

# GET CHARGED TO TACKLE PHYSICS

The Physics faculty of Silver Oaks International School, Hyderabad, presents a question paper for you to practice on...

## GENERAL INSTRUCTIONS

- All questions are compulsory. There are 27 questions in all.
- There are four sections: A, B, C and D
- Section A contains five questions of one mark each, Section B contains seven questions of two marks each, Section C contains 12 questions of three marks each, and Section D contains three questions of five marks each.
- There is no overall choice. However, internal choices have been provided in two questions of one mark, two questions of two marks, four questions of three marks and three questions of five marks weightage. You have to attempt only one of the choices in such questions.
- You may use the following values of physical constants wherever necessary

$c = 3 \times 10^8 \text{ m/s}$   
 $h = 6.63 \times 10^{-34} \text{ Js}$   
 $e = 1.6 \times 10^{-19} \text{ C}$   
 $\mu_0 = 4 \times 10^{-7} \text{ T m A}^{-1}$   
 $\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$   
 $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ N m}^2 \text{ C}^{-2}$   
 $m_e = 9.1 \times 10^{-31} \text{ kg}$   
 mass of neutron =  $1.675 \times 10^{-27} \text{ kg}$   
 mass of proton =  $1.673 \times 10^{-27} \text{ kg}$   
 Avogadro's number =  $6.023 \times 10^{23}$  per gram mole  
 boltzmann constant =  $1.38 \times 10^{-23} \text{ JK}^{-1}$

## SECTION-A

**Q.1** Explain why resistivity of metal increases and that of semiconductor decreases with rise in temperature

**Q.2** No two electric lines of force can intersect each other. why?

**Q.3** Write the following radiations in the descending order of frequencies: red light, x-rays, micro waves and radio waves

OR

The charging current for a capacitor is 0.5A. What is the displacement current across its plates.

**Q.4** The refractive index of material of a convex lens is  $n_1$ . It is immersed in a medium of refractive index  $n_2$ . A parallel beam of light is incident on the lens. Trace the path of emergent ray when  $n_2 > n_1$ .

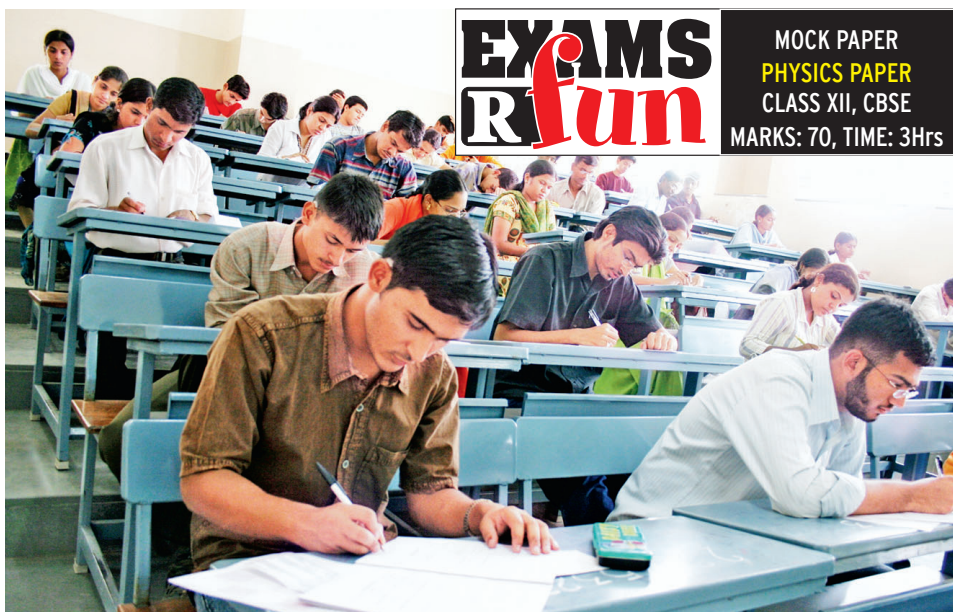
**Q.5** An alpha particle and proton are accelerated through same potential difference. Calculate the ratio of their linear momenta?

OR

Calculate the energy associated in eV with a photon of wavelength 4000Å?

## SECTION-B

**Q.6** In a potentiometer arrangement a cell of emf 1.25v gives a balancing point at 35.0cm length of the wire. If the cell is replaced by

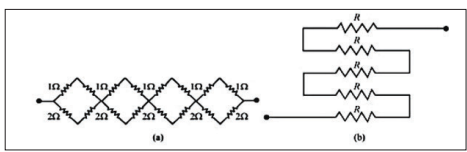


another cell balancing length shifts to 63.0cm. Find the emf of second cell.

