

**: HINTS AND SOLUTIONS :**

- 1 (c)  
Curie = disintegration/second
- 2 (c)  
Solar constant =  $\frac{\text{energy}}{\text{cm}^2\text{min}}$   
∴ The dimensions of solar constant  
=  $\frac{[ML^2T^{-2}]}{[L^2T]} = [ML^0T^{-3}]$
- 3 (b)  
Physical quantity  $u = \frac{B^2}{2\mu_0}$   
Unit of  $u = \frac{(N/Am)^2}{N/A^2} = \frac{N^2A^2}{NA^2m^2}$   
=  $\frac{N}{m^2} = \frac{Nm}{m^3} = \frac{J}{m^3}$   
= energy per unit volume = energy density
- 4 (a)  
 $E = \frac{1}{2}Li^2$  hence  $L = [ML^2T^{-2}A^{-2}]$
- 6 (c)  
Capacity × Resistance =  $\frac{\text{Charge}}{\text{Potential}} \times \frac{\text{Volt}}{\text{amp}}$   
=  $\frac{\text{amp} \times \text{second} \times \text{Volt}}{\text{Volt} \times \text{amp}} = \text{Second}$
- 7 (a)  
Torque = force × distance =  $[ML^2T^{-2}]$
- 8 (d)  
 $[ML^{-2}T^{-2}] = \frac{[MLT^{-2}]}{[L][L^2]}$   
=  $\frac{\text{Force}}{\text{distance} \times \text{area}} = \frac{\text{pressure}}{\text{distance}}$   
= pressure gradient.
- 9 (a)  
1 Newton = 10<sup>5</sup> dyne and 1m=100 cm
- 11 (c)  
Dimensions of Land R  
 $[R] = [ML^2T^{-3}A^{-2}]$   
 $[L] = [ML^2T^{-2}A^{-2}]$   
 $\left[\frac{L}{R}\right] = \frac{[ML^2T^{-2}A^{-2}]}{[ML^2T^{-3}A^{-2}]}$   
= [T]
- 12 (a)  
Volume of cube =  $a^3$   
Surface area of cube =  $6a^2$   
according to problem  $a^3 = 6a^2 \Rightarrow a = 6$   
∴  $V = a^3 = 216 \text{ units}$
- 13 (a)  
Using the relation  $R = \frac{\rho V}{\theta}$

- Dimensions of gas constant R  
=  $\frac{\text{dimensions of pressure} \times \text{dimensions of volume}}{\text{dimension of temperature}}$   
=  $\frac{[ML^{-1}T^{-2}][L^3]}{\theta}$   
=  $[ML^2T^{-2}\theta^{-1}]$
- 14 (b)  
 $mv = kg \left(\frac{m}{\text{sec}}\right)$
- 15 (d)  
Modulus of rigidity =  $\frac{\text{Shear stress}}{\text{Shear strain}}$   
=  $[ML^{-1}T^{-2}]$
- 16 (a)  
Each of three terms in the given equation has the dimensional formula of force.
- 18 (d)  
By the principle of dimensions homogeneity  
 $F = at^{-1}$   
 $[MLT^{-2}] = a[T^{-1}]$   
 $a = [MLT^{-1}]$   
Similarly for  $b = [MLT^{-4}]$
- 19 (b)  
Frequency  $f = cm^xk^y$ ,  $k = \text{Force/Length}$   
 $[M^0L^0T^{-1}] = [M]^x[ML^0T^{-2}]^y$   
=  $[M]^{x+y}[L]^0[T]^{-2y}$   
Comparing the powers on M, L and T  
 $-2y = -1$   
 $\Rightarrow y = \frac{1}{2}$   
And  $x + y = 0$   
∴  $x = -y = -\frac{1}{2}$
- 20 (c)  
 $R_s = \frac{R_1R_2}{R_1 + R_2}$   
 $\frac{\Delta R_s}{R_s} \times 100$   
=  $\frac{\Delta R_1}{R_1} \times 100 + \frac{\Delta R_2}{R_2} \times 100 + \frac{\Delta(R_1 + R_2)}{R_1 + R_2} = 100$

$$\text{Now, } \Delta R_1 = \frac{10}{100} \times 4\text{k}\Omega = 0.4\text{k}\Omega,$$

$$\Delta R_2 = \frac{10}{100} \times 6\text{k}\Omega = 0.6\text{k}\Omega$$

$$\begin{aligned} \text{Again, } \frac{\Delta R_s}{R_s} \times 100 &= \frac{0.4}{4} \times 100 + \frac{0.6}{6} \times 100 \\ &\quad + \frac{0.4 + 0.6}{10} \times 100 \\ &= 10 + 10 + 10 = 30 \end{aligned}$$

21 (c)

$S_{nth}$  represents the distance covered in  $n$ th sec.

