Given $\mathbf{A} = 2\hat{i} + 3\hat{j}$ and $\mathbf{B} = \hat{i} + \hat{j}$. **What is the component of vector A perpendicular to vector B and in the same plane as B ?** (a) $\frac{1}{\sqrt{2}}(\hat{j}-\hat{i})$ (b) $\frac{3}{\sqrt{2}}(\hat{j}-\hat{i})$ (c) $\frac{5}{\sqrt{2}}(\hat{j}-\hat{i})$ (d) $\frac{7}{\sqrt{2}}(\hat{j}-\hat{i})$	1.0
15.	**A** is a vector which when added to the resultant of vectors $(2\hat{i} - 3\hat{j} + 4\hat{k})$ and $(\hat{i} + 5\hat{j} + 2\hat{k})$ yields a unit vector along the y–axis. Then vector **A** is ? (a) $-3\hat{i} - \hat{j} - 6\hat{k}$ (b) $3\hat{i} + \hat{j} - 6\hat{k}$ (c) $3\hat{i} - \hat{j} + 6\hat{k}$ (d) $3\hat{i} + \hat{j} + 6\hat{k}$	1.0

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

16.	Rutherford's α -particle scattering experiment led to the conclusion that **a.** mass and energy are related **b.** the mass and the positive charge of an atom are concentrated in the nucleus **c.** neutrons are present in the nucleus **d.** atoms are electrically neutral	**1.0**
17.	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**
18.	The de–Broglie wavelength of a tennis ball of mass 60 *g* moving with a velocity of 10 *m/s* is (approximately) **a.** $10^{-33} m$ **b.** $10^{-31} m$ **c.** $10^{-16} m$ **d.** $10^{-25} m$	**1.0**
19.	Which of the following is the simplest formula of the compound containing 50% of element X (atomic mass = 10 g/mol) and 50% of element Y (atomic mass = 20 g/mol)? a. XY b. XY_2 c. X_2Y d. X_2Y_3	**1.0**
20.	What is the maximum amount of nitrogen dioxide that can be produced by mixing 4.2g of NO(g) and 3.2g of O_2(g)? a. 4.6g b. 2.3g c. 3.22g d. 6.44g	**1.0**

21.	A drop of water is about 0.05 mL. The density of water at room temperature is about 1.0 g / mL, the number of water molecules present in a drop of water are a. 1.67×10^{21} b. 3.01×10^{21} c. 6.023×10^{23} d. 3.01×10^{23}	**1.0**
22.	The density of water at 4°C is 1.0×10^{3} kgm^{-3}. The volume occupied by one molecule of water is approximately a. 3.0×10^{-23} ml b. 6.0×10^{-22} ml c. 3.0×10^{-21} ml d. 9.0×10^{-23} ml	**1.0**
23.	100 mL of PH_3 on heating forms P and H_2. The volume change in the reaction is **a.** An increase of 50 mL **b.** An increase of 100 mL **c.** An increase of 150 mL **d.** A decrease of 50 mL	**1.0**
24.	The crystalline salt $Na_2SO_4.xH_2O$ on heating loses 55.9% of its weight. The formula of the crystalline salt is: **a.** $Na_2SO_4.5H_2O$ **b.** $Na_2SO_4.2H_2O$ **c.** $Na_2SO_4.7H_2O$ **d.** $Na_2SO_4.10H_2O$	**1.0**
25.	Common salt obtained from sea water contains 95 % NaCl by mass. The approximate number of formula units of NaCl present in 10.0 g of the salt is: **a.** 10^{21} **b.** 10^{22} **c.** 10^{23} **d.** 10^{24}	**1.0**
26.	What is the maximum amount of nitrogen dioxide that can be produced by mixing 4.2g	**1.0**

	of NO(g) and 3.2g of O_2(g)? **a.** 4.6g **b.** 2.3g **c.** 3.22g **d.** 6.44g	
27.	When a gold sheet was bombarded by a beam of α -particles, only a few of them got deflected whereas most passed, undeflected. It happened, because **a.** the force of attraction exerted on the α-particles by the electrons is not sufficient **b.** a nucleus has a much smaller volume than that of an atom **c.** the force of repulsion acting on the fast-moving α -particles is very small **d.** the neutrons in the nucleus do not have any effect on the α-particles	**1.0**
28.	Rutherford's scattering formula fails for very small scattering angles because **a.** The full nuclear charge of the target atom is partially screened by its electron **b.** The impact parameter between the particle source and the nucleus of the target is very large **c.** The kinetic energy of the α-particles is large **d.** The gold foil is very thin	**1.0**
29.	Cathode rays have the same charge to mass ratio as: **a.** α – particles **b.** β – particles **c.** Anode rays **d.** Protons	**1.0**
30.	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**

