CHEMISTRY

BOOKS - ICSE

ATOMIC STRUCTURE

Test Yourself 1 Fill In The Blanks

1. Name the three sub-atomic particles of an atom.

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2. ..... are the smallest units that take part in chemical reactions.

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3. William Crookes named the invisible rays emitted from cathode as

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4. Protons are ..... charged particles.

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5. ..... discovered the neutral particles called neutrons.

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Test Yourself 2 True Or False

1. Nucleus contains the three subatomic particles: electrons, protons and neutrons.

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2. The extra-nuclear part contains energy shells.

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3. The farthest shell from the nucleus contains the least energy.(T/F)

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4. Plum pudding atomic model was suggested by Rutherford.

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5. Atomic number is the sum of number of protons and neutrons.

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Test Yourself 3 Match The Following

1.

1. Arrangement of electrons in energy shells	a. Valence shell
2. Maximum number of electrons $= 18$	b. Electronic configuratio
3. Outermost shell of an atom	c. Valency
4. Combining cpacity of the atoms of an element	d. Number of charge it ca
5. An element with 8 valence electrons	e. M energy shell
6. Valency of a radical	f. Octet configuration

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Exercises Multiple Choice Questions

1. An atom is considered to be electrically

A. positive

B. negative

C. neutral

D. positive or negative

Answer: C

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2. The nucleus of an atom is considered to be electrically

A. positive

B. negative

C. neutral

D. positive or negative

Answer: A

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3. Who suggested that an atom is a spherical cloud of positive charges in which lectrons were spread out?

A. Rutherford

B. Goldstein

C. William Crooks

D. J.J. Thomson

Answer: D

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4. Which atomic particle has negligible mass?

A. proton

B. electron

C. neutron

D. both proton and neutron

Answer: B

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5. Maximum number of valence electrons possible in an atom are

A. 5

B. 6

C. 7

D. 8

Answer: D

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Exercises True Or False

1. Canal rays are invisible rays emitted from the cathode.

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2. All atoms of an element are identical.

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3. Cathode rays have mass and possess kinetic energy.

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4. Shell closest to the nucleus carries the Lowest amount of energy.

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5. Each radical takes part as a whole in chemical reactions and has its own valency.

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Exercises Fill In The Blanks

1. Protons and neutrons are collectively known as .....

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2. Electrons revolve around the nucleus in definite orbits called .....

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3. The outermost shell of an atom is known as its ..... and the electrons in it are known as .....

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4. Electrons are distributed in different energy shells, according to the rules of .....scheme.

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5. Maximum number of electrons in an energy shell is given by the formula ..... .

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Exercises Match The Following

	1. Discovered the cathode rays	(a)E. Goldstein
	2. Discovered the protons	(b)J.J. Thomson
1.	3. Discovered the neutrons	(c)William Crookes
	4. Plum pudding model	(d)Lord Rutherford
	5. Planetary model of an atom	(e)James Chadwick

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Exercises Name The Following

1. Electrons are distributed in different energy shells, according to the rules of

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2. Number of electrons in this energy shell is the same as the number of electrons in the valence shell.

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3. Scientist who proposed that atoms can neither be created nor destroyed.

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4. Type of configuration that an element with 8 valence electrons is said to possess.

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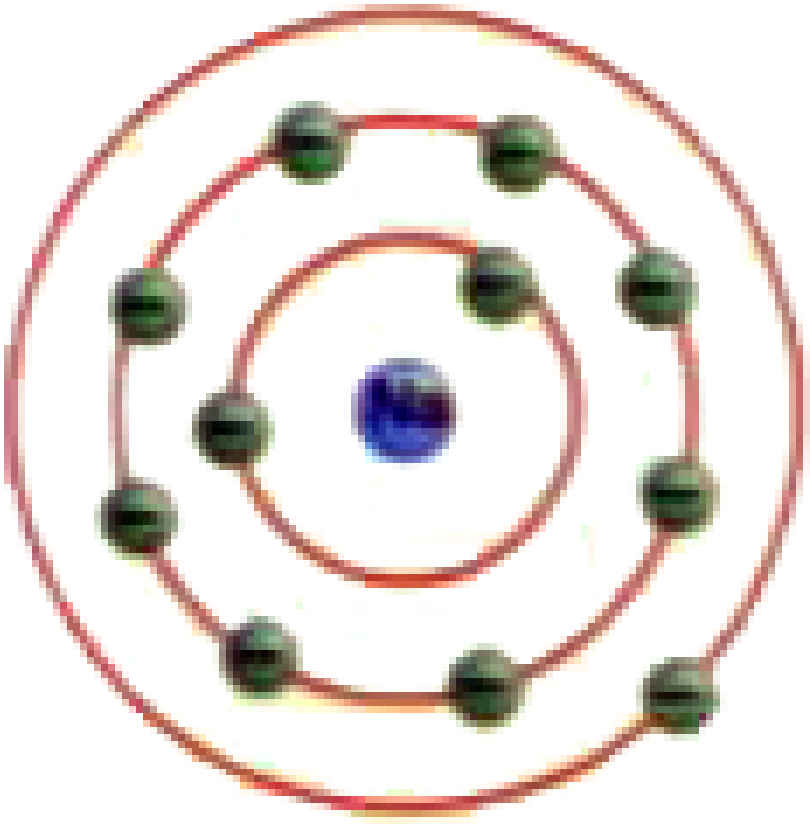
Exercises Diagram Based Questions



