RECENT DEVELOPEMENT IN PHYSICS

PHYSICS - 2 **UNIT - 11**

NAME :

STANDARD : 12 SECTION :

SCHOOL :

EXAM NO :

செல்வத்துட் செல்வஞ் செவிச்செல்வம் அச்செல்வம்
செல்வத்து ளெல்லாம் தலை

செவியால் கேட்டுப் பெறும் செல்வமே சிறந்த செல்வம்.
இது பிற செல்வங்கள் எல்லாவற்றிலும் முதன்மையானது

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2 And 3 Mark Questions & Answers

1. Distinguish between Nanoscience and Nanotechnology.

Nanoscience :

- ✓ It is the science of objects with typical size 1 - 100 nm
- ✓ Nano means one - billionth of a metre. (i.e) $10^{-9}\ m$

Nanotechnology :

- ✓ It is a technology involving the design, production, characterization and application of nano structured materials

2. What is the difference between Nanomaterials and Bulk materials?

- ✓ If the particle of a solid is of size less than 100 nm, it is said to be a 'nano solid'. When the particle size exceeds 100 nm, it is a 'bulk solid'
- ✓ Though nano and bulk solids have same chemical composition, nano form of the material shows strikingly different properties when compared to its bulk counterpart.

3. Give the interdisciplinary nature of nano technology.

- ✓ Nano science and technology is the interdisciplinary area covering its applications in various fields. They are,
  - (1) Physics
  - (2) Chemistry
  - (3) Electrical & Mechanical Engineering
  - (4) Material science
  - (5) Molecular Biology
  - (6) Applied Mathematics & Computer science

4. What is robotics?

- ✓ Robotics is an integrated study of mechanical engineering, electronic engineeting, computer engineering and science.
- ✓ Robot is a mechanical device designed with electronic circuitry and programmed to perform a specific task.

5. What are the components of robotics?

- ✓ The robotic system mainly consists of
  - (1) Sensors
  - (2) Power supplies
  - (3) Controm systems
  - (4) Manipulators
  - (5) Necessary softwares

6. Give the types of robots.

(1) **Human robot** :

- ✓ Certain robots are made to resemble humans in appearance and replicate the human activities like walking, lifting and sensing etc

(2) **Industrial robots** :

- ✓ Six main types of industrial robots are Cartesian, SCARA, Cylindrical, Delta, Polar and Vertically articulated.
- ✓ They are ideal for Arc welding, Spot welding, Material handling, machne tending and other applications.

7. What is artificial intelligence? What are its work?

- ✓ The aim of artificial intelligence is to bring in human like behaviour in robots.
- ✓ It works on,
  - (1) Face recognition
  - (2) Providing response to player's actions is computer games
  - (3) Taking decisions based on previous actions
  - (4) To regulate the traffic by analyzing the density of traffic on roads
  - (5) Translate words from one language to another

8. Write a note on nano robots.

Nano robots :

- ✓ The size of the nano ronots is reduced to microscopic level to perform a task in very small spaces.
- ✓ In future nano robots are used in the medical fields.
- ✓ Nano robots in blood stream to perform small surgical procedures, to fight against bacteria, repairing individual cell in the body.
- ✓ It can travel into the body and once after the job is performed it can find its way out.

9. Why steels are preferred to make robots?

- ✓ For robots, aluminum and steel are the most common metals.
- ✓ Aluminum is a softer metal and is therefore easier to work with it.
- ✓ But steel is several times stronger and because of the inherent strength of steel, robot bodies are made using sheet, bar, rod, channel and other shapes.

5 Mark Questions and Answers

1. Explain Nano structure in nature with examples.

Nano in nature :

(1) Single strand DNA :
- ✓ It is the basic building block of all living things.
- ✓ It is about 3 nm wide

(2) Morpho butterfly :
- ✓ The scales of the wings of this butterfly contains nano structures.
- ✓ When light wave interact with this giving the wings brilliant metallic blue and green hues.

(3) Peacock feathers :
- ✓ They get their iridescent coloration from light interacting with 2 dimensional photonic crystal structres just tens of nanometers thick
- ✓ Similar nano structrures are made in lab to glow in different colors

(4) Parrot fish :
- ✓ It crunches up coral all day.
- ✓ The source of powerful bite is the interwoven fibre nanostructure.
- ✓ Crystals of a mineral called ***fluorapatite*** are woven together in a chain mail-like arrangement. This structure gives parrot fish teeth incredible durability.
- ✓ It provides a blue print for creating ultr-durable synthetic materials that could be useful for mechanical components in electronics and in other devices that undergo repetitive movement, abrasion and contact stress

(5) Lotus Leaf surface :
- ✓ Scaning electron micrograph (SEM) gives the nano structures on the surface of a leaf from a lotus plant.
- ✓ This is the reason for self cleaning process on lotus leaf.

2. Discuss the functions of key components in Robots?

Key components of Robots :
- ✓ Most robots are composed of 3 main parts:
  - (1) Controller
  - (2) Mechanical parts
  - (3) Sensors

(i) **Controller** :
- ✓ It is also known as the "brain" which is run by a computer program.
- ✓ It gives commands for the moving parts to perform the job.

(ii) **Mechanical parts** :
- ✓ It consists motors, pistons, grippers, wheels, and gears that make the robot move, grab, turn, and lift.

(iii) **Sensors** :
- ✓ It tells the robot about its surroundings. It helps to determine the sizes and shapes of the objects around, distance between the objects, and directions as well.

Functions of various components of robotics.

(i) **Power conversion unit**:
- ✓ Robots are powered by batteries, solar power, and hydraulics.

(ii) **Actuators**:
- ✓ Converts energy into movement. The majority of the actuators produce rotational or linear motion.

(iii) **Electric motors**:
- ✓ They are used to actuate the parts of the robots like wheels, arms, fingers, legs, sensors, camera, weapon systems etc.
- ✓ Different types of electric motors are used. - The most often used ones are AC motor, Brushed DC motor, Brushless DC motor, Geared DC motor, etc.

(iv) **Pneumatic Air Muscles**:
- ✓ They are devices that can contract and expand when air is pumped inside.
- ✓ It can replicate the function of a human muscle. ey contract almost 40% when the air is sucked inside them.

(v) **Muscle wires**:
- ✓ They are thin strands of wire made of shape memory alloys. ey can contract by 5% when electric current is passed through them.

(vi) **Piezo Motors and Ultrasonic Motors**:
- ✓ Basically, we use it for industrial robots.

(vii) **Sensors**:
- ✓ Generally used in task environments as it provides information of real-time knowledge.

(viii) **Robot locomotion**:
- ✓ Provides the types of movements to a robot.
- ✓ The different types are
  - (a) Legged
  - (b) Wheeled
  - (c) Combination of Legged and Wheeled Locomotion
  - (d) Tracked slip/skid