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

31.	If $\log_2 3 = a$, $\log_3 5 = b$ and $\log_7 2 = c$, then the logarithm of the number 63 to base 140 is (a) $\frac{1 + 2ac}{2c + abc + 1}$ (b) $\frac{1 - 2ac}{2c - abc - 1}$ (c) $\frac{1 - 2ac}{2c + abc + 1}$ (d) $\frac{1 + 2ac}{2c - abc - 1}$	**1.0**
32.	If $x_n > x_{n-1} > \ldots > x_2 > x_1 > 1$, then the value of $\log_{x_1} \log_{x_2} \log_{x_3} \ldots . \log_{x_n} x_n^{x_{n-1}}$, is (a) 0 (b) 1 (c) 2 (d) undefined	**1.0**
33.	If $\log_{10} 2$, $\log_{10} (2^x + 1)$, $\log_{10} (2^x + 3)$ are in AP, then (a) $x = 0$ (b) $x = 1$ (c) $x = \log_{10} 2$ (d) $x = \frac{1}{2} \log_2 5$	**1.0**
34.	If $A = \log_2 \log_2 \log_4 256 + 2 \log_{\sqrt{2}} 2$, then A is equal to (a) 2 (b) 3 (c) 5 (d) 7	**1.0**
35.	The value of $\frac{1}{\log_2 n} + \frac{1}{\log_3 n} + \ldots + \frac{1}{\log_{43} n}$ is (a) $\frac{1}{\log_{43!} n}$ (b) $\frac{1}{\log_{43} n}$ (c) $\frac{1}{\log_{42} n}$ (d) $\frac{1}{\log_{43} n!}$	**1.0**
36.	$\log_{10} \tan 1° + \log_{10} \tan 2° + \ldots + \log_{10} \tan 89°$ is equal to (a) 0 (b) 1 (c) 27 (d) 81	**1.0**
37.	$\log_7 \log_7 \sqrt{7\sqrt{(7\sqrt{7})}}$ is equal to (a) $3 \log_2 7$ (b) $3 \log_7 2$ (c) $1 - 3 \log_7 2$ (d) $1 - 3 \log_2 7$	**1.0**

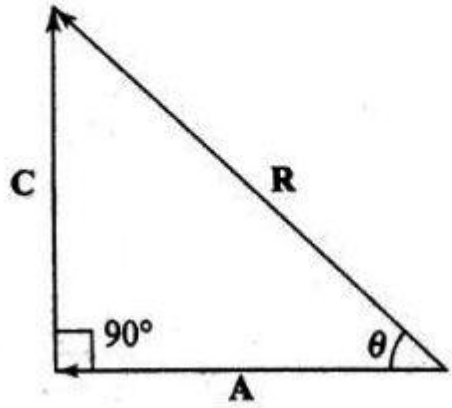
38.	If $\frac{\log x}{b-c} = \frac{\log y}{c-a} = \frac{\log z}{a-b}$, then $x^a y^b z^c$ is equal to (a) xyz (b) abc (c) 0 (d) 1	1.0
39.	$\frac{1}{1+\log_a bc} + \frac{1}{1+\log_b ca} + \frac{1}{1+\log_c ab}$ is equal to (a) 0 (b) 1 (c) 2 (d) 3	1.0
40.	If $(4)^{\log_9 3} + (9)^{\log_2 4} = (10)^{\log_x 83}$, then x is equal to (a) 2 (b) 3 (c) 10 (d) 30	1.0
41.	If x, y, z are in GP and $a^x = b^y = c^z$, then (a) $\log_b a = \log_c b$ (b) $\log_c b = \log_a c$ (c) $\log_a c = \log_b a$ (d) $\log_a b = 2\log_a c$	1.0
42.	If $\log_{0.3}(x-1) < \log_{0.09}(x-1)$, then x lies in the interval (a) $(-\infty, 1)$ (b) $(1, 2)$ (c) $(2, \infty)$ (d) none of these	1.0
43.	The interval of x in which the inequality $5^{\frac{1}{4}(\log_5^2 x)} \geq 5x^{\frac{1}{5}(\log_5 x)}$ (a) $(0, 5^{-2\sqrt{5}}]$ (b) $[5^{2\sqrt{5}}, \infty)$ (c) both (a) and (b) (d) none of these	1.0
44.	The solution set of the equation $\log_x 2 \log_{2x} 2 = \log_{4x} 2$ is (a) $\{2^{-\sqrt{2}}, 2^{\sqrt{2}}\}$ (b) $\{1/2, 2\}$ (c) $\{1/4, 2^2\}$ (d) none of these	1.0
45.	The solution of the equation $\log_7 \log_5(\sqrt{x+5} + \sqrt{x}) = 0$ is (a) 1 (b) 3 (c) 4 (d) 5	1.0