22 (c)

$$Y = \frac{F}{A} \cdot \frac{L}{\Delta L} = \frac{\text{dyne}}{\text{cm}^2} = \frac{10^{-5}N}{10^{-4}\text{m}^2} = 0.1 N/\text{m}^2$$

Chemistry NEET solutions

1 (b)  
Ar and  $\text{Ca}^{2+}$  are isoelectronic species as they have same number of electrons, *i. e.*, 18.

2 (a)  
Tritium is the isotope of hydrogen. Its composition is as follows:  
1 electron, 1 proton and 2 neutrons

3 (b)  
 $E = \frac{hc}{\lambda}$ ,  $h$  and  $c$  for both cases are same so,  
 $\frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1} = \frac{16000}{8000}$   
 $E_1 = 2E_2$

4 (c)  
When  $n = 4$  and  $x = 5$  then electronic configuration can be written as  
 $(4-1)s^2(4-1)p^6(4-1)d^54s^2$   
This electronic configuration represents Mn and its atomic number is 25. Hence, number of protons are 25 in its nucleus.

5 (c)  
Isotones are species which have equal number of neutrons.  
Neutrons in  ${}_{19}\text{K}^{39} = 39 - 19 = 20$   
Neutrons in  ${}_{20}\text{Ca}^{40} = 40 - 20 = 20$

6 (d)  
The mass number = atomic number + number of neutron  
Atomic number = no. of proton  
= no. of electron (for an atom)  
So, mass number =  $18 + 20 = 38$

7 (c)  
Bohr's theory is applicable to unielectron atom or ion only.

8 (a)  
Wave number of spectral line in emission spectrum of hydrogen,

$$\bar{\nu} = R_H \left( \frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \quad \dots (i)$$

$$\text{Given, } \bar{\nu} = \frac{8}{9} R_H$$

On putting the value of  $\bar{\nu}$  in Eq. (i), we get

$$\frac{8}{9} = R_H \left( \frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$

$$\frac{8}{9} = \frac{1}{(1)^2} - \frac{1}{n_2^2}$$

$$\frac{8}{9} - 1 = -\frac{1}{n_2^2}$$

$$\frac{1}{3} = \frac{1}{n_2}$$

$$\therefore n_2 = 3$$

Hence, electron jumps from  $n_2 = 3$  to  $n_1 = 1$

9 (d)  
Angular momentum of an electron  
 $= mvr = \frac{nh}{2\pi}$  ( $n$  is orbit number)

$$\text{in 5th orbit} = \frac{5h}{2\pi} = \frac{2.5h}{\pi}$$

10 (d)  
Hydrogen spectrum is an emission spectrum. It shows the presence of quantized energy levels in hydrogen atom.

11 (d)  
Bohr radius for  $n$ th orbit =  $0.53 \times \frac{n^2}{Z}$   
Where,  $Z$  = atomic number

$$\therefore \text{Bohr radius of 2nd orbit of } \text{Be}^{3+} = \frac{0.53 \times (2)^2}{4}$$

$$= 0.53 \text{ \AA}$$

$$(d) \text{ Bohr radius of 1st orbit of H} = \frac{0.53 \times (1)^2}{1}$$

Hence, Bohr's radius of 2nd orbit of  $\text{Be}^{3+}$  is equal to that of first orbit of hydrogen.

12 (a)  
 $\lambda$  for visible light is in the range of 400 to 780 nm.

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

This, it is in the range of electron volt (eV).

13 (a)  
The value of Rydberg constant is  $10,9678 \text{ cm}^{-1}$ .

