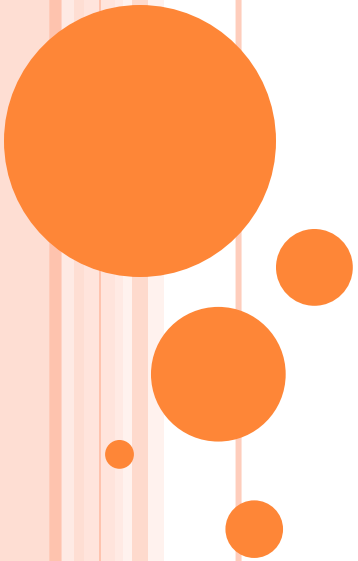
4. Additional Concepts related to Scientific Thinking (part 1)



Content

- What is intelligence
- Two most important Types of thinking
- Types of Scientific Thinking

WHAT IS INTELLIGENCE

Intelligence has been defined in many ways: the capacity for abstraction, logic, understanding, self-awareness, learning, emotional knowledge, reasoning, planning, creativity, critical thinking, and problem-solving. More generally, it can be described as the ability to perceive or infer information, and to retain it as knowledge to be applied towards adaptive behaviors within an environment or context.

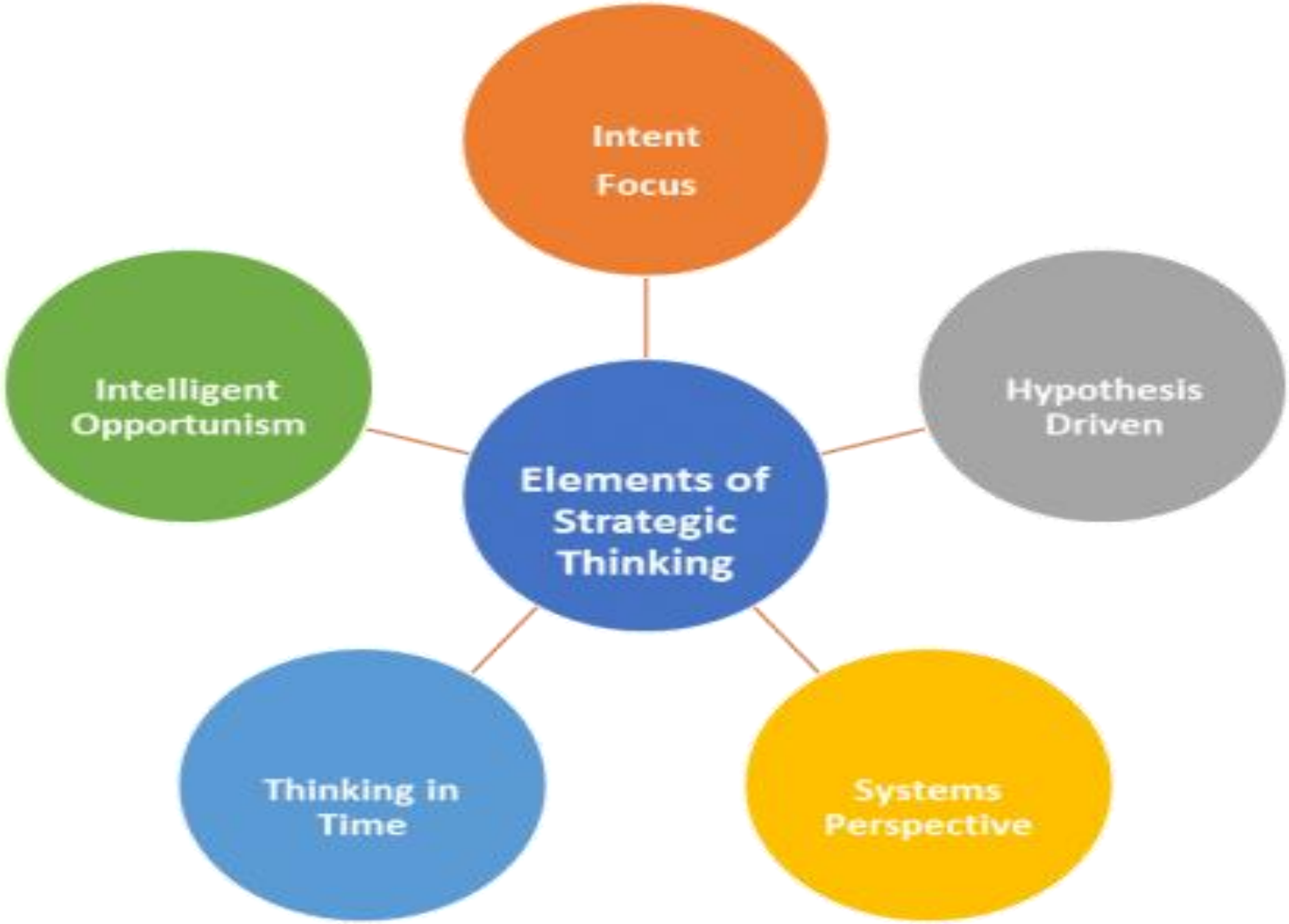
Types of thinking

- **STRATEGIC THINKING**
- **SCIENTIFIC THINKING**

STRATEGIC THINKING

- **Strategic thinking** is simply an intentional and rational thought process that focuses on the analysis of critical factors and variables that will influence the long-term success of a business, a team, or an individual.