Key

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

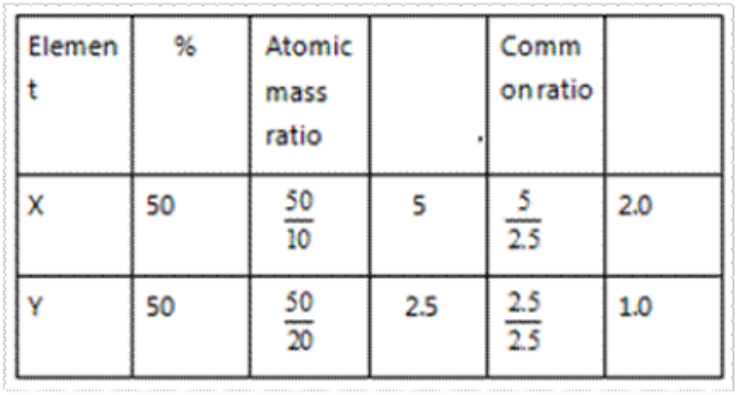
Explanation

Question Number	Explanation
1.	Let θ be the angle between **A** and **B**. Then magnitudes of vectors **P** and **Q** are given by $P^2 = A^2 + B^2 + 2AB\cos\theta$ and $Q^2 = A^2 + B^2 - 2AB\cos\theta$ Since $P = Q$, it follows that $\cos\theta = 0$ or $\theta = \pi/2$. Hence correct choice is (c).
2.	Given $\lvert\mathbf{A}\times\mathbf{B}\rvert = AB\sin\theta = \frac{1}{2}AB$ or $\sin\theta = \frac{1}{2}$. Therefore $\theta = 30°$. Hence the correct choice is (b).
3.	Since $\mathbf{A}\cdot\mathbf{B} = 0$, it follows that **A** is perpendicular to **B**. Also $\mathbf{A}\times\mathbf{C} = 0$. Therefore **A** is perpendicular to **C**. Hence **B** is perpendicular to **C**. Therefore, the correct choice is (b).
4.	Vector **C** lies in the plane containing vectors **A** and **B**, and vector **D** is perpendicular to both **A** and **B**. Hence **D** must be perpendicular to **C**. Hence the correct choice is (c).
5.	Let θ be the angle between the two vectors. The resultant is given by $R^2 = A^2 + B^2 + 2AB\cos\theta$ Putting the values of R, A and B we get $(1)^2 = (3)^2 + (4)^2 + 2\times3\times4\times\cos\theta$ or $\cos\theta = -1$ or $\theta = 180°$ Now $\mathbf{A}\cdot\mathbf{B} = AB\cos\theta = 3\times4\times\cos 180° = -12$ Hence the correct choice is (a).