14 (d)  
According to Bohr model,  
Radius of hydrogen atom  
 $(r_n) = \frac{0.529 \times n^2}{Z} \text{ \AA}$   
Where,  $n$  = number of orbit  
 $Z$  = atomic number  
 $r_3 = \frac{0.529 \times (3)^2}{1} = 4.761 \text{ \AA}$

15 (c)  
Kinetic energy =  $\frac{1}{2}mv^2$ ,

$$\text{Potential energy} = \frac{-e^2}{r}$$

$$\text{But, } mv^2 = \frac{e^2}{r}$$

$$\text{KE} = \frac{1}{2} \frac{e^2}{r}$$

Total energy = KE + PE

$$= \frac{1}{2} \frac{e^2}{r} - \frac{e^2}{r} = \frac{e^2}{r} \left( \frac{1}{2} - 1 \right) = \frac{-e^2}{2r}$$

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

For Lyman series,  $n_1 = 1, n_2 = 2$

$$\frac{1}{\lambda} = 10,9678 \left[ \frac{1}{(1)^2} - \frac{1}{(2)^2} \right]$$

$$= \frac{10,9678 \times 3}{4}$$

$$\lambda = 1216 \text{ \AA}$$

17 (a)

$$E = 3 \times 10^{-12} \text{ ergs}$$

$$\lambda = ?$$

$$h = 6.62 \times 10^{-27} \text{ ergs}$$

$$c = 3 \times 10^{10} \text{ cms}^{-1}$$

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

$$3 \times 10^{-2} = \frac{6.62 \times 10^{-27} \times 3 \times 10^{10}}{\lambda}$$

$$\lambda = \frac{6.62 \times 10^{-27} \times 3 \times 10^{10}}{3 \times 10^{-12}}$$

$$= 6.62 \times 10^{-5} \text{ cm}$$

$$= 662 \times 10^{-7} \text{ cm}$$

$$= 662 \times 10^{-9} \text{ m}$$

$$= 662 \text{ nm.}$$

18 (b)

Velocity of an electron in first orbit of H atom is

$$u = \frac{2.1847 \times 10^8}{1} \text{ cms}^{-1}$$

Hence, it is  $\frac{1}{100}$ th as compared to the velocity of light.

19 (b)

$$\begin{aligned} \text{Ionisation energy of He}^+ &= 13.6 \times Z^2 \text{ eV} \\ &= 13.6 \times (2)^2 \text{ eV} \\ &= 13.6 \times 4 \text{ eV} = 54.4 \text{ eV} \end{aligned}$$

20 (d)

According to Bohr's model of hydrogen atom, the energy of electrons in the orbit is quantised, the electron in the orbit nearest to nucleus has lowest energy and electrons revolve in different orbits around the nucleus.

Whereas according to Heisenberg's uncertainty principle position and velocity of the electrons in the orbit cannot be determined simultaneously.

21 (c)

Give that,

Bohr's orbit of hydrogen atom ( $n$ )=2

Atomic number of hydrogen ( $Z$ )=1

By using

$$\begin{aligned} r &= \frac{0.529 n^2}{Z} \\ &= \frac{0.529 \times (2)^2}{1} \\ &= \frac{0.529 \times 4}{1} \\ &= 2.116 \text{ \AA} \\ &= 0.2116 \text{ nm} \end{aligned}$$

22 (b)

Niels Bohr utilised the concepts of quantisation of energy (proposed by Max planck) first time to give a new model of atom.

23 (a)

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

$$\Rightarrow \frac{1}{\lambda} = (Z)^2 \cdot R_H \left\{ \frac{1}{1} - \frac{1}{4} \right\} = \frac{3}{4} R_H Z^2$$

$$\therefore \lambda \propto \frac{1}{Z^2}$$

Hence for shortest  $\lambda$ ,  $Z$  must be maximum, which is for  $\text{Li}^{2+}$ .