1.

State the electronic configuration of sodium based on the diagram given.

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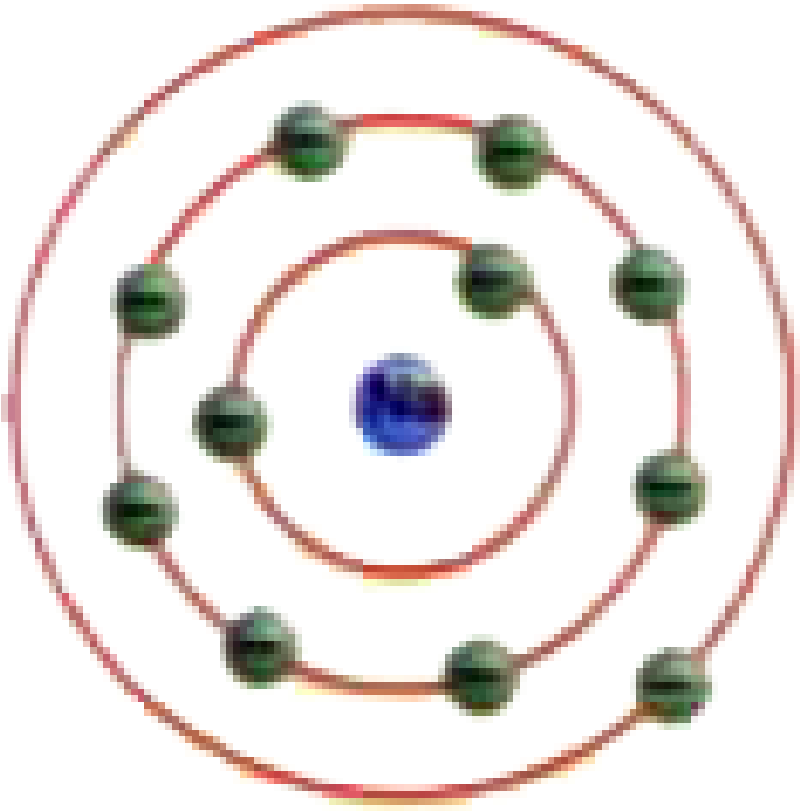

2.

What is its atomic number and valency?

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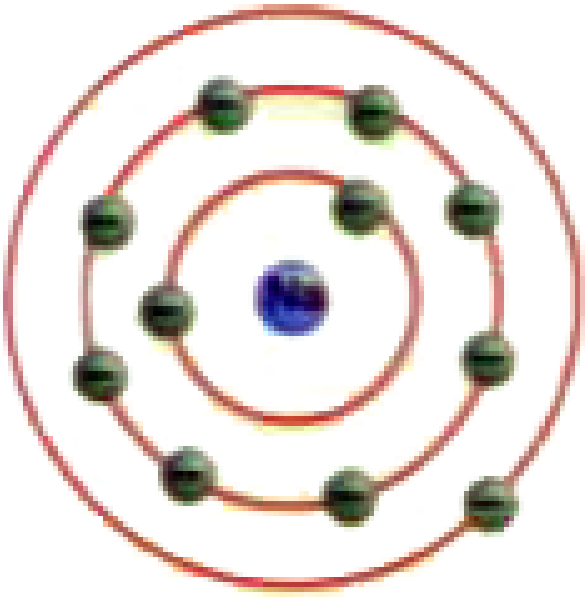

3.

Label the following in the diagram.