6.	The magnitude of $\mathbf{A} \times \mathbf{B} = AB \sin\theta = 3 \times 4 \times \sin 180°$ $= 0$. Hence the correct choice is (d).
7.	Since $\mathbf{A} + \mathbf{B} = \mathbf{C}$, vector $\mathbf{C}$ is the resultant of vectors $\mathbf{A}$ and $\mathbf{B}$. Using the triangle law of vector addition (see Fig. 2.43), we have $\theta = 45°$ ($\because A = C$) Thus, the correct choice is (a).  **Fig. 2.43**
8.	Let $\lvert\hat{\mathbf{i}}\rvert$ and $\lvert\hat{\mathbf{j}}\rvert$ represent the magnitudes of vectors $\hat{\mathbf{i}}$ and $\hat{\mathbf{j}}$ respectively. Since $\lvert\hat{\mathbf{i}}\rvert$ and $\lvert\hat{\mathbf{j}}\rvert$ are unit vectors, $\hat{\mathbf{i}} = 1$ and $\hat{\mathbf{j}} = 1$. Therefore, the magnitude of vector $\hat{\mathbf{i}} + \hat{\mathbf{j}} = \sqrt{(1)^2 + (1)^2} = \sqrt{2}$. Thus, the correct choice is (b).
9.	The angle subtended by vector $\hat{\mathbf{i}} + \hat{\mathbf{j}}$ with the x–axis is given by $$\tan\theta = \frac{\lvert\hat{\mathbf{i}}\rvert}{\lvert\hat{\mathbf{j}}\rvert} = \frac{1}{1} = 1$$ or $\theta = 45°$ which is choice (b).

10.	$\cos\theta = \dfrac{(\hat{i}+\hat{j}+\hat{k})\cdot\hat{i}}{(1^2+1^2+1^2)^{1/2}\times 1} = \dfrac{\hat{i}\cdot\hat{i}+\hat{j}\cdot\hat{i}+\hat{k}\cdot\hat{i}}{(1+1+1)^{1/2}\times 1}$ $= \dfrac{1+0+0}{\sqrt{3}} = \dfrac{1}{\sqrt{3}}$ $(\because\ \hat{j}\cdot\hat{i} = \hat{k}\cdot\hat{i} = 0 \text{ and } \hat{i}\cdot\hat{i} = 1)$ Hence the correct choice is (a).
11.	Here $(0.2)^2 + (0.6)^2 + a^2 = 1$ or $a^2 = 1 - 0.04 - 0.36$, $= 0.6$ or $a = \sqrt{0.6}$. So the correct choice is (c).
12.	$\mathbf{A}\cdot\mathbf{B} = (\hat{i}+\hat{j})\cdot(\hat{i}+\hat{k}) = \hat{i}\cdot\hat{i}+\hat{i}\cdot\hat{k}+\hat{j}\cdot\hat{i}+\hat{j}\cdot\hat{k} = 1+0+0+0=1$ Thus, the correct choice is (a).
13.	The component of vector **A** along vector **B** = $(\mathbf{A}\cdot\mathbf{B})\hat{\mathbf{B}}$ where $\hat{\mathbf{B}} = \dfrac{\mathbf{B}}{B}$ where B is the magnitude of vector **B**. Now $(\mathbf{A}\cdot\mathbf{B}) = (2\hat{i}+3\hat{j})\cdot(\hat{i}+\hat{j})$ $= 2\hat{i}\cdot\hat{i}+2\hat{i}\cdot\hat{j}+3\hat{j}\cdot\hat{i}+3\hat{j}\cdot\hat{j}$ $= 2+0+0+3=5$ Also $\hat{\mathbf{B}} = \dfrac{\mathbf{B}}{B} = \dfrac{\hat{i}+\hat{j}}{\sqrt{1^2+1^2}} = \dfrac{1}{\sqrt{2}}(\hat{i}+\hat{j})$

