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( GEOGRAPHY DEPARTMENT )

**B.A. PART - 1 ( PHYSICAL GEOGRAPHY : PAPER - 1 )**

**TOPIC : GASEOUS HYPOTHESIS OF ORIGIN OF SOLAR SYSTEM**

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### **GASEOUS HYPOTHESIS OF KANT**

Immanuel Kant, the German philosopher, presented his treatise entitled 'The General Natural History and Theory of the Heaven or the Essay on the Working and Mechanical Origin of the Entire Universe on the Basis of Newtonian Laws' in 1755. Kant claimed that his 'gaseous hypothesis' of the origin of the earth was based on the sound principles of Newton's laws of gravitation and rotatory motion.

In the beginning his hypothesis acclaimed world-wide appreciation but later on it was disproved as it was based on erroneous concepts and wrong application of Newtonian laws of gravitation. In spite of severe criticism the hypothesis was considered a great step forward in the field of cosmogony and 'he almost reverberated the mid-18th century with his words...Give me matter and I will build a world out of it.'

Kant postulated his gaseous hypothesis of the origin of the earth on the basis of a few assumptions. He assumed that supernaturally created primordial hard matter was scattered in the universe. In fact, according to Kant there was a primeval, slowly rotating cloud of gas (now called a nebula) and matter comprised of very cold, solid and motionless particles.

In terms of modern scientific language it can be said (but not described by Kant) that the temperature of primordial matter was near

about  $273^{\circ}\text{C}$  or absolute zero or  $0^{\circ}\text{K}$ . This was the reason that cold matter was initially motionless (according to the molecular theory of matter). He further assumed that the particles began to collide against each other under their mutual gravitational attractions.

This mutual attraction and collision between the particles generated random motion in the primordial matter. Collision of the particles also generated friction which generated heat, with the result the temperature of the primordial matter started rising.

He further argued that the random motion of the particles also generated rotatory motion in the primordial matter. Thus, the original cold and motionless cloud of matter became in due course a vast hot nebula and started spinning (rotating) around its axis.

According to Kant with the increase in temperature, the random motion as well as the rate of collision among the particles also increased. This gave extra impetus of the rate of rotatory motion (spinning) of the primordial matter. The rise in temperature also changed the state of primordial matter from solid to gaseous particles. Thus, the initial primordial matter gradually changed in hot rotating nebula. With continuous rise in temperature and rate of rotatory motion the nebula started expanding in size.

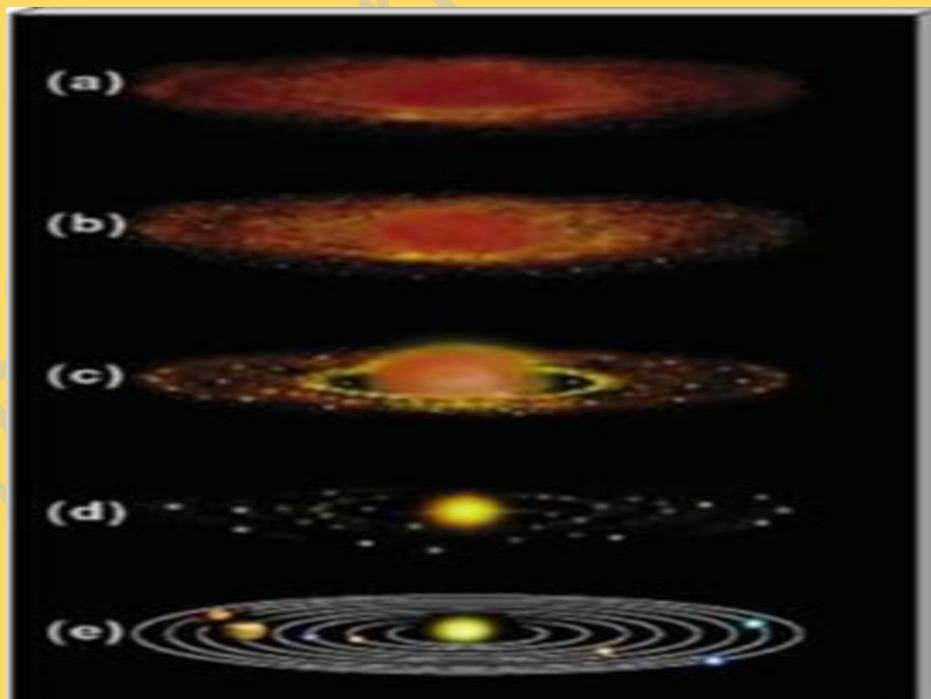
According to Immanuel Kant as the heat increased, the size of nebula increased and as the size of nebula increased, the angular velocity or rotatory speed further increased. Due to continuous increase in the size of nebula the rotatory speed became so fast that the centrifugal force (away from the centre) exceeded the attractive or centripetal force (directed towards the centre).