Five elements of thinking strategically



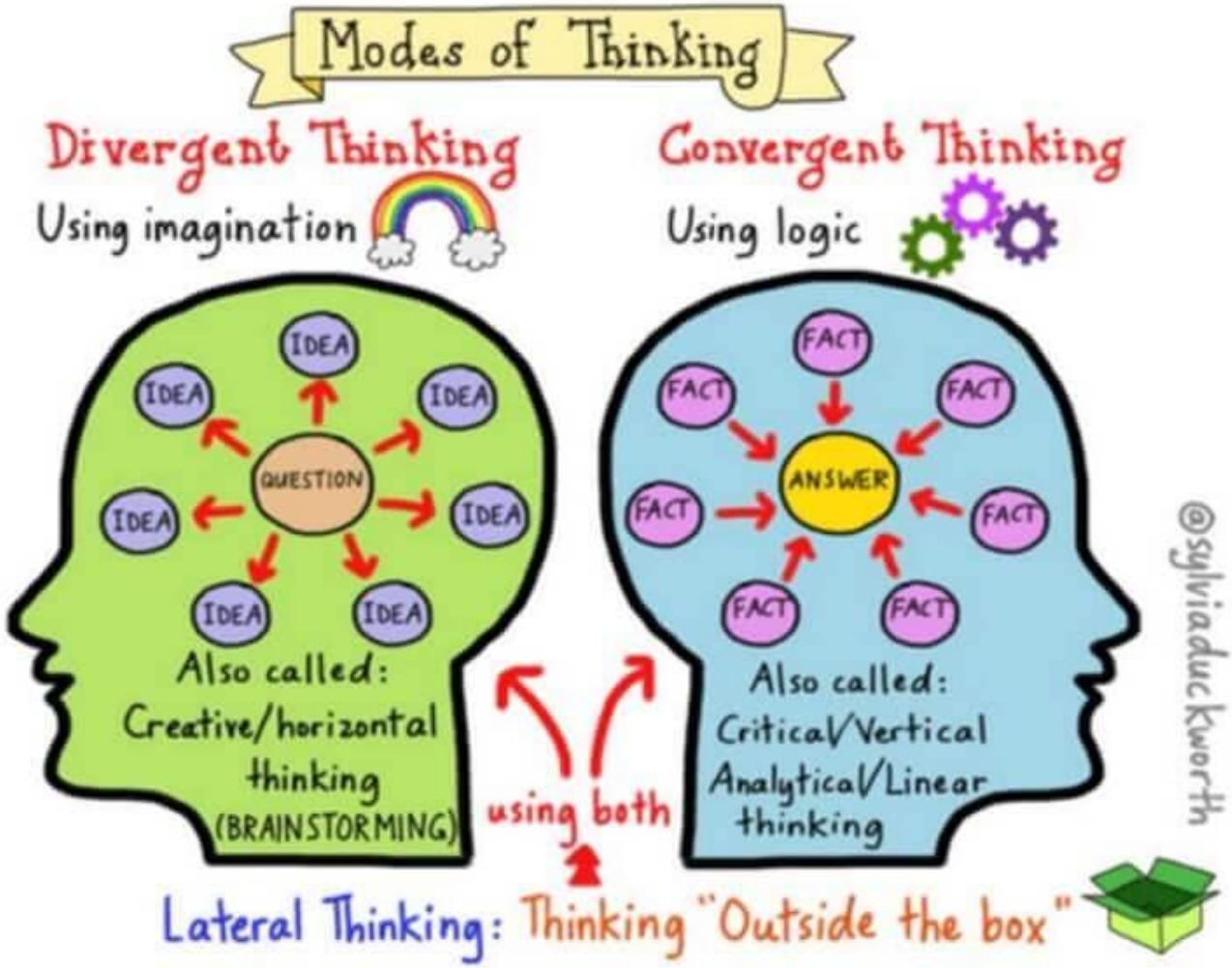
Five elements of thinking strategically

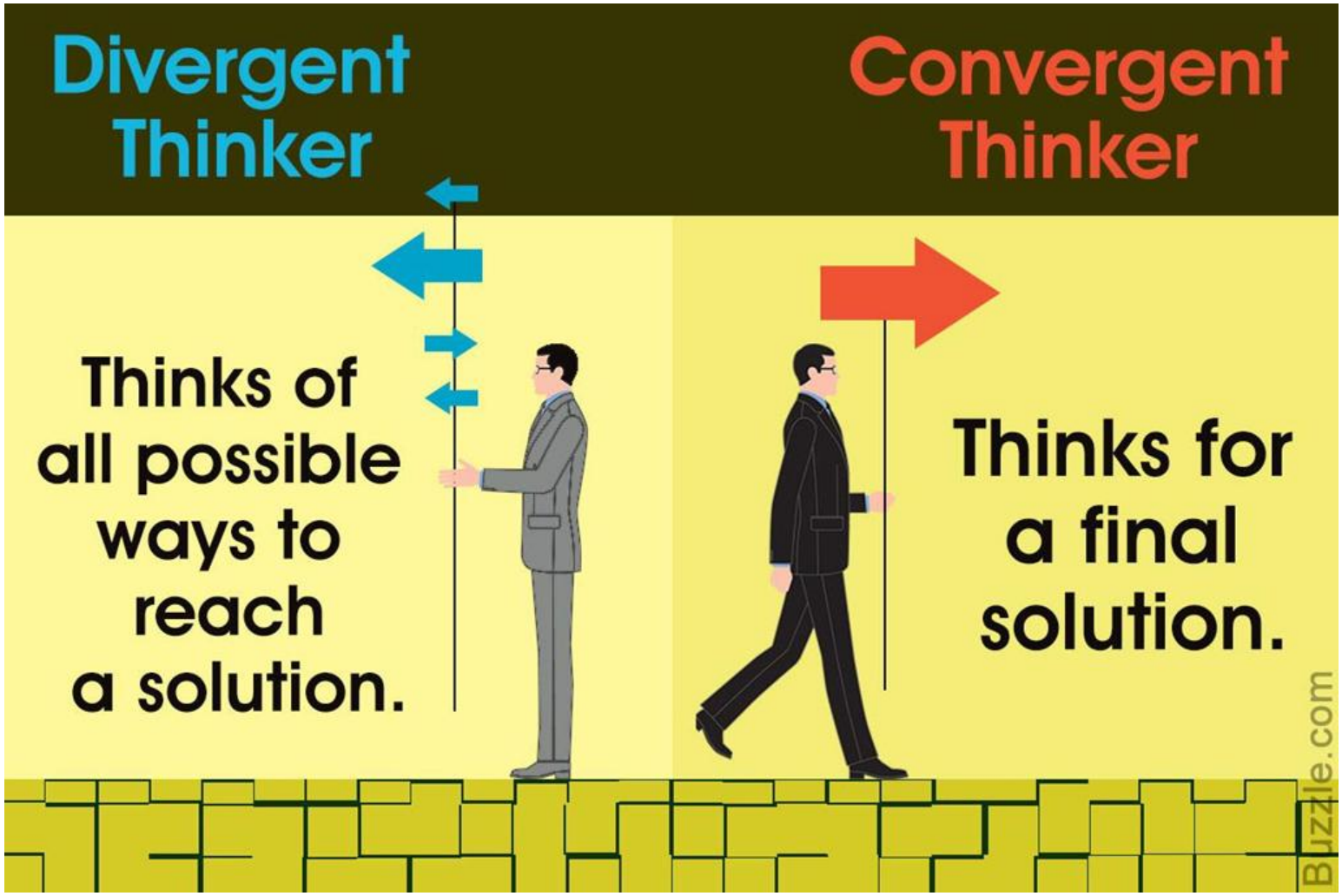
- **Intent focused:** The energy to focus attention, to resist distraction, and to concentrate for as long as it takes to achieve a goal.
- **A systems perspective:** It is knowledge about the organization.
- **Thinking in Time:** connecting the past to the present to the future. You learn from the past and use that learning to make predictions
- **Intelligent Opportunism: Search for new** Ideas and knowledge
- **Hypothesis driven** create new hypothesis for future actions.