14.	Since $(\hat{i}+\hat{j})\cdot(\hat{i}-\hat{j})=0$, vector $(\hat{i}-\hat{j})$ is perpendicu to vector $(\hat{i}+\hat{j})$. Let $\hat{i}-\hat{j}=C$. Now $(A\cdot C)=(2\hat{i}+3\hat{i})\cdot(\hat{i}-\hat{j})$ The required component is $(A\cdot C)\frac{C}{C}=(2\hat{i}+3\hat{j})\cdot(\hat{i}-\hat{j})\frac{\hat{i}-\hat{j}}{\lvert\hat{i}-\hat{j}\rvert}$ $=-\frac{1}{\sqrt{2}}(\hat{i}-\hat{j})=\frac{1}{\sqrt{2}}(\hat{j}-\hat{i})$ $(\because$ Magnitude of $\hat{i}-\hat{j}=\sqrt{1+1}=\sqrt{2}$ Thus, the correct choice is (a).
15.	Given $A+(2\hat{i}-3\hat{j}+4\hat{k})+(\hat{i}+5\hat{j}+2\hat{k})=1\hat{j}$ or $A=-3\hat{i}-\hat{j}-6\hat{k}$, which is choice (a).
16.	Rutherford's experiment led to following conclusion: 1. Most of the space in atom is empty hence maximum α-particles do not have any deviation. 2. Centre of the atom is positively charged, hence few α-particles have deviation. 3. Centre of atom is very small and very dense, hence only few α-particle bounce back. Therefore we can see only option (b) is the correct answer.
17.	According to Bohr's theory $E_n=-\frac{13.6}{n^2}eV$
18.	De-Broglie wavelength $\lambda=\frac{h}{mv}$ Where h = Planck constant, $h=6.636\times10^{-34}JS$ m= mass and v= velocity of the particle.

	$Mass\ of\ ball\ =\ 60/1000\ =\ 0.06\,kg$ $v\ =\ 10\,m/s$ $\lambda\ =\ h/mv\ =\ \left(\ 6.636\ \times\ 10^{-34}\right)/\ 0.06\ \times\ 10$ $=\ 11\times\ 10^{-34}\approx\ 10^{-33}m$
19.	Find the common ratio of elements present and using Empirical formula. Find the molecular formula.  Therefore X = 2 atoms Y = 1 atoms Answer is X_2Y.
20.	No. of Moles of NO $= \frac{4.0}{30} = 0.14$ No. of moles of $O_2 = \frac{3.2}{32} = 0.10$ $2NO_{(g)} + O_2(g) \rightarrow 2NO_2(g)$ Using limiting reagent concept Mass of NO_2 =0.14 mol × 46 g mol^{-1} = 6.44g

Element	%	Atomic mass ratio		Common ratio	
X	50	$\frac{50}{10}$	5	$\frac{5}{2.5}$	2.0
Y	50	$\frac{50}{20}$	2.5	$\frac{2.5}{2.5}$	1.0

21.	Mass of $H_2O = 18\,g$. No. of moles in $H_2O = \frac{given\ mass}{molar\ mass} ----(1)$ $d = \frac{m}{v}$ Given mass= density × volume = 0.05 ml × 1 = 0.05 g Put this in equation (1) $\frac{0.05}{18} \times 6.022 \times 10^{23}$ No. of water molecules $= 1.67 \times 10^{21}$
22.	$\text{Volume} = \frac{\text{mass}}{\text{density}}$ Mass of one molecule of water $= \frac{18}{6.02 \times 10^{23}}$ Density $= 1.0 \times 10^3 \text{kgm}^{-3}$ $= 1.0 \times 10^3 \times 1000 \times 10^{-6} \text{gcm}^{-3}$ So $V = \frac{18}{6.02 \times 10^{23} \times 1.0} = 3.0 \times 10^{-23} \text{ml}$
23.	The reaction is $2PH_3(g) \rightarrow 2P(s) + 3H_2(g)$ Thus, 2 volumes of PH_3 form 3 volumes of H_2 therefore, 100 mL of PH_3 would form $\frac{100x3}{2} = 150mL$. $\therefore$ increase = 150 – 100 = 50 mL
24.	Molar mass of $Na_2SO_4 \text{ x } H_2O = 142 + 18x$

	Mass % of water $= \left(\frac{18x}{142+18x}\right) x100 = 55.9$ On solving, x= 10
25.	From percentage purity, find out the mass of $NaCl$ in 10g sample. Calculate the number of moles and then the number of formula units. Mass of pure NaCl $= \frac{10 x 95}{100} = 9.5g$ Molecular Mass of NaCl $= 58$ 58g NaCl contains $= 6.023x10^{23}$ $\therefore$ 9.5g would contain $= \frac{6.023x10^{23} x9.5}{58.5} = 10^{23}$
26.	No. of Moles of NO = $\frac{4.0}{30} = 0.14$ No. of moles of O_2 = $\frac{3.2}{32} = 0.10$ $2NO_{(g)} + O_2(g) \rightarrow 2NO_2(g)$ Using limiting reagent concept Mass of NO_2 =0.14 mol × 46 g mol^{-1} = 6.44g
27.	Due to smaller volume of nucleus very few alpha particles experience repulsion.
28.	Partial screening was not considered by Rutherford. Hence it fails here.
29.	Cathode rays are made up of electrons and β – particles are also fast moving electrons
30.	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