OR

Three identical cells each of emf 2v and unknown internal resistance are connected in parallel. This combination is connected to a 50 ohm resistor. If the terminal voltage across the cell is 1.5v. What is the internal resistance of each cell.

**Q.7** Determine the equivalent resistance of networks shown in the figures



OR

A storage battery of emf 8.0V and internal resistance 0.5ohms is being charged by a 120V dc supply using a series resistor of 15.5ohms. What is the terminal voltage of the battery during charging? What is the purpose of having series resistor in the charging circuit.

**Q.8** If a series LCR circuit connected to an ac source of variable frequency and voltage  $V = V_m \sin \omega t$ . Draw a plot showing the variation of current I with angular frequency? for two different values of resistance  $R_1$  and  $R_2$  ( $R_1 > R_2$ ).

**Q.9** Answer the following questions

- (a) Long distance radio broadcasts use short-wave bands. Why?  
 (b) It is necessary to use satellites for long distance TV transmission. Why?

**Q.10** In a Young's double-slit experiment, the slits are separated by 0.28 mm and the screen is placed 1.4 m away. The distance between the central bright fringe and the fourth bright fringe is measured to be 1.2 cm. Determine the wave length of light used in the experiment.

**Q.11** If the output of a 2 input NAND gate is fed as input to a NOT gate, name the new logic gate obtained and write its truth table.



**Q.12** A TV transmitting antenna is 81m tall. How much service area can it cover if the receiving antenna is at the ground level.

## SECTION-C

**Q.13** Consider a uniform electric field  $E = 3 \times 10^3 \text{ IN/C}$ .

- (a) what is the flux of this field through a square of 10 cm on a side whose plane is parallel to the yz plane.  
 (b) what is the flux through the same square if the normal to its plane makes a  $60^\circ$  angle with the x-axis?

**Q.14** A spherical conducting shell of inner radius  $r_1$  and outer radius  $r_2$  has a charge Q.

- (a) A charge q is placed at the centre of the shell. What is the surface charge density on the inner and outer surfaces of the shell?  
 (b) Is the electric field inside a cavity (with no charge) zero, even if the shell is not spherical but has any irregular shape? Explain.

**Q.15** With the help of labelled circuit diagram, explain full wave rectification using junction diode. Draw input and output waveforms?

- Q.16** (a) A magnetic field that varies in magnitude from point to point but has a constant direction (east to west) is set up in a chamber. A charged particle enters the chamber and travels undeflected along a straight path with constant speed. What can you say about the initial velocity of the particle?  
 (b) A charged particle enters an environment of a strong and non-uniform magnetic field varying from point to point both in magnitude and direction, and comes out of it following a complicated trajectory. Would its final speed equal the initial speed if it suffered no collisions with environment.  
 (c) An electron travelling west to east enters a chamber having a uniform electrostatic field in north to south direction. Specify the direction in which a uniform magnetic field should be set up to prevent the electron from deflecting from its straight line path.

OR

A charged particle having a charge q is moving with a speed v along the x-axis. It enters a region of space where an electric field E along y-axis and a magnetic field B are both present. The particle, on emerging from this region, is observed to be moving along the x-axis only. Obtain an expression for the magnitude of B in terms of v and E. Also give the direction of B

**Q.17** An inductor L, a capacitor  $20 \mu\text{F}$ , a resistance 10ohms are connected in series with an ac source of frequency 50 Hz. If the current is in phase with voltage, calculate the inductance L.

- Q.18** (a) what are eddy currents  
 (b) write applications of eddy currents  
 (c) How they can be minimised

OR

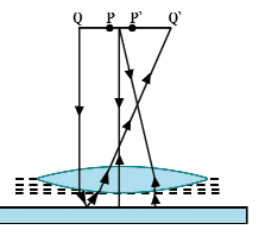
In free oscillations of LC circuit, show that energy stored in inductor and capacitor are independent of time

**Q.19** (a) Draw a labeled diagram to show the final image formed by compound microscope at near point.  
 (b) Distinguish reflecting and refracting telescopes

OR

- (a) Define limit of resolution and resolving power of microscope  
 (b) Distinguish interference and diffraction

**Q.20** Figure shows an equiconvex lens of refractive index 1.50 in contact with a liquid layer on top of a plane mirror. A small needle with its tip on the principal axis is moved along the axis until its inverted image is found at the position of the needle. The distance of the needle from the lens is measured to be 45.0 cm. The liquid is removed and the experiment is repeated. The new distance is measured to be 30.0 cm. what is the refractive index of the liquid?



