

# 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 engineering, 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) Control 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, machine 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 in 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 robots 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 structures just tens of nanometers thick
- ✓ Similar nano structures 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 ultra-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 :

- ✓ Scanning 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. They contract almost 40% when the air is sucked inside them.

##### (v) Muscle wires:

- ✓ They are thin strands of wire made of shape memory alloys. They 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

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