31.

$$\because \quad a=\frac{\log 3}{\log 2},\ b=\frac{\log 5}{\log 3} \text{ and } c=\frac{\log 2}{\log 7}$$

$$\therefore \quad abc=\frac{\log 5}{\log 7},\ 2c=\frac{2\log 2}{\log 7} \text{ and } ac=\frac{\log 3}{\log 7} \qquad \ldots.(i)$$

$$\therefore \log_{140} 63=\frac{\log 63}{\log 140}=\frac{2\log 3+\log 7}{\log 7+2\log 2+\log 5}$$

$$=\frac{2\left(\frac{\log 3}{\log 7}\right)+1}{1+2\left(\frac{\log 2}{\log 7}\right)+\frac{\log 5}{\log 7}}$$

$$=\frac{2ac+1}{1+2c+abc} \qquad \text{[from Eq. (i)]}$$

32.

$$\log_{x_1} \log_{x_2} \log_{x_3} \ldots. \log_{x_{n-1}} \log_{x_n} x_n^{x_{n-1}^{\cdot^{\cdot^{x_1}}}}$$

$$=\log_{x_1} \log_{x_2} \log_{x_3} \ldots \log_{x_{n-1}} \left(x_{n-1}^{x_{n-2}^{\cdot^{\cdot^{x_1}}}} \cdot \log_{x_n} x_n\right)$$

$$=\log_{x_1} \log_{x_2} \log_{x_3} \ldots \log_{x_{n-1}} x_{n-1}^{x_{n-2}^{\cdot^{\cdot^{x_1}}}}$$

$$\ldots\ldots\ldots\ldots$$

$$=\log_{x_1} x_1=1.$$

33.

$\because$ $\log_{10} 2, \log_{10}(2^x+1), \log_{10}(2^x+3)$ are in AP.

$\therefore$ $2, 2^x+1, 2^x+3$ are in GP.

Then, $(2^x+1)^2=2(2^x+3)$

or $2^{2x}=5$

or $2x=\log_2 5$

or $x=\frac{1}{2}\log_2 5$.

34.	$A = \log_2 \log_2 \log_4 (4)^4 + 2\log_{2^{1/2}} 2$ $= \log_2 \log_2 4 + 2\left(\frac{1}{1/2}\right)$ $= \log_2 \log_2 2^2 + 4$ $= \log_2 2 + 4$ $= 1 + 4 = 5$
35.	$\frac{1}{\log_2 n} + \frac{1}{\log_3 n} + \ldots + \frac{1}{\log_{43} n}$ $= \log_n 2 + \log_n 3 + \ldots + \log_n 43$ $= \log_n (2 \cdot 3 \cdot \ldots \cdot 43) = \log_n (43!)$ $= \frac{1}{\log_{43!} n}$
36.	$\log_{10} \{\tan 1° \tan 2° \tan 3° \ldots \tan 45°$ $\ldots \tan 87° \tan 88° \tan 89°\}$ $= \log_{10} \{\tan 1° \tan 2° \tan 3° \ldots \tan 45°$ $\ldots \cot 3° \cot 2° \cot 1°\}$ $= \log_{10} 1 = 0$
37.	$\log_7 \log_7 7^{\frac{1}{2}+\frac{1}{4}+\frac{1}{8}} = \log_7 \left(\frac{1}{2}+\frac{1}{4}+\frac{1}{8}\right) = \log_7 \left(\frac{7}{8}\right)$ $= 1 - \log_7 8$ $= 1 - 3\log_7 2$
38.	$\because \quad \frac{\log x}{b-c} = \frac{\log y}{c-a} = \frac{\log z}{a-b}$ $= \frac{a\log x + b\log y + c\log z}{0}$ $\Rightarrow \quad \log (x^a y^b z^c) = 0 \Rightarrow x^a y^b z^c = 1$
39.	$\frac{1}{1+\log_a bc} + \frac{1}{1+\log_b ca} + \frac{1}{1+\log_c ab}$ $= \frac{\log a}{\log a + \log b + \log c} + \frac{\log b}{\log a + \log b + \log c}$ $+ \frac{\log c}{\log a + \log b + \log c}$ $= 1$

