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SCIENCE
A Complete Guide

Answers for Govt Exam Questions, PTA and QR Code Questions included

How to draw diagrams?

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WAY TO SUCCESS TEAM

SALIENT FEATURES

➢ Provides prompt & easy answers for all textbook questions.

➢ It includes Exam oriented additional questions, Textbook examples, do you know questions, etc.,

➢ Brief solutions & explanations to one marks & Problems.

➢ Points to remember for fast revision & comparative study.

➢ Various shortcuts & tricks to remember are provided.

➢ Answers for Govt. Model - 2019, April-2023, May-2022, August – 2022, September–2020, 2021, 6 sets of PTA and QR Code questions included in each unit.

➢ Practice Book - To evaluate your learning.

TRICKS

&

SHORTCUTS

SCIENTISTS – INVENTIONS & DISCOVERIES

Father of		Laws	
Leonardo da Vinci	Paleontology	Newton	Laws of motion
Kaspar Maria Von Sternberg	Paleobotany	Snell	Law of refraction
Birbal Sahani	Indian Paleobotany	Soddy & Fajan	Displacement law
Thomas Addison	Endocrinology	Henry Moseley	Modern periodic law
Nehemiah Grew	Plant Anatomy.	Boyle, Charles, Avogadro	Fundamental Laws of gases
William Harvey **[SEP-20]**	Modern physiology	Rayleigh, Mie, Tyndall, Raman	Law of Scattering
Gregor Johann Mendel	Genetics		
Dr. Norman E. Borlaug	Green Revolution.	Albert Einstein	Mass energy equivalence

Discoveries		Introduced/ First coined the term	
Marie curie	Radium	Kogl & Haagen- Smith	Auxin.
Martin Klaproth	Uranium	W.M.Bayliss & E.H.Starling	Hormone.
Henry Bequerel	Natural radioactivity	Waldeyer	Chromosome **[MAY-22]**
Irene Curie	Artificial radioactivity	J.W. Harshberger	Ethnobotany **[MAY-22]**
Robin Hill	Light reaction.	Karl Landsteiner **[SEP-21]**	Concept of Blood group
Landsteiner & Wiener	Rh factor	Decastello and Steini	Identified AB Blood group
W.F. Libby **[PTA-5]**	Radio carbon dating	Fredrick Banting, Charles Best & MacLeod	Human insulin

| Others	
Johann Lippershey	Invented the First Telescope
Dr.Homi Jahangir Bhaba	First chairman of Indian Atomic Energy Commision.
Frits Warmolt Went	Demonstrated the existence and effect of auxin in plants.
James Watson & Francis Crick.	Proposed Three-dimensional model of DNA.
Erwin Chargaff	Proportion of Adenine = Thymine & Guanine = Cytosine
Kurosawa	Observed Bakanae disease or foolish seedling disease in rice crops
Dr. Suniti Solomon	Pioneered HIV research and treatment in India
Jean Baptiste Lamarck	Theories of Evolution (Use and Disuse Theory)
Charles Darwin **[PTA-6]**	Theory of Natural Selection
Oparin & Haldane	Chemical evolution of life
Ernst Haeckel	Biogenetic law / Recapitulation theory
Louis Pasteur **[SEP-21]**	Speculated biogenesis - Life originates from pre-existing life

IMPORTANT DAYS

World Cancer Day	February 4th	Menstrual Hygiene day	May 28th
National Cancer awareness day	November 7th	National Forest Policy	1952 & 1988
AIDS Day	December 1st	Forest conservation Act	1980
Anti Tobacco Act	May 1st 2004	Chipko movement victory	1980
World Anti-Tobacco Day	May 31st	Wildlife protection Act	1972
International day against drug abuse	June 26th	Child helpline number	1098

Tips & Tricks for Refraction through Concave & Convex Lens

Types of lens	Object position	Image position	Nature of the image	Image Size	f	u	v	$m = \dfrac{v}{u}$
Convex	Beyond 2F	Opposite side of object	Real, Inverted	Img < Obj	+	-	+	-
	At 2F			Img = Obj				
	Between 2F & F			Img > Obj				
	Between F & O	Same side of object	Virtual, Erect	Img > Obj	+	-	-	+
Concave	All positions	Same side of object At F / Between F & O	Virtual, Erect	Img < Obj	-	-	-	+