24 (a)

$$v = \frac{c}{\lambda} = \frac{3 \times 10^{10}}{2000 \times 10^{-8}} = 1.5 \times 10^{15} \text{ s}^{-1}$$

$$h = 6.6 \times 10^{-27} \text{ erg s.}$$

$$E = hv = 6.6 \times 10^{-27} \times 1.5 \times 10^{15}$$

$$= 9.94 \times 10^{-12} \text{ erg}$$

- 1 (b) **Linnaeus system** is an example for the artificial system of classification. Linnaeus also gave binomial nomenclature. In this, first part is generic name and second one is the specific name.
- 2 (b) In majority of the higher organisms (plant and animals) reproduction and growth characteristic are mutually exclusive events as increase in the body size of living being do not alters the rate of reproduction or *vice-versa*
- 3 (d) → A taxon is the taxonomic group of any rank in the system of classification
- 4 (d) The term 'Systematic Botany' refers to the methodical study of plants, dealing with identification, naming and classification.
- 5 (b) Binomial system of classification was based on morphological characteristic of an organism
- 6 (d) In biological taxonomy, a monograph is a comprehensive, treatment of a taxon which revises all known species within a group, add any newly discovered species and collects and synthesis available information on various aspects, eg, ecological association, geographic distributions and morphological variations within the group.
- 7 (d) Taxonomic categories are the various grouping levels or rank in classification like kingdom (largest) and species (lowest category). So, here division and phylum are categories
- 8 (c) Taxa is plural of taxon. A taxon represents a grouping in a systematic classification of organism (whatever its rank)
- 9 (c) The framework system of classification in which various taxonomic categories are arranged in an order of logical sequence is called **taxonomic hierarchy**, a taxonomic category of overall taxonomic arrangement. All categories together make taxonomic hierarchy. It is also called Linnaean hierarchy as it was first proposed by **C Linnaeus**. There are seven obligate categories- Kingdom, Division (in plants) or Phylum (in animals), Class, Order, Family, Genus and Species.
- 10 (d) **R H Whittaker** divided living organisms into five kingdoms based in cell, body structure, nutrition and life style. The five kingdoms as given by Whittaker are: **Monera, Protista, Fungi, Plantae and Animalia**.
- 11 (c) Species is basic/lowest/smallest unit of taxonomy. According to Earnst Mayr species are group of interbreeding natural populations. Which are reproductively isolated from other such groups. It contains most similar organisms
- 12 (a) In **artificial system** of classification, only a few characters of the plants are being considered, for example, the grouping of plants into herbs, shrubs and trees or the sexual system of Linnaeus was based on number od stamens. The best known artificial system is of **Linnaeus** published in 1735.
- 13 (c) Growth is exhibited by living as well as non-living organism. When increase is body mass is considered as a criterian for growth this may be as the result of accumulation of material on non-living surface or weight increase in livings, e.g., mountains and sand dunes increase due to accumulation of material on their surface
- 14 (a) John Ray introduced the term 'Species' in its presence sense for the first time. He also published a book *Historia Generalis Plantarum*
- 15 (b) 'Species Plantarum' includes names and description of 6000 species of 1000 genera of plants. The binomial nomenclature given by Linnaeus was first used in **Species Plantarum**.
- 16 (b) According to Earnt Mayr species are group of interbreeding natural populations that are reproductively isolated from other such groups. It contains most similar organisms
- 17 (c) According to phylogenetic system of classification, **primitive charecters** are perenniall and shrubby nature, solitary flower, numerous stamens

multiple or aggregate fruit, while **advanced characters** are compound leaves, zygomorphic flowers, epigynous flowers, fused stamens (dichlamydeous condition) and albuminous seeds.

Thus, the ratio of advanced and primitive characters according to question is 1:1.

- 18 (a) The ascending hierarchy in similar characteristic is Class < Family < Genus < Species, *i.e.*, specificity is increasing
- 19 (b) The genus *Felis* is used to represent cats
- 20 (b) Binomial system of nomenclature was proposed by Carolus Linnaeus. The system of nomenclature was first issued in *Species Plantarum*. Binomial system approve two name for an organism, *i.e.*, generic and specific name
- 21 (a) R.H. Whittaker, an American taxonomist proposed five kingdom classification. His five kingdoms are Monera, Protista, Fungi, Plantae and Animalia
- 22 (a) Species, phylum and class are all taxonomic categories, while Asteraceae/Fabaceae are families
- 23 (a) Taxonomic hierarchy refers to stepwise arrangement of all categories for classification of plants and animals. The categories in taxonomic hierarchy are: Kingdom → Division (Phylum) → Class → Order → Family → Genus → Species
- 24 (c) Growth self-replication and response to stimuli are the properties, which are exclusive among the living being as increase in mass can be observed in non-living thing, e.g., mountains, sand mounds also shows increase in size by accumulation of material on their surface
- 25 (b) Reproduction by fragmentation can be best observed in protonema of mosses, filamentous algae and in the fungi
- 26 (a) Taxon can be defined as a group of organisms with similar trait of any taxonomic rank like roses (genus), legumes (family), gymnosperm (class). According to Simpson, it is a group of real organisms recognized at a formal unit at any level in hierarchy
- 27 (d) Increase in mass and increase in number of

individuals are considered twin characteristics of growth, metabolic reaction can also be demonstrated *in vitro* and consciousness is considered as a determining property of living

