: HINTS AND SOLUTIONS :

1 (a)
The term 'taxonomy' was introduced by **A P de Candolle** (1813)in his book, **'TheorieElementarie de la Botanique' (Theory of Elementary Botany)**. Father of taxonomy is regarded to **Carolus Linnaeus.**

2 (d)
Father of Botany – Theophrastus

Father of Zoology/Biology – Aristotle

Father of Cytology – Robert Hooke.

3 (a)
Phylogeny (Gr. *Phylon*=tribe or race; *geneia*=origin) is the origin and diversification of any taxon or the evolutionary history of its origin and diversification. It is usually represented as a diagrammatic phylogenetic tree (that traces putative evolutionary relationships) i.e., dendrogram.

4 (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.

5 (d)
Binomial nomenclature was given by **Carlous Linnaeus**. It was first issued in Species Plantarum.

6 (b)
ICBN stands for International Code for Botanical Nomenclature.

7 (a)
Linnaeus proposed binomial nomenclature. According to this scientific name of organism consists of generic epithet and specific epithet, e.g., *Labeo rohita*.

8 (a)
As per binomial system of nomenclature, botanical name consists of generic epithet. The names are written in italic, generic name begins with capital letter and specific name begins with small letter, e.g., *Brassica indica*.

9 (c)
Linnaeus not only laid of taxonomy but also introduced binomial nomenclature. According to this scientific name consists of two parts, the first is the name of the 'genus' and the second is called the 'specific epithet' that identifies the particular species within the genus.

10 (b)
Bauhin (1623) proposed a binary system of naming plants. This concept was properly enlarged by Lannaeus (1753), while publishing 'Species Plantarum'. According to this, plant name consists of two parts-the generic and specific epithet.

11 (d)
There are certain rules

(i) The names are in Latin language, sometimes in Greek.

(ii) Generic name begins with the capital letter and is placed before specific name.

The specific name begins with a small letter.

(iii) The scientific name should either be underlined or italicized.

(iv) Name of the authority should be written after specific epithet in an abbreviated from.

12 (b)
Reproduction by fragmentation can be best observed in protonema of mosses, filamentous algae and in the fungi

13 (d)
Metabolic reactions can also be performed outside the body in a cell free system, *i.e*., an isolated metabolic reaction *in vitro*

14 (c)

Increase in mass and increase in number of individuals are considered the twin characteristic of growth in living organisms

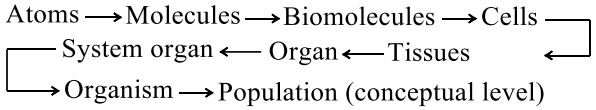
15 (c)
Reproduction.
Regeneration was first observed in *Hydra. Planaria* exhibits true regeneration. All these organisms show regeneration as a key feature

16 (d)
The general characteristic of life are growth, reproduction, consciousness, body organization metabolism, adaptation and death

17 (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

18 (a)
Increase in size with rest 3, the living organisms undergo self-replication, also and this feature makes them unique among all other forms

19 (b)
Organization level starts at sub-microscopic level and leads to population levels. 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



20 (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

21 (a)
Regeneration was first observed in *Hydra. Planaria* exhibits true regeneration. All these organisms show regeneration as a key feature

22 (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 livings

23 (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

24 (c)
In plant growth occurs by cell division or multiplication continuously in all parts throughout their life span

25 (c)
Metabolism is the sum of all the metabolic activities in body, i.e., anabolism and catabolism. Anabolism is constructive process, while catabolism is a destructive process

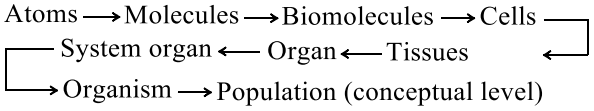
26 (c)
Mule a result of outbreeding interspecific hybridization and worker bee lack primary sex organ. So, they are unable to do reproduction

27 (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

28 (a)
Aristotle (384-322 BC) described structure, habit, reproduction and classification of animals in his book *Historia Animalium*. He is regarded as father of zoology and biology

29 (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*

30 (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



31 (d)

Growth also occur in unicellular organisms by cell division. It can be observed in *vitro* culture by counting the number of cell under microscope

32 (c)
All living organism from prokaryotes to the most complex eukaryotes can respond external stimuli. The non-living things do not have this property at all