IMAGE POSITION THROUGH CONVEX LENS
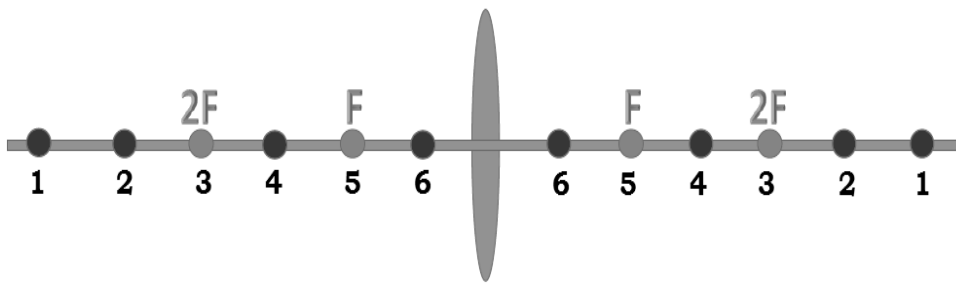
1 – At infinity
2 – Beyond 2F
3 – At 2F
4 – Between 2F and F
5 – At F
6 – Between F and O

Trick

From the first table, we can find nature of image, image size and sign for f, u, v & m

To find the precise Image Position,

✽ *Identify the object position number as given in the table.*

✽ *Subtract the identified number from 6.* **Image position = 6 – object position**

✽ *Identify the Image position from the calculated number.*

✽ *If the calculated number is zero, the image will be by the side of the object after F.*

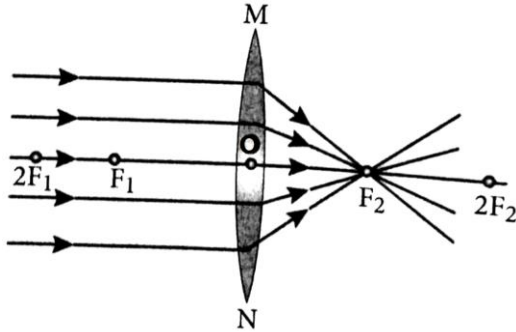### Example : Object beyond - 2F ; Image - Between F & 2F

1. An object is placed Beyond 2F/C (object position =2)
2. Image position = 6 – 2 = 4 (Between 2F and F)
3. Image size < Object size
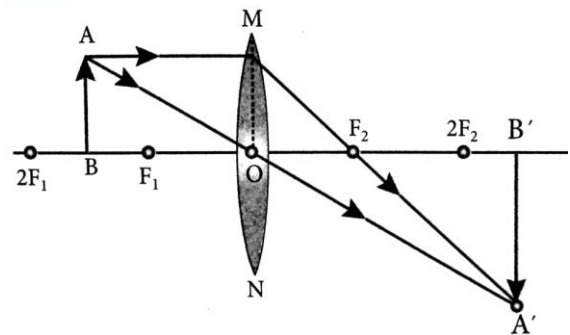4. Real & inverted image
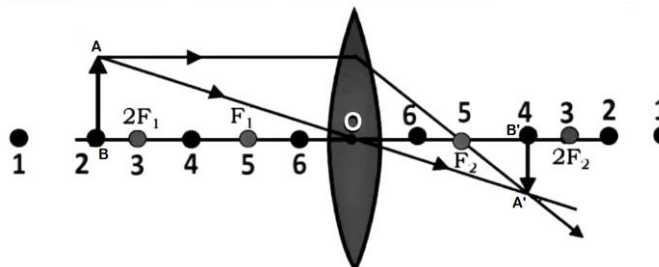
REFRACTION THROUGH A CONVEX LENS

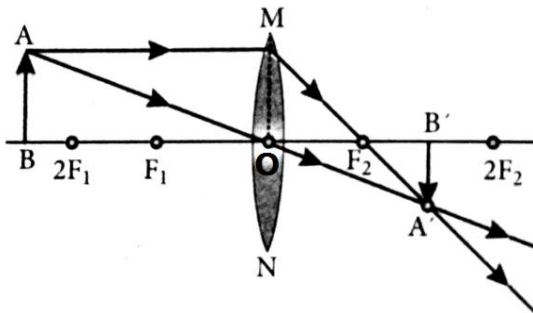| Object position : Infinity | Image size << Object size, |
| Image position : At F | **Real image** |

| Object position : between F & 2F | Image size > Object size, |
| Image position : beyond C/2F | **Real & inverted image** |

| Object position : beyond C / 2F | Image size < Object size, |
| Image position : between F & 2F | **Real & inverted image** |

| Object position : At F | Image size >> Object size, |
| Image position : Infinity | **Real & inverted image** |

| Object position : At C / 2F | Image size = Object size, |
| Image position : At 2F | **Real & inverted image** |