Different energy shells, valence shell, valence electrons

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Exercises Give Reasons For The Following

1. Rutherford's atomic model is called the 'planetary model of an atom'.

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2. An atom is considered to be electrically

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3. Cathode rays can move the blades of the paddle wheel placed in its path.

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4. Valency of noble gases is zero.

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Exercises Short Answer Questions

1. What are the main features of Dalton's Atomic Theory?

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2. Differentiate between the three subatomic particles.

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3. State two main discoveries made during the discharge tube experiment conducted by J.J. Thomson.

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4. What are energy shells?

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5. Calculate the number of neutrons the following elements contain and state the formula used.

$(i)_{19}K^{39}$ $(ii)_{9}F^{19}$ $(iii)_{4}Be^{9}$ $(iv)_{13}Al^{27}$

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6. State two important rules of Bohr-Bury scheme.

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7. Write the electronic configuration and valency of the following elements.

Element	Atomic Number
(i) Lithium	3
(ii) Magnesium	12
(iii) Sulphur	16
(iv) Argon	18

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8. How can we determine the valency of a radical?

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9. How is mass number (A) and atomic number (Z) of an element (X) represented?

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Check Your Progress Answer These Questions

1. Name the three sub-atomic particles of an atom.

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2. Who discovered electrons?

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3. What is the positively-charged particle present in an atom called?

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4. Protons and neutrons are collectively known as .....

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5. What does the extra-nuclear region of an atom contain?

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Exercise Tick The Most Appropriate Answer

1. Which of the following scientists observed that cathode rays consist of negatively-charged particles?

A. John Dalton

B. J. J. Thomson

C. E. Goldstein

D. James Chadwick

Answer:

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2. Rutherford's alpha-particle scattering experiment discovered

A. nucleus

B. electrons

C. Protons

D. neutrons

Answer:

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3. What is an electrode connected to the negative terminal of a voltage source called?

A. cathode

B. neutron

C. anode

D. proton

Answer:

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4. What is an electrode connected to the positive terminal of a voltage source called?

A. cathode

B. neutron

C. anode

D. proton

Answer:

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5. What is the positively-charged core in the centre of an atom called?

A. neutron

B. anode

C. proton

D. nucleus

Answer:

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6. Which of the following symbols represents the atomic number of an element?

A. Z

B. p

C. e

D. A

Answer:

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7. Which of the following is not present in a hydrogen atom?

A. proton

B. neutron

C. nucleus

D. electron

Answer:

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8. Maximum number of electrons in the M shell

A. 2

B. 8

C. 18

D. 32

Answer:

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Exercise Fill In The Blanks

1. An electron carries a _____ charge.

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2. An atom is electrically _____

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3. The mass of a _____ is equal to that of hydrogen.

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4. Electrons revolve around the nucleus in definite orbits called .....

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5. A _____ has mass approximately equal to that of a proton.

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6. The number of protons present in the nucleus of an atom is known as its _____

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7. The outermost shell of an atom is also called the _____ shell

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Exercise Write True Or False Correct The False Statements

1. Maharshi Kanada named the smallest particle of matter anu.

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2. All atoms of an element differ from each other.

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3. Atoms of different elements combine in fixed, small whole-number ratios to form compounds.

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4. True or False: An electrode connected to the negative terminal of a voltage source is called the anode.

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5. An electron is considered nearly massless.

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6. True or False: The positive charge of the nucleus is due to the neutrons present in it.

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7. The number of protons present in the nucleus of an atom is known as its _____

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8. Thomson proposed that the nucleus of an atom contains protons and neutrons.

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Exercise Name The Following

1. A subatomic particle that carries a negative charge

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2. The model that states the atom is a sphere of positive charges and the electrons are spread out inside it. This model is called as.....

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3. All the mass of an atom is concentrated in its-

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4. Name: A subatomic particle that is electrically neutral

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5. The arrangement of electrons in different shells of an atom is called.....

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6. The outermost shell of an atom is also called the _____ shell

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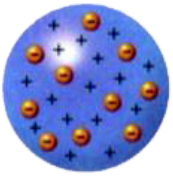
Exercise Match The Columns

1. Match the columns

1. J. J. Thomson	a. proton
2. Ernest Rutherford	b. neutron
3. James Chadwick	c. atomic theory
4. John Dalton	d. nucleus
5. E. Goldstein	e. electron



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Exercise Answer The Following In Short

1. What are cathode rays? How are these rays formed?

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2. Name three fundamental particles of the atom. Give the symbol and charge of each particle.

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3. What is a proton? How does it differ from a neutron?