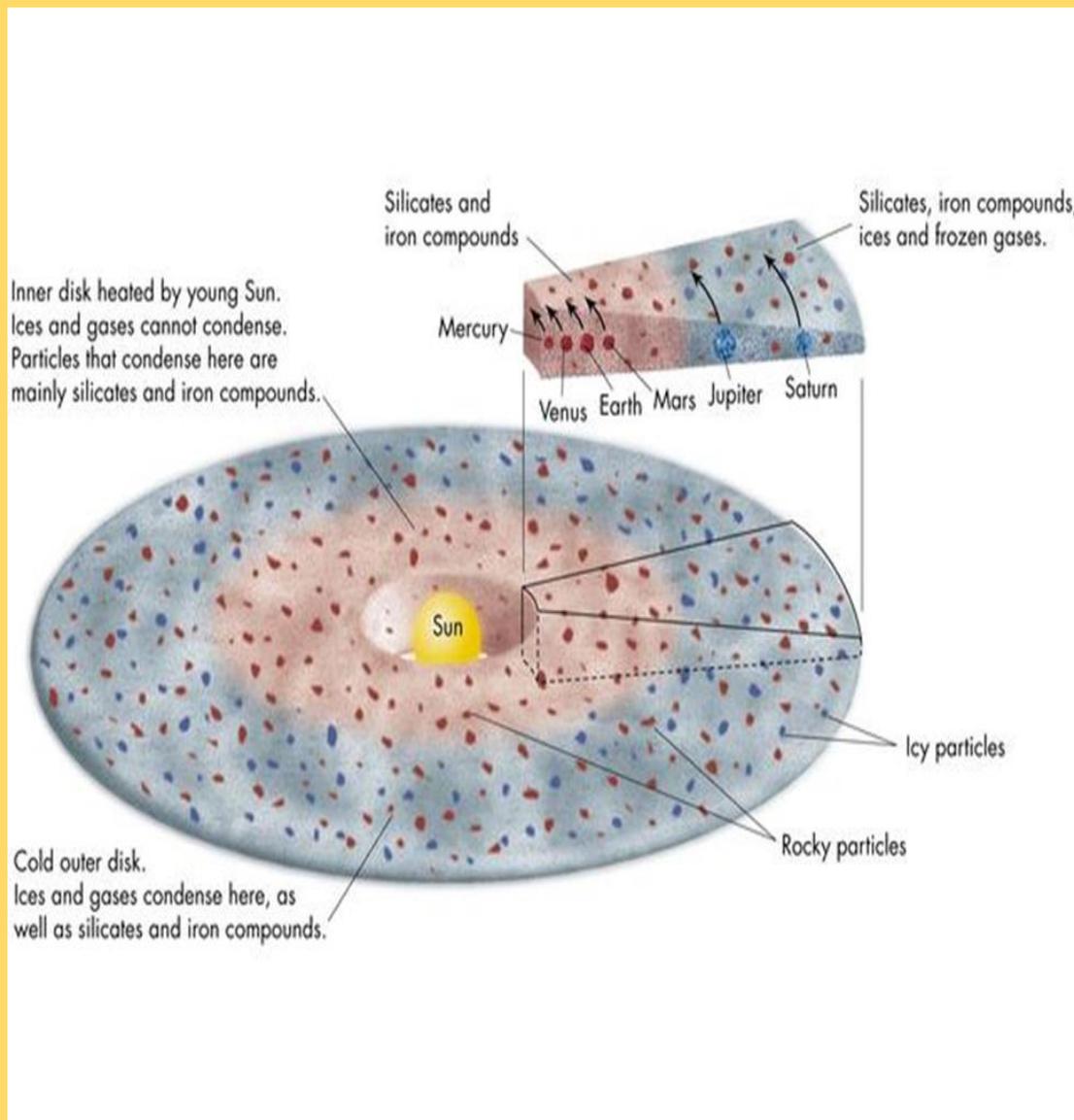
The nebula started spinning so rapidly that an irregular ring was separated from the middle part of the nebula and was ultimately thrown off due to centrifugal force. By the repetition of the same process a system

of concentric rings (nine) were separated from the nebula. The residual central mass of the nebula remained as the sun.

The irregularity of the rings caused the development of the cores (knots) for the formation of the corresponding planets. In other words, all the matters of each ring were aggregated at a point to form a core or a knot which ultimately grew as a planet in due course of time. Thus, it is apparent that according to Kant the earth was formed due to aggregation of all the matter of the ring which was separated from the nebula due to centrifugal force.

By the repetition of same process rings were separated from the newly formed planets and the materials of each ring were condensed to form satellites of the concerned planets. Thus, the whole solar system comprised of the sun (residual part of the rotating nebula), nine planets and their satellites were formed.





### **Evaluation:**

Though Immanuel Kant based his gaseous hypothesis on scientific principles (Newton's law of gravitation) to solve the problem of the origin of the solar system and the earth but his hypothesis has been rendered baseless because it is based on several erroneous facts of science.

**In fact, Kant's hypothesis was declared dynamically unsound:**

- (1) It was one of the basic assumptions of Kant's hypothesis that there was primordial matter in the universe but he never explained the source of the origin of the primordial matter.
- (2) Kant did not explain the source of energy to cause random motion of the particles of the primordial matter which were cold and motionless in the initial stage. According to Newton's first law of motion 'a body remains at rest, or if in motion it remains in uniform motion with constant speed, unless or until an external force is applied on it.' The particles of the primordial matter, as assumed by Kant, were at rest and no external force was applied on them, then what was the cause for the random motion among the particles of primordial matter?
- (3) The collision among the particles of the primordial matter can never generate rotatory motion in it. It is an erroneous statement of mechanism.

It means that if anybody is rotating, the total amount of its angular momentum will always remain constant unless an external force is applied on the rotating body.

This statement is erroneous as it is against the law of conservation of angular momentum. Thus, the very foundation, on which Kant's hypothesis was based, is proved unsound and wrong. However, the importance of Kant's hypothesis lies in the fact that it was first scientific attempt for the explanation of the origin of the earth. In fact, Kant's hypothesis paved the way for the postulation of nebular hypothesis by Laplace.

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