33 (c)
Regeneration is a process in which a lost part of the body is recreated by the organism to became a new organism. It can be best observed in flatworm *Planaria*

34 (a)
In unicellular organisms like bacteria, algae (unicellular) and *Amoeba* reproduction is increase in number of cells. *i.e*., synonymous with growth

35 (a)
Increase in the body mass is a common feature of non-living and living objects to represent growth as non-living objects also grows if we take increase, in body mass as criterian for growth, e.g., mountains and boulder also grows by accumulation of material on surface

36 (b)
Binomial system of nomenclature was proposed by Carolus Linnaeus. The system of nomenclature was firsts issued in Species Plantarum. Binomial system approve two name for an organism, i.e., generic and specific name

37 (b)
Systema Naturae was a work of Carolus Linnaeus. He describe about 4330 species of animal in this, while around 6000 species of plant had been described in *Species Plantarum*

38 (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)

39 (a)
Mangifera is the generic name of mango

40 (b)
Mangifera indica, scientific name consists of two words a generic and another specific name. It is binomial system of nomenclature.
The first word denoting the genus start with capital letter, while specific epithets start with small letter

41 (a)
Number and type of organisms it includes

42 (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

43 (c)
Panthera leo is scientific name of lion. *Cannis* is genus (cat), *Pisum* is also generic name of sweet pea, Carnivora is order

44 (b)
Solanum and *Panthera* are genera of family—Solanaceae and Felidae, respectively

45 (b)
Carolus Linnaeus is a Swedish botanist is regarded as Father of Taxonomy. Binomial nomenclature was published by him in *Species Plantarum*

46 (c)
ICNB stands for International Code of Bacteriological Nomenclature

47) Conceptual 48) Conceptual 49) Conceptual 50) Conceptual

: HINTS AND SOLUTIONS :

1 **(b)**

Positron is as heavy as an electron.

2 **(a)**

The third alkaline metal is $^{40}_{20}$Ca. It contains 20 protons and 20 electrons.

3 **(b)**

$\frac{e}{m}$ for electron $(e) = \frac{1.6 \times 10^{-19}}{9.1 \times 10^{-28}}$

$= 1.758 \times 10^{8}$

$\frac{e}{m}$ for proton $(p) = \frac{1.6 \times 10^{-19}}{1.672 \times 10^{-24}}$

$= 9.56 \times 10^{4}$

$\frac{e}{m}$ for neutron $(n) = \frac{0}{1.675 \times 10^{-24}} = 0$

$\frac{e}{m}$ for $\alpha -$ particle $= \frac{2}{4} = 0.5$

Hence, the increasing order of $\frac{e}{m}$ is as

$n < \alpha < p < e$

4 **(a)**

Rutherford showed the existence of nucleus in an atom by his α −particles scattering experiment. He postulated that every atom has a small central part which has positive charge and almost all the mass of atom ($i.e.$, nucleus consists of protons and neutrons).

5 **(b)**

A heavy element has atomic number X and mass number Y.

The atomic number of heavy element is smaller than its mass number.

$i.e.,\quad X < Y$

6 **(b)**

$N^{3-} 7 + 3 = 10$ electrons

$F^{-} 9 + 1 = 10$ electrons

$Na^{+} 11 - 1 = 10$ electrons

7 **(b)**

J.J. Thomson (1987) was first experimentally demonstrated particle nature of electron. It was first of all proposed by Millikan's oil drop experiment.

8 **(d)**

Common name for proton and neutron is nucleon.

9 **(d)**

The isoelectronic species have same number of electrons.

1. NaCl has Na^{+} and Cl^{-} ions

Electrons in $Na^{+} = 11 - 1 = 10$

Electrons in $Cl^{-} = 17 + 1 = 18$

∴ They are not isoelectronic.

2. CsF has Cs^{+} and F^{-} ions

Electrons in $Cs^{+} = 55 - 1 = 54$

Electrons in F^{-} =9+1=10

∴ They are not isoelectronic.

3. NaI has Na^{+} and I^{-} ions

Electrons in $Na^{+} = 11 - 1 = 10$

Electrons in $I^{-} = 53 + 1 = 54$

∴ These are not isoelectronic.

4. K_2S has K^{+} and S^{2-} ions

Electrons in $K^{+} = 19 - 1 = 18$

Electrons in $S^{2-} = 16 + 2 = 18$

∴ In K_2S, the ions K^{+} and S^{2-} are isoelectronic.