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4. What are shells? Write the maximum number of electrons that they can accommodate.

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5. How is an element symbolically represented?

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6. Differentiate between the atomic number and the mass number.

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7. From the symbol ${}_{2}^{4}X$, Identify the element and write down its mass number and atomic number.

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Exercise Answer The Following In Detail

1. What are the main features of Dalton's Atomic Theory?

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2. Describe Thomson's plum pudding model. Which subatomic particle was not present in this model of the atom?

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3. What conclusion was drawn by Rutherford based on Geiger-Marsden.s experiment on scattering of alpha particles ?

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4. Describe Rutherford's nuclear model of the atom.

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5. Give the postulates of Bohr's atomic model.

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6. What is the Bohr-Bury scheme of electronic configuration? Write down the rules that are observed according to the scheme for writing the number of electrons in different energy levels or shells.

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7. Explain how the electrons are arranged in the shells of a potassium atom.

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Exercise Draw Diagrams Of The Following

1. Rutherford's alpha-scattering experiment

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2. Give the postulates of Bohr's atomic model.

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Exercise Complete The Following Table

1. Complete the following table

Element	Atomic number (Z)	Mass number (A)	No. of protons (p)	No. of electrons (e)	No. of neutrons (n)
He					
O					
F					
Cl					

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Exercise Study The Table And Answer The Questions Given Below

1. Study the table and answer the questions given below

Element	No. of protons (p)	No. of electrons (e)	No. of neutrons (n)
X	17	17	18
Y	13	13	14

a. Write down the atomic number and mass number of each element.

b. Identify elements X and Y.

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Think And Answer

1. The atom as a whole is electrically neutral. Why?

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2. Rutherford's atomic model is called the 'planetary model of an atom'.

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3. The shells surrounding the nucleus are called energy levels. Why?

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4. The electronic configuration of sodium is written as 2, 8, 1, but not 2, 9. Explain.

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Exercise Atomic Structure

1. State the main postulates of Dalton's atomic theory

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2. Electrons revolve around the nucleus in fixed orbits or shells called energy levels'. State how these energy levels are represented.

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3. Draw a neat labeled diagram representing an atom. Name the three sub-atomic particles in the atom & represent them symbolically showing the mass & charge of each. State where the sub-atomic particles are present in the atom.

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4. Define the term - 'atomic number of an atom. If an atom 'A' has an atomic number of - eleven, state the number of protons & electrons it contains.

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5. Define the term - 'mass number of an atom. If an atom 'B' has mass number 35 & atomic number 17, state the number of protons, electrons & neutrons it contains.

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6. State why the atomic weight of an element is also termed - relative atomic mass.

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7. State how electrons are distributed in an atom. Explain in brief the rules which govern their distribution.

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8. If an atom 'A has atomic number 19 & mass number 39, state -

i) Its electronic configuration. ii) The number of valence electrons it possesses.

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9. Draw the atomic diagrams of the following elements showing the distribution of - protons, neutrons & the electrons in the various shells of the atoms. (a) Carbon ${}^{12}_{6}C$ (b) Oxygen ${}^{16}_{8}O$ (c) Phosphorus ${}^{31}_{15}P$ (d) Argon ${}^{40}_{18}Ar$ (e) Calcium ${}^{40}_{20}Ca$

[The upper number represents the - mass number & the lower number the - atomic number e.g. calcium - mass number = 40, atomic number = 20]

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10. Valency is the number of hydrogen atoms which can combine with (or displace) one atom of the element (or radical] forming a compound'. With reference to the above definition of valency, state the valency of chlorine in hydrogen chloride, giving reasons.

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11. Valency is also the number of electrons - donated or accepted by an atom so as to achieve stable electronic configuration of the nearest noble gas'. With reference to this definition -

a] State what is meant by 'stable electronic configuration'.

b] State why the valency of-

(i) sodium, magnesium & aluminium is +1,+2& +3 respectively.

ii] chorine, oxygen & nitroge is: -1, -2 & -3 respectively.

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12. With reference to formation of compounds from atoms by electron transfer - electrovalency, state the basic steps in the conversion of sodium & chlorine atoms to sodium & chloride ions leading to the formation of the compound - sodium chloride.