Scientific Thinking

- *Creative/Divergent Thinking*
- *Critical/Convergent Thinking*
- *Lateral /Metacognitive (*thinking about their thinking) *thinking*

Three types of Scientific thinking

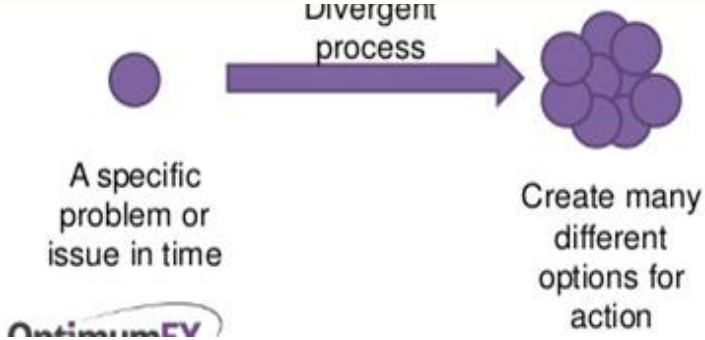



Divergent Thinker
Convergent Thinker
Thinks of all possible ways to reach a solution.
Thinks for a final solution.
Buzzle.com

Three types of Scientific thinking

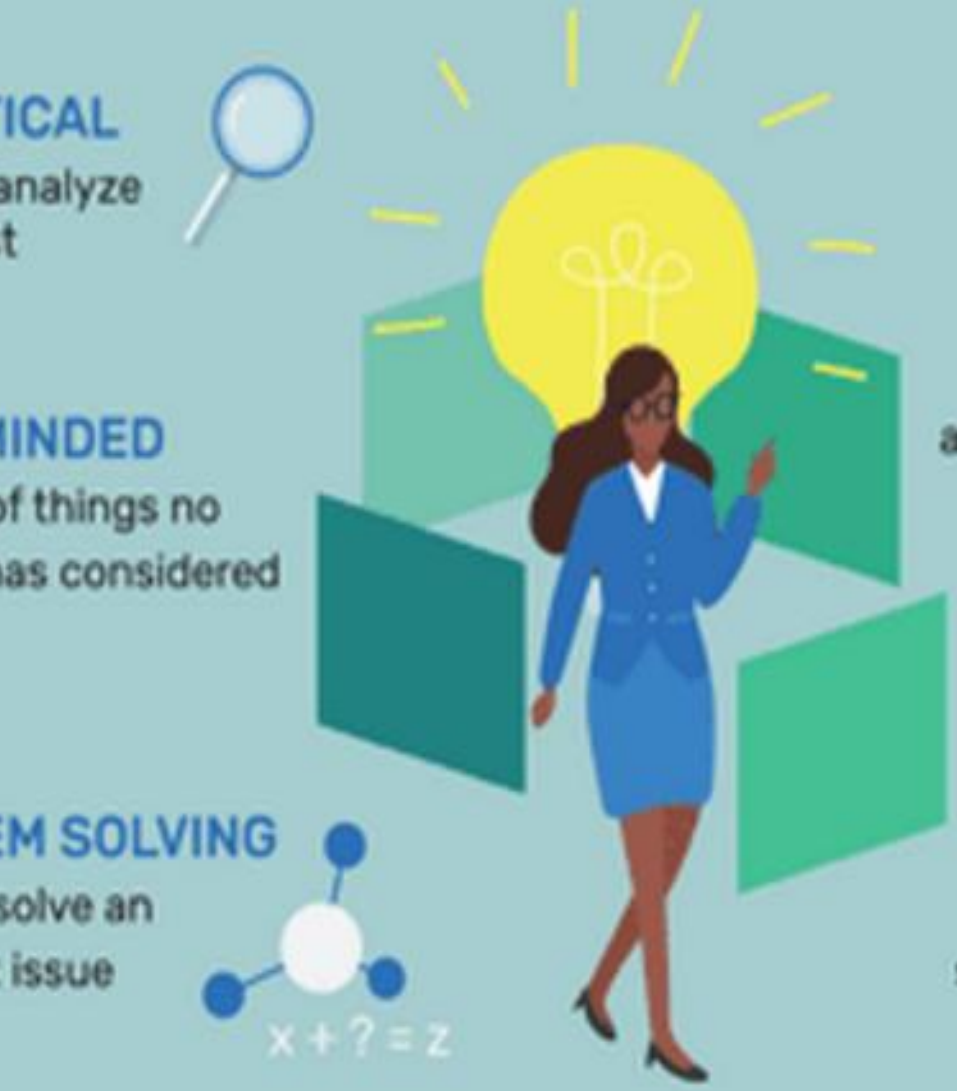
Creative/Divergent Thinking Definition

- **Divergent thinking** is a thought process or method used to generate creative ideas by exploring many possible solutions.
- Divergent thinking typically occurs in a spontaneous, free-flowing, 'non-linear' manner, such that many ideas are generated in an emergent cognitive fashion.
- Many possible solutions are explored in a short amount of time, and unexpected connections are drawn. After the process of divergent thinking has been completed, ideas and information are organized and structured using convergent thinking.



Types of process:
- Any process that creates ideas
- Brainstorming
- Vision creation exercises

Top Creative Thinking Skills



ANALYTICAL

Ability to analyze things first

OPEN-MINDED

Thinking of things no one else has considered before

PROBLEM SOLVING

Ability to solve an important issue

ORGANIZATION

Being able to structure a plan of action with clear goals and deadlines

COMMUNICATION

Strong written and oral skills, ability to listen and ask the right questions

THE CONTEXT OF CREATIVE THINKING?

- In the context of studying, creative thinking is about applying imagination to finding a solution to your learning task.
- **Creative thinking embodies**
  - Open approach more than critical thinking.
  - Less ordered, less structured, less predictable than critical thinking.
- Therefore it also requires some risk-taking as there is a chance that you will make 'mistakes' or not come up with an answer at all.
- You need to be prepared to cope with the resultant risk, confusion and disorder. If you are generally ordered and organized this may take some getting used to. Creative thinking skills are as much about attitude and self-confidence as about talent.

How to increase creativity

1-Learn Through Curiosity

- The human brain works magically when you read enough or talk to enough experts,
- When you have enough inputs, new ideas start appearing

2. Do Something You Love

- Do something that pleases you that is the way to learn the most
- When you are doing something with such enjoyment, you don't notice that the time passes

3. **have a hobby**

- participate in a hobby, such as playing an instrument, running, or collecting memorabilia can help you relax and fight stress while giving your creativity a boost.