40.

$$(4)^{\log_{3^2} 3} + (9)^{\log_2 2^2} = (10)^{\log_x 83}$$

$$\Rightarrow \quad (4)^{1/2} + 9^2 = (10)^{\log_x 83}$$

$$\Rightarrow \quad (83)^1 = (83)^{\log_x 10}$$

$$\therefore \quad 1 = \log_x 10 \Rightarrow x = 10$$

41.

$$a^x = b^y = c^z$$

$$\Rightarrow \quad x \log a = y \log b = z \log c$$

$$\therefore \quad \frac{y}{x} = \frac{z}{y} \Rightarrow \frac{\log a}{\log b} = \frac{\log b}{\log c}$$

$$\Rightarrow \quad \log_b a = \log_c b$$

42.

$$\because \quad x - 1 > 0 \Rightarrow x > 1$$

and $\log_{0.3} (x-1) > \log_{(0.3)^2} (x-1)$

$$\Rightarrow \quad \log_{0.3} (x-1) > \frac{1}{2} \log_{0.3} (x-1)$$

$$\frac{1}{2} \log_{0.3} (x-1) > 0 \Rightarrow \log_{0.3} (x-1) > 0$$

$$\Rightarrow \quad x - 1 < 1, \therefore x < 2$$

Then, $x \in (1, 2)$

43.

$$5^{\frac{1}{4}(\log_5^2 x)} \geq 5x^{\frac{1}{5}(\log_5 x)}$$

Taking logarithm on base 5, then

$$\left(\frac{1}{4}\right)(\log_5^2 x) \geq 1 + \frac{1}{5}(\log_5 x)(\log_5 x)$$

$$\Rightarrow \quad \frac{1}{20} \log_5^2 x \geq 1$$

or $(\log_5 x)^2 \geq 20$

or $\log_5 x \geq 2\sqrt{5}$ and $\log_5 x \leq -2\sqrt{5}$

or $x \geq 5^{2\sqrt{5}}$ and $x \leq 5^{-2\sqrt{5}}$

But $x > 0$

$\therefore \quad x \in (0, 5^{-2\sqrt{5}}] \cup [5^{2\sqrt{5}}, \infty)$

44.

$\because \log_x 2 \log_{2x} 2 = \log_{4x} 2$

$\because \quad x > 0,\ 2x > 0$ and $4x > 0$ and

$x \neq 1,\ 2x \neq 1,\ 4x \neq 1$

$\Rightarrow \quad x > 0$ and $x \neq 1, \frac{1}{2}, \frac{1}{4}$

Then, $\frac{1}{\log_2 x} \cdot \frac{1}{\log_2 2x} = \frac{1}{\log_2 4x}$

$\Rightarrow \quad \log_2 x \cdot \log_2 2x = \log_2 4x$

$\Rightarrow \quad \log_2 x \cdot (1 + \log_2 x) = (2 + \log_2 x)$

$\Rightarrow \quad (\log_2 x)^2 = 2$

$\Rightarrow \quad \log_2 x = \pm \sqrt{2}$

$\therefore \quad x = 2^{\pm \sqrt{2}}$

$\therefore \quad x = \{2^{-\sqrt{2}}, 2^{\sqrt{2}}\}$

45.

It is clear that $x \geq 0$ and $x \geq -5$

ie, $x \geq 0$

$\because \quad \log_7 \log_5 (\sqrt{x+5} + \sqrt{x}) = 0$

$\Rightarrow \quad \log_5 (\sqrt{(x+5)} + \sqrt{x}) = 1$

$\Rightarrow \quad \sqrt{(x+5)} + \sqrt{x} = 5$

or $\quad \sqrt{(x+5)} = 5 - \sqrt{x}$

or $\quad (x+5) = (5 - \sqrt{x})^2$

$\Rightarrow \quad x + 5 = 25 + x - 10\sqrt{x}$

or $\quad 10\sqrt{x} = 20$

$\Rightarrow \quad \sqrt{x} = 2$

$\therefore \quad x = 4$