[electronic configuration of: Na = 2,8,1 & Cl = 2,8,7]

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Objective Type Questions Atomic Structure

1. Match the statements in List I with the correct answer from List II.

List I	List II
1. Mass number of an atom is the number of protons and	**A:** Electron
2. The sub-atomic particle with a negligible mass.	**B:** Argon
3. An atom having stable electronic configuration.	**C:** Nitrogen
4. A molecule formed by sharing of electrons [covalency].	**D:** Sodium
5. A metallic atom having unstable electronic configuration.	**E:** Neutrons

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2. Select the correct answer from the choice in bracket to complete each sentence:-

An element 'X' has six electrons in its outer or valence shell. Its valency is _____ [+2/-2/-1].

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3. Select the correct answer from the choice in bracket to complete each sentence:-

An element 'Y' has electronic configuration 2, 8, 6. The element 'Y' is a _____ [metal/non-metal/noble gas].

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4. Select the correct answer from the choice in bracket to complete each sentence:-

A- [proton/neutron] is a sub-atomic particle with no charge and unit mass.

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5. Select the correct answer from the choice in bracket to complete each sentence:-

An element Z with zero valency is a — [metal/noble gas/non-metal].

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6. Select the correct answer from the choice in bracket to complete each sentence:-

Magnesium atom with electronic configuration 2, 8, 2 achieves stable electronic configuration by losing two electrons, thereby achieving stable electronic configuration of the nearest noble gas _____ [neon/argon).

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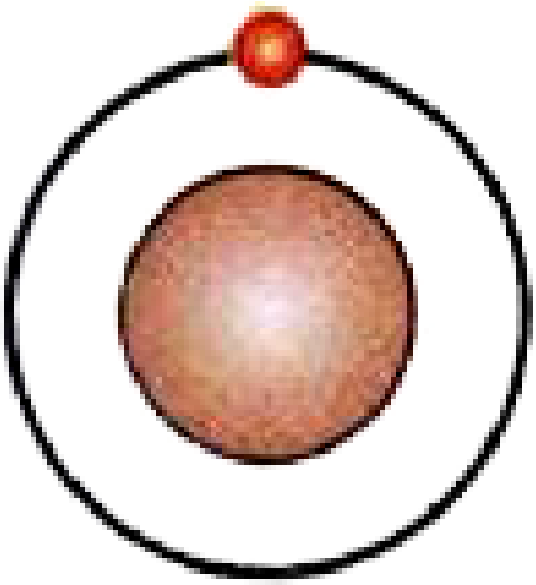
7. The diagram represents an isotope of hydrogen (H). Answer the following:

Are isotopes atoms of the same element or different elements.



At. no. = 1

Mass no. = 1

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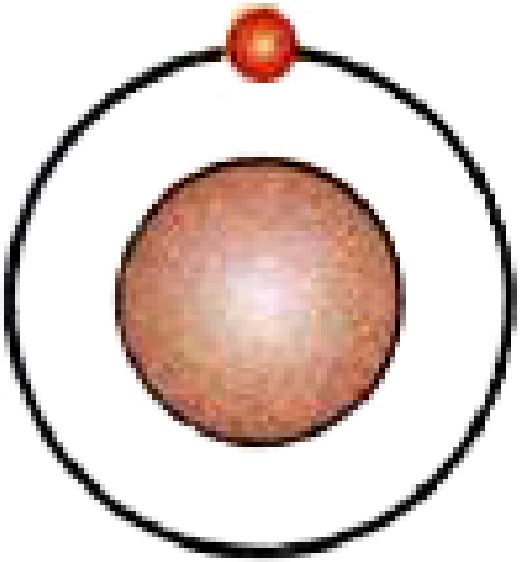
8. The diagram represents an isotope of hydrogen (H). Answer the following:

Do isotopes have the same atomic number or the same mass number.



At. no. = 1

Mass no. = 1

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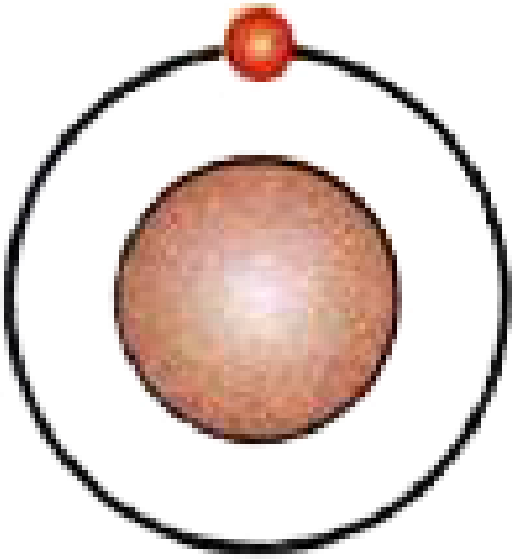
9. The diagram represents an isotope of hydrogen (H). Answer the following:

If an isotope of 'H' has mass no. = 2, how many electrons does it have.