10 **(b)**

e/m ratio for $He^{2+} = \frac{2}{4}$

e/m ratio for $H^{+} = \frac{1}{1}$

e/m ratio for $He^{+} = \frac{1}{4}$

e/m ratio for $D^{+} = \frac{1}{2}$

∴ The e/m is highest for hydrogen.

11 **(c)**

Isotopes are atoms of same elements having different mass number

Isobars are atoms of different elements having same mass number.

Isotones are atoms of different elements having same number of neutrons.
Nuclear isomers are atoms with the same atomic number and same mass number but different radioactive properties.

12 (a)
No. of neutron=atomic mass−atomic number.
For C^{12}No. of neutron $= 12 - 6 = 6$

13 (c)
Nucleus of an atom is small in size but carries the entire mass $i.e.$, contains all the neutrons and protons.

14 (c)
Tritium contains 2 neutrons and 1 proton.

15 (a)

5.	J.J. Thomson	Determined charge on electron
6.	Neil Bohr	Gave structure of atom
7.	James Chadwick	Discovered neutron
8.	Mullikan	Carried out oil drop experiment

16 (a)
$_8O^{2-}$ has 10 electrons. $_{18}Ti^{+}$ has 80 electrons.

17 (c)
Isoelectronic species have same number of electron. Mg^{2+} and Na^{+}both have 10 electrons hence, they are isoelectronic species.

18 (c)
Mass or proton $= 1.672614 \times 10^{27}$kg
Mass of electron $= 1.60211 \times 10^{-31}$kg
$\therefore$ Mass of proton/Mass of electron $= \frac{1}{1837}$

19 (a)
Isobars have same atomic mass but different atomic number.
Thus, the isobar of $_{20}Ca^{40}$ is $_{18}Ar^{40}$.

20 (c)
Number of electrons in $M^{2+} = 24$
$\therefore$ Number of electrons in M=26
$i.e.$, atomic number (Z)=26
Mass number (A)=56
$\therefore$ Number of neutrons $= A - Z$=56-26=30

21 (d)
$^{14}_{6}C, ^{16}_{8}O, ^{15}_{7}N$ =isotonic triad
Isotonic=same number of neutron.
All species contain 8 neutrons.

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

23 (c)
The proton has unit positive charge $(+1.602 \times 10^{-19}C)$ and its mass is 1.007 u $(1.677 \times 10^{-27}kg)$.

24 (c)
Isotonic species are those species which have equal number of neutrons,
$e.g.$, $^{14}_{6}C, ^{15}_{7}N$ and $^{17}_{9}F$.

25 (a)
Isoeletronic means having same number of electrons. $K^{+}, Cl^{-}, Ca^{2+}, Sc^{3+}$ (all are having 18 electrons).

: HINTS AND SOLUTIONS :

1 (d)

[capacitance X]=$[M^{-1}L^{-2}T^{2}Q^{2}]$

[Magnetic induction Z] = $[MT^{-1}Q^{-1}]$

$[Z^2]$=$[M^{2}T^{-2}Q^{-2}]$

Given, $X = 3YZ^2$ or $Y = \frac{X}{3Z^2}$ or $[Y] = \frac{[X]}{[Z]^2}$

$\therefore \quad [Y] = \frac{[M^{-1}L^{-2}T^{2}Q^{2}]}{[M^{2}T^{-2}Q^{-2}]} = [M^{-3}L^{-2}T^{4}Q^{4}]$

2 (c)

$KE = \frac{1}{2}mv^2$

$\therefore [KE] = [M][LT^{-1}]^2 = [ML^2T^{-2}]$

3 (b)

The action of impulse is to change the momentum of a body or particle and the impulse of force is equal to the change in momentum.

Thus, the dimensions of impulse are same as that of momentum.