| Object position : F & O | Image size > Object size, |
| Image position : At F | **Virtual & Erect image** |
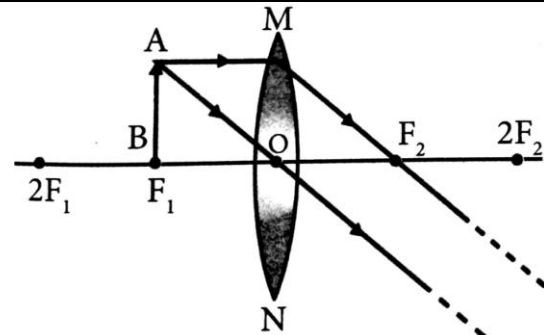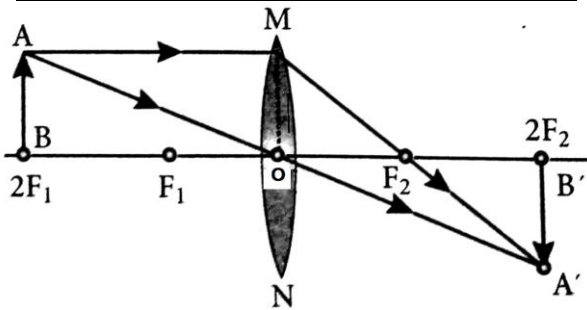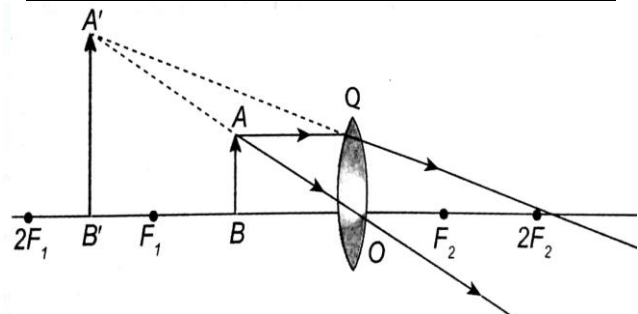
REFRACTION THROUGH A CONCAVE LENS

| Object position : Infinity | Image size << Object size, |
| Image position : At F | **Virtual image** |

| Object position : Any finite distance from the lens |
| Image position : Between F & O |
| Image size < Object size, **Virtual image** |
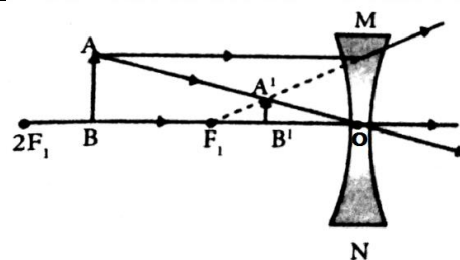
Distance between the object & lens decreased,   Distance between the image & lens decreases

Note: Here AB is the Object and A'B' is the Image. 2F$_1$ & 2 F$_2$ can also be represented as C

12. Explain about the various types of telescope.

Based on Optical property	Based on things which are been observed

i) *Refracting telescope*
     lenses are used here.
     Eg: Galilean telescope, Keplerian telescope, Achromatic refractors
 ii) *Reflecting telescope*
     Parabolic mirrors are used here.
     Eg: Gregorian, Newtonian,
        Cassegrain telescope
	i) *Astronomical Telescope*
	     It is used to view heavenly bodies like stars, planets, galaxies and satellites.
	 ii) *Terrestrial Telescopes*
	     It is similar to astronomical telescope, with an advantage of erecting the final image with respect to the object.

VIII. Numerical Problems

1. An object is placed at a distance 20 cm from a convex lens of focal length 10 cm. Find the image distance and nature of the image.

Given : Focal length of convex lens $f = 10$ cm

      Distance between object and lens $u = -20$ cm

      Distance between image and lens $v = ?$

Solution : Lens formula, $\dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u}$

$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$$

$$= \frac{1}{10} + \frac{1}{-20} = \frac{2-1}{20} = \frac{1}{20}$$

$$v = 20 \text{ cm}$$

∴ The image distance is 20 cm.

