SATISH SCIENCE ACADEMY

DHANORI PUNE-411015

THE FUNDAMENTAL UNIT OF LIFE

Class 09 - Science

Time Allowed: 3 hours **Maximum Marks: 129**

Section A

1. The average atomic mass of boron is 10.8 u. If the isotopic mass of B-10 is 10.013 and that of B-11 is 11.009, then the relative abundance of these isotopes is respectively **[1]**

   a) 11% and 89%
   b) 20.98% and 79.02%
   c) 10.001% and 89.9%
   d) 80.1% and 19.9%

2. The triad which is isoelectronic **[1]**

   a) Mg^{2+}, F^{-}, O
   b) Na^{+}, O^{2-}, Ne
   c) Na^{+}, Al, N_3^{-}
   d) Cl^{-}, Ar, Ca

3. A thin sheet of gold foil is bombarded with α-particles as in Rutherford's experiment. Which of the given descriptions most accurately represents the path of α-particles? **[1]**

	Undeflected	No. of particles deflected through a small angle	No. of particles deflected through a large angle
I	All	None	None
II	Most	A few	None
III	Most	A few	A few
IV	A few	Most	A few

   a) IV
   b) III
   c) II
   d) I

4. Which of the following statements are incorrect regarding the elements given below? **[1]**

   ${}^{39}_{19}U$, ${}^{127}_{53}V$, ${}^{35}_{17}W$, ${}^{80}_{35}X$, ${}^{40}_{18}Y$

   i. The correct order of increasing proton number is U < W < X < V < Y.
   ii. The correct order of increasing mass number is W < U < Y < X < V.
   iii. There is difference in the orders of proton number and mass number.
   iv. The number of protons is equal to number of neutrons in all the given elements.

   a) i and iv only
   b) i and ii only
   c) ii and iv only
   d) ii and iii only

5. An element has 3 valence electrons in its outermost 3rd shell, the name of element is **[1]**

   a) B
   b) Mg

c) Ga

d) Al

6. The number of electrons in an element x is 15 and the number of neutrons is 16. Which of the following is the correct representation of the element ? **[1]**

a) ${}^{31}_{16}X$

b) ${}^{31}_{15}X$

c) ${}^{15}_{16}X$

d) ${}^{16}_{15}X$

7. Rutherford's α- scattering experiment led to the conclusion that **[1]**

a) atoms are electrically neutral.

b) the mass and the positive charge of an atom are concentrated in the nucleus.

c) mass and energy are inter-related.

d) neutrons are present in the nucleus.

8. There are two atomic species X and Y, such that **[1]**

Atomic species	X	Y
Protons	8	8
Protons	8	10

Which of the following statements is true about X and Y?

a) X and Y have different chemical properties.

b) X and Y are isobars.

c) X and Y have different physical properties.

d) All are correct.

9. An atom with 3 protons and 4 neutrons will have valency of **[1]**

a) 4

b) 1

c) 7

d) 3

10. How many electrons, protons and neutrons will be present in X^-, if atomic number of X is 9 and mass number is 19? **[1]**

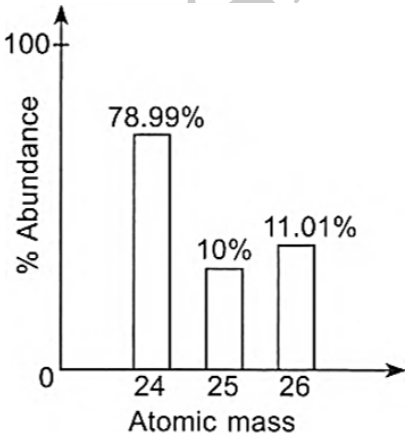
a) E = 10, P = 9, N = 10

b) E = 9, P = 10, N = 10

c) E = 10, P = 10, N = 10

d) E = 9, P = 9, N = 10

11. Study the given mass spectrum of magnesium carefully. **[1]**



The number of protons in ^{26}Mg, number of neutrons in ^{25}Mg, and the relative atomic mass of Mg are respectively

a) 12, 13 and 25

b) 12, 13 and 24.32

c) 14, 13 and 25

d) 16, 12 and 24.32

12. Cathode rays have **[1]**

a) mass only
b) charge only
c) charge as well as mass
d) neither charge nor mass

13. The conclusion of Rutherford's scattering experiment does not include **[1]**

a) The radius of nucleus is less than 10^{-14} m.
b) The positively charged particles of atom move with very high velocity.
c) Scattering follows coulomb's law, i.e., same charges repel each other.
d) α-particles can come within the distance of order of 10^{-14} m of the nucleus.