**Q.21** Draw the labeled graphs to show the following concerning photo-electric emission

- (a) Variation of photo current with stopping potential  
 (b) Variation of stopping potential with frequency of incident radiation  
 (c) The work function of material

**Q.22** A hydrogen atom initially in the ground level absorbs a photon, which excites it to  $n=4$  level. Determine the frequency and wavelength of photon.

**Q.23** The Q value of a nuclear reaction  $A + b \rightarrow C + d$  is defined by  $Q = [m_A + m_b - m_C - m_d]c^2$  where the masses refer to the respective nuclei. Determine from the given data the Q-value of the following reactions and state whether the reactions are exothermic or endothermic.

OR

Draw a curve between mass number and binding energy per nucleon. write any three salient features of this curve. Hence define

binding energy.

**Q.24** What is amplitude modulation and with labeled diagram show how an amplitude modulated wave is detected.

## SECTION-D

**Q.25** a) what is cyclotron? Explain its working principle

b) A cyclotron's frequency is 10MHZ. What should be the operating magnetic field for accelerating protons? If the radius of its dees is 20cm. What is the kinetic energy of the proton beam produced by the accelerator.

OR

a) Draw a labelled diagram of a moving coil galvanometer. prove it in a radial magnetic field, the deflection of the coil is directly proportional to the current flowing in the coil.

b) A galvanometer can be converted into voltmeter to measure upto

1) V volts by connecting a resistance  $R_1$  in series with the coil

2)  $V/2$  volts by connecting a resistance  $R_2$  in series with the coil and find R in terms of  $R_1$  and  $R_2$  required to convert it into voltmeter that can read upto 2 volts.

**Q.26** a) In YDSE, deduce the conditions for obtaining constructive and destructive interference fringes. Hence deduce the expression for fringe width.

b) Show that the fringe pattern on the screen is actually a superposition of slit diffraction from each slit.

c) What should be the width of each slit to obtain 10 maxima of double slit pattern with in the central maxima of the single pattern for green light of wavelength 500nm, if the separation between the slits is 1mm?

OR

a) State Brewster's law? Using this prove that at polarizing angle of incidence, the reflected and transmitted rays are perpendicular to each other.

b) what are polaroids and write its uses

c) What type of waves show the property of polarization and name two methods to produce plane polarized light.

**Q.27** a) State briefly the processes involved in the formation of p-n junction explaining clearly how the depletion region is formed.

b) Using the necessary circuit diagrams, show how V-I characteristics of p-n junction diode are obtained in 1) forward biasing 2) reverse biasing.  
 c) How these characteristics are made use in rectification

OR

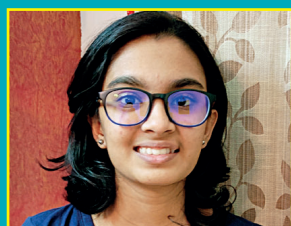
a) Why the base junction of transistor is lightly doped

b) Explain the working of p-n-p transistor when connected in CE configuration

c) Using graphs how amplification factor and resistance gain can be determined.

These questions and the marks alongside are meant for practice purpose only. Students are advised to check format, syllabus and marks for Board test papers with their teachers. Questions have been given by teachers and NIE is not responsible for them.

## 'A positive spin on peer pressure helps'



**Ananya R Burti**  
 of BGS National Public School, Hulimavu, Bengaluru shares how she aced her XII CBSE Boards

**Q** Describe briefly the study plan you followed while preparing for the Boards?

I practised 10-15 question papers from previous years. I wrote mock exams and timed myself. Most importantly, I stuck to NCERT. I believe it is sufficient if we do well in these exercises.

**Q** What were the key challenges you faced and how did you tackle them?

The challenges I faced included time management mainly because initially, I found it difficult to maintain brevity in my answers. But after going through the answer keys for the previous years papers, I think I could predict what answers were expected

from students.

**Q** How did you deal with pressure to perform, and keep yourself motivated?

I think peer pressure is something we all face. In my case, it motivated me to study harder. I suggest that students take peer pressure positively. My parents and teachers also played a critical role in encouraging me.

**Q** How did you balance academics with other activities?

Music is my passion.



