NAME -
UID –
SEM – 4TH
BRANCH – BTECH CSE
SUBJECT – AI
DATE – 22 MARCH 2022

Q - What are the levels in Structuring of knowledge?

General structure of knowledge

In this workshop---and in our approach to physics in general---there are 3 basic themes:

1. *Particular types of knowledge and knowledge structures are needed for proficient problem-solving.* Much of this knowledge is conceptual in nature, as opposed to operational or procedural, and powerful knowledge structures necessarily involve conceptual elements. The presence of conceptual elements in the knowledge structures is the key to having a "deeper understanding" of physics.
2. *Particular types of cognitive processes are required for the acquisition of conceptual knowledge and the construction of useful knowledge structures.*
3. *It is possible to design activities that promote these desirable cognitive processes.* In many cases, these activities are simply actualizations of the cognitive processes themselves. (This point will, hopefully, become clearer later.)

We begin by identifying some of the various types of knowledge that students need to know:

- *Conceptual knowledge,* such as the concept of momentum or energy, or that the velocity of an object changes when it accelerates, or that the gravitational potential energy of an object decreases as it falls.
- *Factual knowledge,* such as the value of the gravitational constant g, the radius of the moon, or the density of iron.
- *Representational knowledge,* such as how to draw and use graphs.
- *Strategic knowledge,* such as the ability to recognize the applicability of a concept, such as, momentum is conserved when there are no external forces, or that energy is conserved when there are no non-conservative forces.
- *Meta-cognitive knowledge,* for example, the awareness of underlying assumptions, or that an answer should be checked by solving the problem a different way.

- *Self knowledge,* such as knowing one's likely sources of mistakes, or knowing that one should be more procedural when solving problems.
- *Operational knowledge,* such as how to take the cross product or dot product of two vectors, or how to take the determinant of a matrix, or how to draw a free-body diagram.
- *Procedural knowledge,* such as when to use conservation of energy (i.e., when all forces are conservative), or when to specify a coordinate system (e.g., when finding potential energy), or when to draw a free-body diagram (e.g., when applying Newton's Laws).
- *Problem-state knowledge,* which are the features of a problem used for deciding how to solve it. Examples are: knowing that there are no external forces in a particular problem, or that there are no non-conservative forces in the problem, or that an object is at rest initially, or that the object is on an incline.

In order to discuss the organizational and structural aspects of knowledge, we have found it convenient to broadly classify these types into three general categories. We call these three groups: **Conceptual Knowledge, Operational and Procedural Knowledge, and Problem-State Knowledge**.