- 28 (a) The term new systematic was given by **Julian Huxley** (1940). New systematic or Biosystematics is the concept of systematic which bring out taxonomic affinity on the basis of evolutionary, genetic and morphological traits. The term systematic was given by **Linnaeus** (Father of Taxonomy), who also gave binomial nomenclature concept.
- Darwin** has given theory of natural selection and theory of pangenesis.
- 29 (b) Organization or living being starts with atomic, *i.e.*, sub-microscopic level and reaches to cells (microscopic level), then become visible or microscopic with tissue and organs and then reaches to conceptual level
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Atoms → Molecules → Biomolecules → Cells → System organ ← Organ ← Tissues → Organism → Population (conceptual level)
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- 30 (a) The basic unit of classification is species. It is the lowest category of classification. It is a group of closely related individuals with similar morphological, anatomical, biochemical and cytological characters. It is a group of naturally interbreeding populations with ability to produce fertile off springs. Individuals of a species share a common gene pool. Species is reproductively isolated, thus genetically closed system. Species has the real existence in nature. The term 'species' was given by **John Ray**, an English naturalist.
- 31 (d) Taxon is used to represent any rank in taxonomic hierarchy, *i.e.*, any level of grouping of organism based on observable feature like dog (species), monocot (class). According to Simpson, taxon is a group of real organisms recognized at a formal unit at any level in hierarchy
- 32 (a) In the natural system, all the important characters of plants are being considered and the plants are classified according to their related affinities. This system reflects the situation as it is thought to exist under natural conditions, *i.e.*, Bentham and Hooker's system.

- 33 (c) **Hooker** proposed the concept of genus.
- 34 (a) Species is a group of actually or potentially inbreeding population that are reproductively isolated from other such groups
- 35 (c) Reproduction is not essential for the survival of individual. However, it is essential and required for the survival of population because the through this loss of life is compensated
- 36 (a) National Botanical Research Institute is located at Lucknow.
- 37 (a) Term 'Taxonomy' is coined by AP de Candolle (1813) in his book *Theory Elementarie de La Botanique, i.e., Theory of Elementary Botany*. While Carolus Linnaeus is regarded as Father of Taxonomy
- 38 (c) A species is a group of organisms that interbreed freely in their natural setting and do not interbreed with other population. In simple words, members of one species are reproductively isolated from members of other species. Species is the real basic unit for understanding taxonomy as well as evolution.
- 39 (d) Umbelliferae of Apiaceae (carrot family) shows cup-shaped thalamus structure. Bentham and Hooker in his classification placed it under series-Calyciflorae.
- 40 (c) Hierarchical classification is  
 Kingdom  
 ↓  
 Division/Phylum  
 ↓  
 Class  
 ↓  
 Order  
 ↓  
 Family  
 ↓  
 Genus  
 ↓  
 Species  
 Class occupy a position between division/phylum and order
- 41 (d)

- Biological or scientific name are generally written in italics at these are Greek or Latin words. The first word denotes genus and begin with capital letter, while second words denote species and starts with small letters
- 42 (c) A species is a group of organisms, which are closely related and sharing a common gene pool. **John Ray** (1627-1705) introduced the term 'species' for any shole kind of living thing.
- 43 (c) Binomial nomenclature provide a distinct and proper scientific name to organism, each consisting of two words, first generic name and second specific name, which are derived from Latin language. Scientific names are printed in italics and hand written name is underlined (zig zag)
- 44 (c) Linnaeus produced sexual system of classification based upon the numerical relations of the floral parts. He grouped all the genera into 24 classes based on number and morphological arrangement of their stamens.
- 45 (d) When synthetic process or constructive process called anabolism exceeds destructive process of the body *i.e.*, catabolism, growth will takes place, which in turn proceeds development and body will function well