At. no. = 1

Mass no. = 1

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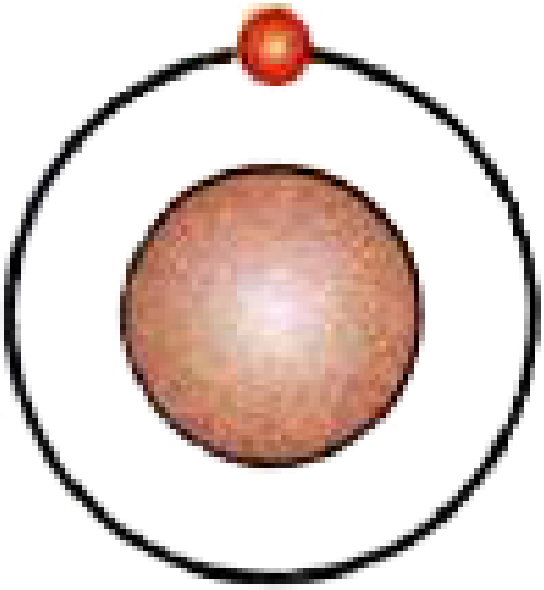
10. The diagram represents an isotope of hydrogen (H). Answer the following:

If an isotope of 'H' has mass no. = 3, how many neutrons does it have.



At. no. = 1

Mass no. = 1

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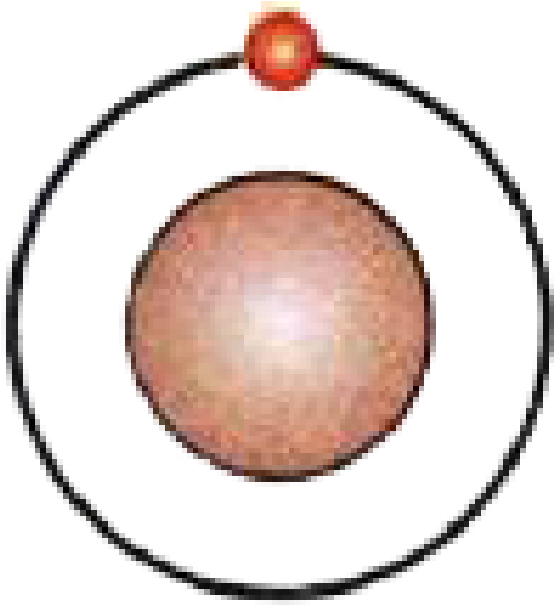
11. The diagram represents an isotope of hydrogen (H). Answer the following:

Which sub-atomic particles in the 3 isotopes of 'H' are the same.



At. no. = 1

Mass no. = 1

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12. State the electronic configuration for each of the following: Hydrogen

[p = 1]

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13. State the electronic configuration for each of the following: Boron [p = 5].

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14. State the electronic configuration for each of the following: Nitrogen [p=7].

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15. State the electronic configuration for each of the following: Neon [p=10].

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16. State the electronic configuration for each of the following: Magnesium [p = 12].

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17. State the electronic configuration for each of the following: Aluminium [p = 13].

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18. State the electronic configuration for each of the following: Sulphur [p=16].

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19. State the electronic configuration for each of the following: Argon [p=18].

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20. State the electronic configuration for each of the following: Potassium [p = 19].

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21. State the electronic configuration for each of the following: Calcium [p = 20].

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22. Draw the structure of the following atoms showing the nucleus containing - protons, neutrons and the orbits with the respective electrons : Lithium [At. no. =3, Mass no. = 7].

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23. Draw the structure of the following atoms showing the nucleus containing - protons, neutrons and the orbits with the respective electrons : Carbon [At. no. 6, Mass no. = 12].

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24. Draw the structure of the following atoms showing the nucleus containing - protons, neutrons and the orbits with the respective electrons : Silicon (At. no. 14, Mass no. = 28].

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25. Draw the structure of the following atoms showing the nucleus containing - protons, neutrons and the orbits with the respective electrons : Sodium [At. no. 11, Mass no. 23].

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26. Draw the structure of the following atoms showing the nucleus containing - protons, neutrons and the orbits with the respective electrons : Isotopes of hydrogen $\left[{}_{1}^{1}H, {}_{1}^{2}H, {}_{1}^{3}H\right]$

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