Nature : Real and inverted image. (∵ Image is at 2 F)

> ****Sign convention rules****
>
> **f →** **+ve** for convex
>   **-ve** for concave
>
> **u →** **-ve** always *(object is placed in left)*
>
> **v →** **+ve** if image is on right *(Real & Inverted)*
>   **-ve** if image is on left *(Virtual & Erect)*
>
> ****Shortcut****
>
> | For Convex | | For Concave |
> |---|---|---|
> | **f →** +   **u →** − | | **f, u, v →** − |
> | **v →** + (-ve only if object is between F&O) | | (All are negative) |

2. An object of height 3 cm is placed at 10 cm from a concave lens of focal length 15 cm. Find the size of the image.

Given : Focal length of concave lens, $f = -15$ cm

      Distance between object and lens $u = -10$ cm

      Height of the object, $h = 3$ cm

      Height of the image, $h' = ?$

Solution : Lens formula, $\dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u}$ $\Rightarrow$ $\dfrac{1}{v} = \dfrac{1}{f} + \dfrac{1}{u}$

$$\frac{1}{v} = \frac{1}{-15} + \frac{1}{-10} = \frac{-2-3}{30}$$

$$\frac{1}{v} = -\frac{5}{30} = -\frac{1}{6}$$

$$v = -6 \text{ cm}$$

$$\text{Magnification } m = \frac{v}{u} = \frac{-6}{-10} = 0.6$$

$$\text{Magnification } m = \frac{h'}{h} = \frac{h'}{3} = 0.6$$

$$h' = 0.6 \times 3 = 1.8 \text{ cm}$$

∴ Height of the image h' is 1.8 cm.

BEST

PRESENTATION

b) Name and define its unit. (or) Define the unit of electric current.   **[MAY - 2022, PTA– 1]**
- ❖ The SI unit of electric current is ampere (A).
- ❖ The current flowing through a conductor is said to be one ampere, when a charge of one coulomb flows across any cross-section of a conductor, in one second.

$$1 \text{ ampere} = \frac{1 \text{ coulomb}}{1 \text{ second}}$$

c) Which instrument is used to measure the electric current? How should it be connected in a circuit?   **[MAY - 2022, PTA– 1]**

    Ammeter is used to measure the electric current. It should be connected in series in a circuit.

3. a) State Joule's law of heating. (Or) Write two properties of the heat produced in any resistor, according to the Joules Law of heating.   **[APR – 2023]**

    Joules' law of heating states that the heat produced in any resistor is
- ❖ directly proportional to the square of the current passing through the resistor.
- ❖ directly proportional to the resistance of the resistor.
- ❖ directly proportional to the time for which the current is passing through the resistor.

$$H = I^2 R t$$

b) An alloy of nickel and chromium is used as the heating element. Why?

    An alloy of Nickel and chromium is used as the heating element because,
- (i) It has high resistivity.
- (ii) It has a high melting point.
- (iii) It is not easily oxidized.

c) How does a fuse wire protect electrical appliances?
- ❖ Fuse wire is connected in series in a circuit. It is made up of a material of low melting point.
- ❖ When a large current passes through the circuit, fuse wire melts due to Joule's heating effect. Hence, the circuit gets disconnected. Thus, electric appliances are saved from any damage.

4. Explain about domestic electric circuits. (circuit diagram not required)   **[SEP – 2020]**

Source :

    The electricity produced in power stations is distributed to domestic circuits through overhead and underground cables. Power supply is brought to the main-box from a distribution panel.

Main-box :

    Meter : It is used to record the consumption of electrical energy.

    Fuse box : It contains a fuse wire or miniature circuit breaker (MCB). It is used to protect the household electrical appliances from overloading due to excess current.

Types of wires :
- ✶ *Live wire* has red insulation.   ✶ *Neutral wire* has black insulation.

Domestic electric circuit :
- ❖ Electricity supplied to domestic circuits are alternating current with electric potential of 220 V.
- ❖ Live wire connected via main fuse and the neutral wire enter into the electricity meter.
- ❖ These wires then enter into main switch. This helps us to discontinue the supply whenever required.
- ❖ *After this, there are two separate circuits :*
  - ☞**5 A rating** – for low power rating appliances. *Eg :* Tube lights, Bulbs, Fans
  - ☞**15 A rating** – for high power rating appliances. *Eg :* AC, Fridge, Heaters
- ❖ All circuits are connected in parallel so that disconnection of one circuit will not affect the other. Each electric appliance gets an equal voltage.