14. How many electrons are present in the species He^{2+} ion? **[1]**

a) 2
b) 0
c) 4
d) 8

15. Dalton’s atomic theory successfully explained **[1]**

i. Law of conservation of mass
ii. Law of constant composition
iii. Law of radioactivity
iv. Law of multiple proportions

a) (ii), (iii) and (iv)
b) (i), (ii) and (iii)
c) (i), (iii) and (iv)
d) (i), (ii) and (iv)

16. Which of the following pairs have identical values of charge/mass? **[1]**

a) A proton and a deuterium.
b) A deuterium and an α - particle.
c) An electron and γ - rays.
d) A proton and a neutron.

17. Isotopes of an element have **[1]**

a) Same physical properties
b) Different chemical properties
c) Different atomic number
d) Different number of neutrons

18. The $\frac{charge}{mass}$ ratio of electron **[1]**

a) depends upon nature of electrodes
b) depends upon nature of gas
c) remains constant
d) depends upon both nature of gas and nature of electrodes

19. The isotopes of hydrogen which contain same number of electrons, protons and neutrons? **[1]**

a) Deuterium
b) Tritium
c) Pratium
d) Protium

20. The ion of an element has 3 positive charges. Mass number of the atom is 27 and the number of neutrons is 14. What is the number of electrons in the ion? **[1]**

a) 13
b) 14
c) 10
d) 16

21. A compound of carbon, hydrogen and nitrogen contains these elements in the ratio 9 : 1 : 3.5. If its molecular **[1]**

mass is 108, what is the molecular formula?

a) C_2HN_2 b) C_2H_2N

c) $C_6H_8N_2$ d) C_3H_4N

22. The isotope of carbon which has same number of neutrons as ${}_8O^{16}$, is used in radiocarbon dating to determine age of old samples of living organisms? **[1]**

a) ${}_6C^{15}$ b) ${}_6C^{12}$

c) ${}_6C^{14}$ d) ${}_6C^{13}$

23. In K^+ and K^-**:** **[1]**

a. Number of electrons is the same
b. Number of protons is the same
c. Number of neutrons are the same
d. Number of shells are the same

a) (a) and (b) are correct b) All of these

c) (a), (b) and (c) are correct d) (b) and (c) are correct

24. In a sample of ethyl ethanoate ($CH_3COOC_2H_5$) the two oxygen atoms have the same number electrons but different number of neutrons. Which of the following is the correct reason for it ? **[1]**

a) The two oxygen atoms are isobars b) One of the oxygen atom has gained neutrons

c) One of the oxygen atom has gained electrons d) The two oxygen atoms are isotopes

25. Which of the following has the highest n/p ratio? **[1]**

a) ${}^{222}_{88}Ra$ b) ${}^{235}_{92}U$

c) ${}^{14}_{6}C$ d) ${}^{3}_{1}H$

26. The number of valence electrons determines **[1]**

a) Both Physical and chemical properties of elements b) Neither physical nor chemical properties of elements

c) Physical properties of elements d) Chemical properties of elements

27. The first model of an atom was given by **[1]**

a) Rutherford b) N. Bohr

c) E. Goldstein d) J.J. Thomson

28. Rutherford's alpha-particle scattering experiment was responsible for the discovery of**:** **[1]**

a) Atomic nucleus b) Proton

c) Electron d) Neutron

29. Fill in the gap using given analogy **[1]**

Atomic number : Number of protons :: Mass number : _____.

a) Number of protons + Number of electrons b) Number of neutrons + Number of protons

c) Number of electrons
d) Number of protons

30. In a species, the number of electrons is more than the number of protons. Predict its nature. **[1]**

a) Anion
b) All of these
c) Cation
d) Neutral atom

31. **Assertion (A):** The mass of the total number of protons and neutrons is a measure of the approximate mass of an atom. **[1]**

Reason (R): The mass of an electron is negligible.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

32. **Assertion (A):** Electrons moving in the same orbit will lose or gain energy. **[1]**

Reason (R): On jumping from higher to lower energy level, the electron will gain energy.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