4 (c)

Velocity is given by

$$v = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$

$$\therefore \quad v^2 = \frac{1}{\mu_0 \varepsilon_0} = [LT^{-1}]^2$$

$$\therefore \quad \frac{1}{\mu_0 \varepsilon_0} = [L^2T^{-2}]$$

5 (c)

According to the definition

6 (d)

$[\eta] = ML^{-1}T^{-1}$ so its unit will be $kg/m\text{-}sec$

7 (c)

Torque = $[ML^2T^{-2}]$, Angular momentum = $[ML^2T^{-1}]$

So mass and length have the same dimensions

8 (d)

Given, $U = \frac{A\sqrt{x}}{x+B}$ ... (i)

Dimensions of U = dimensions of potential energy

$$= [ML^2T^{-2}]$$

From Eq. (i),

Dimensions of B = dimensions of $x = [M^0LT^0]$

$\therefore$ Dimensions of A

$$= \frac{\text{dimensions of } U \times \text{dimensions of}(x+B)}{\text{dimension of}\sqrt{x}}$$

$$= \frac{[ML^2T^{-2}][M^0LT^0]}{[M^0L^{1/2}T^0]}$$

$$= [ML^{5/2}T^{-2}]$$

Hence, dimensions of AB

$$= [ML^{5/2}T^{-2}][M^0LT^0]$$

$$= [ML^{7/2}T^{-2}]$$

9 (b)

Force = mass $\times$ acceleration

Or $F = ma$

$\therefore \quad [F] = [m][a]$

$$= [M][LT^2]$$

$$= [MLT^{-2}]$$

10 (c)

Unit of energy will be $kg - m^2/sec^2$

11 (c)

As $I = MR^2 = kg - m^2$

12 (b)

Power= $\frac{\text{Work}}{\text{Time}}$

$\therefore$ [Power] $= \frac{[\text{Work}]}{[\text{Time}]} = \frac{[ML^2T^{-2}]}{[T]}$

$= [ML^2T^{-3}]$

13 (b)

We know that

$$\text{Specific heat} = \frac{Q}{m\,\Delta t}$$

$$\text{Unit of specific heat} = \frac{\text{unit of heat}}{\text{unit of mass} \times \text{unit of temperature}}$$

$$\therefore \text{Unit of specific heat} = \frac{\text{J}}{\text{kg°C}} = \text{Jkg}^{-1}\text{°C}^{-1}$$

14 (d)

$[h] = [\text{Angular momentum}] = [ML^2T^{-1}]$

15 (d)

$NSm^{-2} = Nm^{-2} \times S = \text{Pascal-second}$

16 (d)

According to Wien's law the product of wavelength corresponding to maximum intensity of radiation and temperature of body (in Kelvin) is constant $ie, \lambda_m T = b = \text{constant}$, where b is Wien's constant and has value $2.89 \times 10^{-3}\text{m} - \text{K}$.

18 (c)

The right hand side of the given relation is basically $\frac{k}{\text{metre}}$. But, since the left hand side is joule, therefore k should be J m.

19 (a)

$$\text{Magnetic field} = \frac{\text{Force}}{\text{Charge} \times \text{velocity}}$$

$$= \frac{[\text{MLT}^{-2}]}{[\text{AT}][\text{LT}^{-1}]} = [\text{MA}^{-1}\text{T}^{-2}]$$

20 (c)

$$[X] = [F] \times [\rho] = [MLT^{-2}] \times \left[\frac{M}{L^3}\right] = [M^2L^{-2}T^{-2}]$$

21 (d)

$\text{Charge} = \text{Current} \times \text{Time} = [AT]$

23 (a)

$$\frac{\text{Angular momentum}}{\text{Linear momentum}} = \frac{mvr}{mv} = r = [M^0L^1T^0]$$

24 (a)

$$\frac{R}{L} = \frac{V/I}{V \times T/I} = \frac{1}{T} = \text{Frequency}$$

25 (b)

$$L = \frac{\emptyset}{I} = \frac{Wb}{A} = Henry$$

Hints

1. conceptual
2. Formula ($\log_a m + \log_a n = \log_a mn$)
3. Formula ($\log_a m - \log_a n = \log_a \frac{m}{n}$)
4. Formula $\log_a m^n = n \log_a m$
5. Formula
6. Formula
7. Formula
8. Formula
9. Formula
10. Formula($\log_a m + \log_a n = \log_a mn$) & $\log_a m^n = n \log_a m$
11. Formula
12. Formula ($\log_n m = \frac{\log m}{\log n}$)
13. Conceptual
14. Formula
15. Formula
16. Formula
17. Formula ($\log_n m = \frac{\log m}{\log n}$)
18. Formula($\log_n m = \frac{\log m}{\log n}$)
19. Formula
20. Formula ($\log_a a = 1$)
21. Formula ($\log_a a = 1$)
22. Conceptual
23. Conceptual
24. Conceptual
25. Formula ($\log_a m^n = n \log_a m$ & $\log_a m + \log_a n = \log_a mn$)