3. What is a nuclear reactor? Explain its essential parts with their functions. [APR – 2023]

Nuclear reactor	
❖ A nuclear reactor is a device in which the nuclear fission reaction takes place in a self-sustained and controlled manner to produce electricity. ❖ The essential components of a nuclear reactor are,	
Fuel	❖ A fissile material is used as the fuel. *Eg :* Uranium
Moderator	❖ A moderator is used to slow down the high energy neutrons to provide slow neutrons. *Eg :* Graphite (and) heavy water
Control rod	❖ Control rods are used to control neutrons number and to have sustained chain reaction. They absorb the neutrons. *Eg :* Boron (or) Cadmium rods.
Coolant	❖ Coolant is used to remove the heat produced in the reactor core, to produce steam. *Eg :* Water, air and helium ❖ This steam is used to run turbine to produce electricity.
Protection wall	❖ A thick concrete lead wall is built around the nuclear reactor. ❖ It prevents harmful radiations from escaping into environment.

Additional Questions

4. Explain uses of radioactivity in various fields.

Uses of Radioactivity in Agriculture : [MAY – 2022]
- The radio isotope of Phosphorous(P-32) is used to increase the productivity of crops.
- Radiations are used to kill insects and parasites and prevents the wastage of agricultural products.
- It helps to enhance the storage time of certain perishable cereals when exposed to radiations.
- Very small doses of radiation prevent sprouting and spoilage of onions, potatoes and gram.

Uses of Radioactivity in Medicine : [PTA – 2]
- Radio isotopes can be used for Diagnosis and Therapy of various diseases.
    * **Radio sodium (Na^{24}) :** Used for effective functioning of heart.
    * **Radio iodine (I^{131}) :** Used to cure goiter.
    * **Radio iron (Fe^{59}) :** Used to diagnose and treat anaemia.
    * **Radio phosphorous (P^{32})** : Used in treatment of skin diseases.
    * **Radio cobalt (Co^{60})** and **radio gold (Au^{198})** : Used in treatment of skin cancer.
- **Radiations** are used to sterilize surgical devices as they can kill germs and microbes.

Uses of Radioactivity in Industries : [PTA – 4]
- Radioactive isotopes are used to detect manufacturing defects like cracks, leaks and packaging faults.
- Gauges with Radioactive sources are used to check the level of gases, liquids and solids.
- An isotope of **californium (Cf^{252})** is used in airlines to detect explosives in luggage.
- An isotope of **Americium (Am^{241})** is used as smoke detector.

Uses of Radioactivity in Archeological research :
- Radio carbon dating is used to determine the age of Earth, fossils, old paintings & monuments.
- In radio carbon dating, existing amount of radio carbon is determined and this gives its age.

2. Illustrate the structure and functions of brain.   **[PTA – 1]**

Brain is the controlling centre of all body activities. It is covered by 3 connective membranes called Duramater, Arachnoid Membrane, Piamater. Three main parts of brain are,

i) Forebrain : It is formed of **cerebrum** and **diencephalon**.

Diencephelon consists of dorsal *thalamus* and ventral *hypothalamus*.

✷ *Cerebrum :* It is the largest portion of brain.

- It is longitudinally divided into right and left cerebral hemispheres by median cleft.
- **Corpus Callosum:** Thick nerve fiber that interconnects 2 Cerebral hemisphere.
- **Cerebral Cortex:** Grey Mattered outer portion of Cerebral hemisphere.
  - **Gyri** - Elevations of Cortex; **Sulci** - Depressions of Cortex
- **Cerebral Medulla:** It is the white mattered inner portion of Cerebral hemisphere.
- **Cerebral Lobes:** It consists of Frontal lobe, Parietal lobe, temporal lobe, occipital lobe.

Functions: Responsible for intelligence, consciousness, memory, imagination, reasoning, willpower.

✷ *Thalamus :* It is present in cerebral medulla.

Functions : It is a major conducting centre for sensory & motor signaling. Acts as relay centre.

✷ *Hypothalamus :* It lies at the base of thalamus.

Functions : It controls involuntary functions and hormone secretion from anterior pituitary. It is the thermal regulatory center and a link between nervous & endocrine system.

ii) Midbrain : It is located between thalamus and hindbrain.

Its dorsal portion consists of four rounded bodies called **Corpora quadrigemina**.

Functions: It control visual & auditory reflexes.

iii) Hindbrain : It is formed of three parts. They are,

✷ *Cerebellum :* It is the second largest portion. It is of two large hemispheres & middle vermis.

Functions It coordinates voluntary movements and maintains body balance.

✷ *Pons :* It connects the lobes of cerebellum.

- It relay signals between cerebellum, spinal cord, midbrain and cerebrum.

Functions: It controls respiration and sleep cycle.

✷ *Medulla oblongata:* It is the posterior part that connects spinal cord and various parts of brain.

Functions: It controls heartbeat (cardiac centre), respiration (respiratory centre), contraction of blood vessels (vasomotor centres) and regulates vomiting and salivation.