33. **Assertion (A):** According to Octet's rule, the maximum number of electrons that the outermost shell of an electrically neutral and chemically stable atom can have is 2'. **[1]**

Reason (R): Hydrogen and helium have only 2 electrons.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

34. **Assertion (A):** A German scientist, E. Goldstein in 1886, modified the discharge tube and passed an electric current through it. **[1]**

Reason (R): He found that the positively charged rays were emitted from the cathode in the discharge tube.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

35. **Assertion (A):** Isobars are identical in chemical properties. **[1]**

Reason (R): Isobars have same atomic number.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

36. **Assertion (A):** Atom is electrically neutral. **[1]**

Reason (R): A neutral particle, neutron is present in the nucleus of atom.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

37. **Assertion (A):** A few positively charged α-particles are deflected in Rutherford's experiment. **[1]**

Reason (R): Most of the space in the atom is empty.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

38. **Assertion (A):** Cathode rays get deflected towards the positive plate of electric field. **[1]**

Reason (R): Cathode rays consist of negatively charged particles known as electrons.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

39. **Assertion (A):** The valency of an element is defined as the number of electrons lost, gained, or shared by its atom during a chemical combination. **[1]**

Reason (R): The outermost shell or orbit of an atom is known as the valence shell or valence orbit.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

40. **Assertion (A):** Rutherford's atomic model was that it could not explain the stability of atoms. **[1]**

Reason (R): Any charged particle during acceleration would radiate energy, and while revolving, it would lose its energy and eventually fall into the nucleus.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

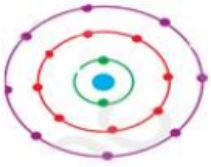
41. Calculate the number of neutrons present in the nucleus of an element 'X' which is represented as ${}^{31}_{15}X$. **[2]**

42. In the gold foil experiment of Geiger and Marsden, that paved the way for Rutherford's model of an atom, $\sim$1.00% of the α-particles were found to deflect at angles > 50°. If one mole of α-particles were bombarded on the gold foil, compute the number of α-particles that would deflect at angles less than 50°. **[2]**

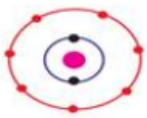
43. Why did Rutherford select a gold foil in his α–ray scattering experiment? **[2]**

44. What are the limitations of J.J. Thomson's model of an atom? **[2]**

45. Find out the valency of the atoms represented by the fig. (a) and (b). **[2]**



(a)



(b)

46. There are 2 elements C and B. C emits an α-particle and B emits a β-particle. How will the resultant elements charge? **[2]**

47. Complete the following table**:** **[2]**

	Ion	Number of electrons	Atomic Number	Number of Neutrons	Atomic Mass
(a)	${}^{86}Rb^{+}{}_{37}$				

(b)	$^{24}Mg^{2+}{}_{12}$				
(c)	$^{80}Br^{-}{}_{35}$				

48. Explain why chlorine, whether as the element or its compounds, always has a relative atomic mass of about 35.5. **[2]**

49. Hydrogen has three isotopes. State the composition of their nuclei and write their mass number. Also represent them in the form of symbols. **[2]**

50. The element boron occurs in nature as two isotopes having atomic masses 10u and 11u. What are the percentage abundances of these isotopes in a sample of boron having average atomic mass of 10.8u? **[2]**

51. In the atom of an element X, 6 electrons are present in the outermost shell. If it acquires noble gas configuration by accepting requisite number of electrons, then what would be the charge on the ion so formed? **[2]**

52. The atomic number of Al and Cl are 13 and 17 respectively. What will be number of electrons in Al^{3+} and Cl^{-}? **[2]**

53. Why do helium, neon and argon have a zero valency? **[2]**

54. Do isobars have also identical chemical characteristics like isotopes? **[2]**

55. One electron is present in the outer most shell of the atom of an element X. What would be the nature and value of charge on the ion formed if this electron is removed from the outer most shell? **[2]**

56. Why do elements which exist as isotopes have fractional atomic masses? **[2]**

57. On the basis of Thomson's model of an atom, explain how the atom is neutral as a whole. **[2]**

58. What are isotopes? Name the isotopes of hydrogen and draw the structure of their atoms? **[2]**

59. Define the terms:- **[2]**

    a. Atomic number

    b. Mass number

60. An element 'X' has mass number 4 and atomic number 2. Write the valency of this element. Will it react with other atoms of different elements? **[2]**