Singing and listening to music served as stress busters for me. It helps to clear my mind and makes me feel invigorated.

**Q** What tips would you give future aspirants?

Everybody has their own ways to achieve success. But I think it all boils down to hard work and focus. Staying away from social media is an added advantage to avoid any kind of distraction. No matter what, have faith in yourself and stay happy. Eat well, sleep well.

## Silence is not golden to me!



While studying there can be various distractions ranging from the constantly buzzing notifications on the mobile phone to the doorbell ringing. On the contrary, I believe that the eerie silence in the room is the biggest distraction. Thankfully, this silence is broken quite a number of times by the whirring of the fan or the sound of the birds. I find that the silence creates a very unusual feeling, leading to the mind wandering. So I tackle this by reading books aloud. This not only helps me focus on what I am reading but also leads to a better understanding of the concept at hand.

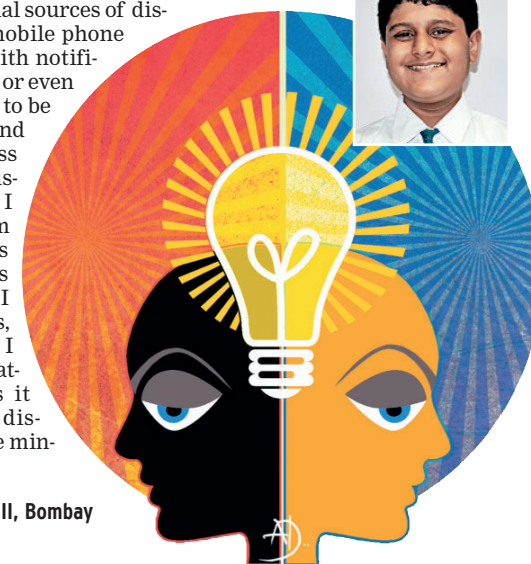
Divij Dodeja, Class X, Nalanda Public School, Mulund (E), Mumbai



## BATTLING MIND GAMES

My biggest distraction is my mind. Of course it's always easier to blame external sources of disturbance like the mobile phone which is buzzing with notifications and updates or even my iPad as it seems to be inviting me to the land of games. But, I guess these are mere excuses my mind seeks. I am no saint, but I am trying my own ways of finding solutions and it has helped. I tell my mind to focus, I try to discipline it. I focus on reading whatever is at hand as it helps to keep the distractions to the bare minimum.

Apurva Singh, Class VIII, Bombay Scottish Powai



## MY SCHOOL PROJECT CONSTELLATIONS

### STARRY NIGHTS

Our Class 7 had done a Physics project on Constellations. We were divided into groups and each group chose a different constellation to work on. We researched the topic, and made models of the various constellations at school. We then made a presentation on the history, the formation, and the characteristics of the constellations we had worked on.

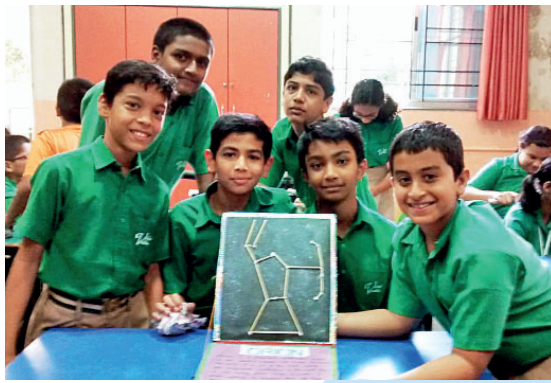
■ Mine was a group of six, and we chose the constellation Cygnus (The Swan). We had to give some information about it in the form of a chart.

■ To make the model we



used a small portion of canvas which we painted to look like the night sky.

■ To represent the main stars of the constellation we used board pins. We covered the pins with aluminium foil and stuck them firmly on the canvas in the shape of Cygnus and connected all the pins with a silver thread.



■ My team and I had a lot of fun while making this project. We learnt a lot about the constellation itself as well as the fascinating history behind it. All through our work on this project, we learnt so many new things about every constellation.

Rubal Mustaq, Class 8, Vidya Valley School, Pune

### THE SWAN

Cygnus is the 16th largest constellation, occupying an area of 804 square degrees. It is an easily recognisable constellation. Its brightest star, Deneb, forms one vertex of the Summer Triangle asterism. Cygnus appears as a 'T'-shaped grouping of stars, with a fainter star Albireo making the T into a cross. Hence, it is sometimes known as the Northern Cross.

