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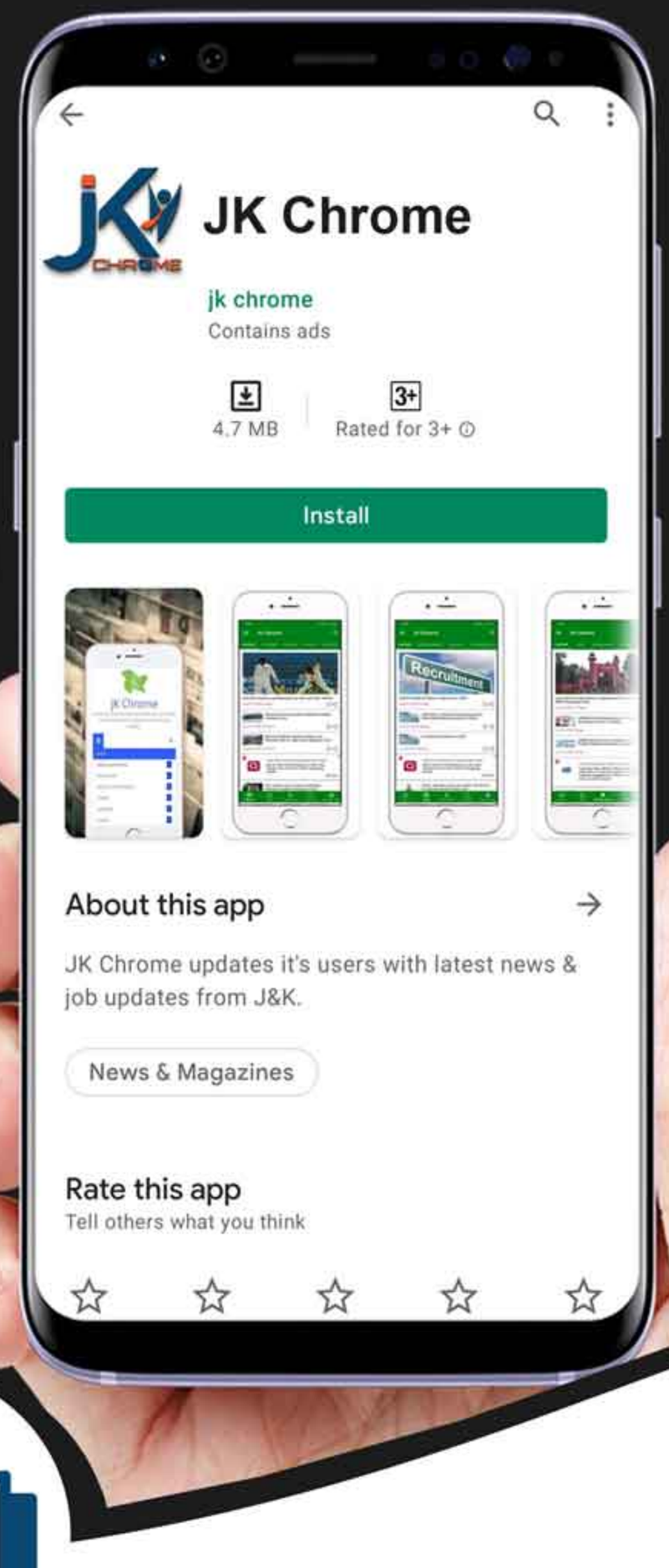

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Atomic Structure

Atom : The smallest particle of an element is called an atom. An atom can take part in chemical combination and does not occur free in nature. The atom of the hydrogen is the smallest and lightest. Example—Na, K, Ca, H etc.

Molecule : A molecule is the smallest particle of an element or compound that can have a stable and independent existence. Example—O_2, N_2, Cl_2, P_4, S_8 etc.

Mole : A mole is a collection of 6.023 ×1023 particles. It means that

1 mole = 6.023 × 1023

1 mole atom = 6.023 × 1023 atoms

1 mole molecule = 6.023 × 1023 molecules

1 mole ion = 6.023 × 1023 ions

1 mole mango = 6.023 × 1023 mangoes

1 mole Apple = 6.023 × 1023 apples

Avogadro's Number : The number 6.023 × 1023 is called Avogadro's Number.

Molecular mass : It indicates how many times one molecule of a substance is heavier in comparison to 1/12th mass of one atom of Carbon–12.

Constituents of an atom : Fundamental particles of an atom are Electron, Proton & Neutron.

Atomic number (Z) : The number of proton or electron in an atom of the element is called atomic number. It is denoted by Z.

Z = e = p where, e = no. of electrons and p = no. of protons.

Mass number (A) : The sum of number or protons and neutrons in an atom of the element is called mass number. It is denoted by A.

A = p + n where, p = no. of protons and n = no. of neutrons

Let, $_{11}^{23}Na$,

In Na, Z = 11, A = 23 and,

e = 11, p = 11

∴ n = A – p = 23 – 11 = 12

Isotopes : These are atoms of the elements having the same atomic number but different mass number.

Isotopes of Carbon—12C6, 13C6, 14C6

Isobars : These are atoms of the elements having the same mass number but different atomic numbers. e.g.

40Ar18, 40K19, 40Ca20,

Isotones : These are atoms of different elements having the same number of neutrons.

14C6, 15N7, 16O8,

Isoelectronic : These are atoms / molecules / ions containing the same number of electrons.

(i) O2–, F–, Ne, Na+, Mg2+ (ii) CN–, N2, 2+O2 etc.

Thomson's model of an atom : According to Thomson, an atom is treated as sphere of radius 10–8 cm in which positively charged particles are uninformally distributed and negatively charged electrons and embedded through them. This is also called Plum-Pudding model of an atom or watermelon model of an atom.

Rutherford's model of an atom : On the basis of scattering experiment, Rutherford proposed a model of the atom which is known as nuclear atomic model.

According to this model,

(i) An atom consists of a heavy positively charged nucleus where all protons and neutrons are present. Protons & neutrons are collectively called nucleons. Almost whole mass of the atom is contributed by these nucleons.

(ii) Radius of a nucleus = 10–13 cm

Radius of an atom = 10–8 cm

Radius of an atom = 105 times of the radius of the nucleons.

(iv) Electrons revolve around the nucleus in closed orbits with high speed. This model is similar to the solar system, the nucleus representing the sun and revolving electrons as planets. The electrons are therefore, generally referred as planetary electrons.

Zeeman's effect : When spectral lines obtained from atomic spectra is placed in a magnetic field, they are splitted into number of fine lines, this is called Zeeman's effect.

Stark's effect : When spectral lines obtained from atomic spectra is placed in electric field, they are splitted into number of fine lines this is called Stark's effect.