4. Ask For Advice or Feedback

- Asking for help isn't a sign of weakness.
- Ask for help and advice from friends
- Even if you don't use their advice, it may spark some new, creative thinking that will get you where you need to go.

Some approaches involved in creative thinking skills:

- **Creative thinking skills involve such approaches as:**
  - Looking for many possible answers rather than one.
  - Allowing yourself to make wild suggestions as well as those that seem sensible.
  - Not judging ideas early in the process
  - treat all ideas as if they may contain the seeds of something potentially useful.
  - Don't be afraid to make mistakes.
  - Learning from what has not worked as well as what did.

Think about the following quotation from Edward de Bono – author of 'Six Thinking Hats' (1985). *"The need to be right all the time is the biggest bar to new ideas. It is better to have enough ideas for some of them to be wrong than to be always right by having no ideas"*

Blocks to creativity We may fear…

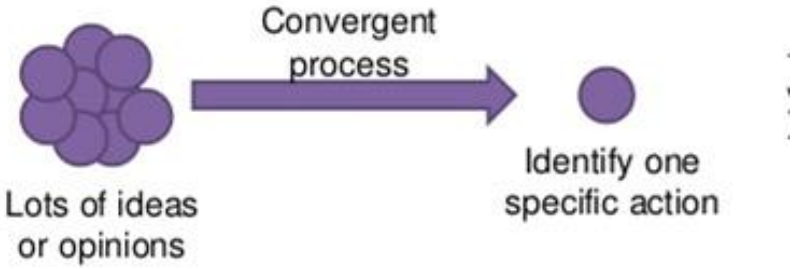
1. **Fear that you are not a creative person: solution** Look around at the ways you overcome difficulties and see how creative you already are.
2. **Fear of failure: solution** know that success is the process of exploring and learning.

Exercise: try to remember a time when u were creative, what happened? How did u feel?

Three types of Scientific thinking

- **Critical Thinking**

- **Convergent thinking** is the process of finding a single best solution to a problem that you are trying to solve. Many tests that are used in schools, such as multiple choice tests, spelling tests, math quizzes, and standardised tests, are measures of convergent thinking. Traditional intelligent tests, such as the Stanford-Binet, also measure convergent testing.



Three types of Scientific thinking

- **Lateral /Metacognition Thinking**

'Lateral thinking is solving problems through an indirect and creative approach, using reasoning that is not immediately obvious and involving ideas that may not be obtainable by using only traditional step-by-step logic.[1]

Three types of Scientific thinking

1.Critical / Convergent Thinking	2. Creative / Divergent Thinking	3. Lateral / Metacognition Thinking
1. Analyzing components and relationships in a system 2. Comparing and contrasting options 3. Making inferences and interpretations from data 4. Evaluating the relative worth of options	1. Generating many possible options 2. Generating a variety of types of possible options 3. Generating originality in possible options 4. ***What if . . . ? How about . . .? Could we try this or that idea . . .***?	1. Monitoring, 2. Evaluating 3. revising own thinking

EXAMPLES

- **Creative/Divergent thinking:**
  - Mr. A's home is at a distance of five miles from work. His Chevrolet gets 30 MPG. However, he wishes to expend less fuel in his travel for both monetary and conservation-associated reasons. Money is not an issue. **What choices does he have to cut his fuel consumption?**
  - it could still be possible to find an option that is entirely different from what the user asked – like devise a vehicle that runs off of air, or start a new business from home.}
- **Critical/Convergent thinking:**
  - Mr. A's home is at a distance of five miles from work. His Chevrolet gets 30 MPG. However, he wishes to expend less fuel in his travel for both monetary and conservation-associated reasons. Money is not an issue. **Which three vehicles are the best replacements for his car?**

QUESTIONS

- **What are the types of Scientific Thinking**
- **Describe with examples**
  - Creative/Divergent Thinking
  - Critical/Convergent Thinking
  - Lateral /Metacognitive thinking
  - **What are blocks to creativity**
  - **How to increase creativity**
  - **What are Creative thinking skills**