61. Write the distribution of electrons in carbon and sodium atoms. **[2]**

62. Find the percentage composition of sucrose $C_{12}H_{22}O_{11}$. **[2]**

Section C

63. Compare the properties of electrons, protons and neutrons. **[3]**

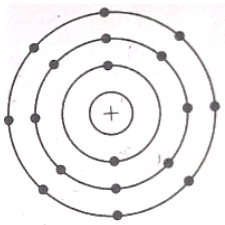
64. Justify the statement, 'Protons are constituents of all atoms'. **[3]**

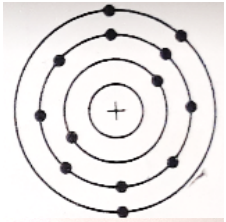
65. Composition of the nuclei of two atomic species X and Y are given as under**:** **[3]**

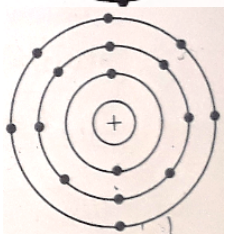
	X	Y
Protons	6	6
Neutrons	6	8

Give the mass numbers of X and Y. What is the relation between the two species?

66. Find out the valency of atoms represented by the following figures. **[3]**

i. 

ii. 

iii. 

67. In the following table, the mass numbers and the atomic numbers of certain elements are given. **[3]**

Element	A	B	C	D	E
Mass no.	1	7	14	40	40
At. no.	1	3	17	18	20

i. Select a pair of isobars from the above table.

ii. What would be the valency of element C listed in the above table?

iii. Which two sub-atomic particles are equal in number in a neutral atom?

68. An old man and a scientist were talking about a deserted house. The old man was sure that it was haunted by ghosts, but the scientist discarded the view saying no one had ever seen a ghost. The old man was annoyed and challenged the scientist about existence of atoms, sub-atomic particles which also could not be seen. **[3]**

i. Name the three sub-atomic particles and their discoverers.

ii. Whose viewpoint do you support and why?

69. On the basis of the number of protons, neutrons and electrons in the samples given below identify **[3]**

i. the cation.

ii. the pair of isobars, and

iii. the pair of isotopes.

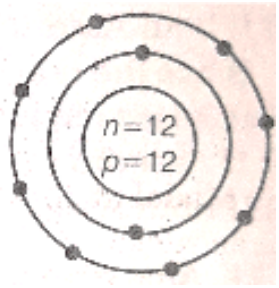
Sample	**Protons**	**Neutrons**	**Electrons**
A	17	18	16
B	18	19	18
C	17	20	17
D	17	17	17

70. Study the data given below and answer the questions which follow: **[3]**

Particle	**Electrons**	**Protons**	**Neutrons**
A	2	3	4
B	10	9	8
C	8	8	8
D	8	8	10

i. Write the mass number and atomic number of particles A, B, C, D.

ii. Which particles represent a pair of isotopes? Explain.

71. 

[3]

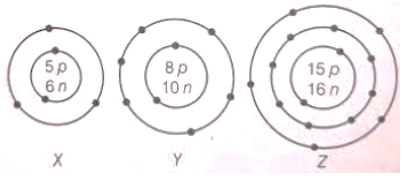
i. Identify the ion from the given figure.

ii. Write the electronic configuration of the ion and atom mentioned in the figure.

iii. How do we get the number of protons as 12?

72. What information do you get from the figure about the atomic number, mass number and valency of atoms X, Y and Z? **[3]**

Give your answer in a tabular form.



Section D

73. The ratio of the radii of the hydrogen atom and its nucleus is $\sim 10^5$. Assuming the atom and the nucleus to be spherical, **[5]**

i. What will be the ratio of their sizes?

ii. If an atom is represented by planet Earth 'R_e'= 6.4×10^6 m. Estimate the size of the nucleus.

74. i. From Rutherford's α-particle scattering experiment, give the experimental evidence for deriving the conclusion that **[5]**

a. most of the space inside the atom is empty.

b. the nucleus of an atom is positively charged.

ii. An element has mass number = 32 and atomic number = 16, find

a. the number of neutrons in the atom of the element.

b. the number of electrons in the outermost shell of the atom.

iii. On the basis of Rutherford's model of an atom, which subatomic particle is present in the nucleus of an atom?

75. Calculate the ratio between the mass of one atom of hydrogen and mass of one atom of silver. **[5]**