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CLASS 12

PHYSICS

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FOR MARCH 2016 EXAMS

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QUESTION BANK
Chapter-Wise Solutions

Physics

Including Solved Paper 2015
with Toppers Answers of Paper 2014

Class XII

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PREFACE

CBSE always believes in Global Trends of Educational Transformation. The CBSE curriculum gets its lead from National Curriculum Framework – 2005 and Right to Free and Compulsory Education Act – 2009. The aim of CBSE Curriculum is not just to let learners obtain basic knowledge but to make them life-long learners. CBSE always updates and reviews the syllabus to make it more relevant with educational transformation and in last few years the chapters and topics which CBSE has added are very interesting and increase practical knowledge.

Oswaal Question banks are designed to nurture individuality and thus enhance one's innate potentials which help in increasing the self-study mode for students. This book strengthens knowledge and attitude related to subject. It is designed in such a way that students can set their own goals and can improve their problem solving and thinking skills.

The journey of this book is never ending as this book is reviewed every year and new questions, previous year's examination questions, new HOTS or any change in syllabus is updated time to time. Also regular review and reader's feedback increases the efficiency of this book gradually.

Moreover, every Question Bank strictly follows the latest syllabus and pattern, and contains more than sufficient questions and brief description of chapters, which help students in practicing and completing the syllabus. Higher Order Thinking Skills (HOTS) questions, Value Based Questions, Previous Year Questions and Important Questions from NCERT makes this book complete and very efficient. Solutions are always checked twice and tried to make precise as per marking scheme. Practically, this book provides students everything they need to learn.

At last we would like to thank our authors, editors, reviewers and specially students who regularly send us suggestions which helps in continuous improvement of this book and makes this book stand in the category as "One of the Best". Wish you all Happy Learning.

–Publisher

16.06

Highlights of Curriculum Document 2015-16 for March 2016 Exam

Circular No. Acad.-18/2015

Curriculum 2014-15 (Printed in 2014)	Curriculum 2015-16 final for the examination to be held in March 2016
Unit wise distribution of the Course Structure **Unit III** **Magnetic Effects of Current and Magnetism** Straight and toroidal solenoids **Unit V** **Electromagnetic Waves** Need for : displacement current	Unit wise distribution along with the specific Chapters of NCERT textbooks included therein **Unit III** **Magnetic Effects of Current and Magnetism** **Chapter 4 – Moving Charges and Magnetism** Straight and toroidal solenoids (only qualitative treatment) [CBSE Curriculum Vol.-1, Page No. 115] **Unit V** **Electromagnetic Waves** **Chapter 8 – Electromagnetic Waves** Basic idea of : displacement current [CBSE Curriculum Vol.-1, Page No. 116]

SYLLABUS

Time : Three Hours **Marks : 70**

		No. of Periods	Marks
Unit-1	**Electrostatics**	22	15
	Chapter-1 : Electric Charges and Fields		
	Chapter-2 : Electrostatic Potential and Capacitance		
Unit-II	**Current Electricity**	20	
	Chapter-3 : Current Electricity		
Unit-III	**Magnetic Effects of Current and Magnetism**	22	16
	Chapter-4 : Moving Charges and Magnetism		
	Chapter-5 : Magnetism and Matter		
Unit-IV	**Electromagnetic Induction and Alternating Current**	20	
	Chapter-6 : Electromagnetic Induction		
	Chapter-7 : Alternating Current		
Unit-V	**Electromagnetic waves**	04	17
	Chapter-8 : Electromagnetic waves		
Unit-VI	**Optics**	25	
	Chapter-9 : Ray Optics and Optical Instruments		
	Chapter-10 : Wave Optics		
Unit-VII	**Dual Nature of Radiation Matter**	08	10
	Chapter-11 : Dual Nature of Radiation Matter		
Unit-VIII	**Atoms and Nuclei**	14	
	Chapter-12 : Atoms		
	Chapter-13 : Nuclei		
Unit-IX	**Electronic Devices**	15	12
	Chapter-14 : Semiconductor Electronics : Materials,		
	Devices and Simple Circuits		
Unit-X	**Communication Systems**	10	
	Chapter-15 : Communication Systems		
	Total	**160**	**70**

UNIT I : Electrostatics **(Periods 22)**

Chapter-1 : Electric Charges and Fields

Electric Charges; Conservation of charge, Coulomb's law - Forces between two point charges, forces between multiple charges; Superposition principle and continuous charge distribution.

Electric field, electric field lines, electric field due to a point charge; electric dipole, electric field due to a dipole at axial and equitorial position; torque on a dipole in uniform electric field.

Electric flux, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged inifinite plane sheet and uniformly charged thin spherical shell (field inside and outside).

Chapter-2 : Electrostatics Potential and capacitance

Electric Potential. Potential Difference electric potential due to a point charge, a dipole and system of charges; equipotential surfaces, electrical potential energy of a system of two point charges and of electric dipoles in an electrostatic field.

Conductors and insulators, free charges and bound charges inside a conductor; Dielectrics and electric polarisation, capacitor and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with dielectric medium between the plates, energy stored in a capacitor.

UNIT II : Current Electricity **(Periods 20)**

Chapter-3 : Current Electricity

Electric current, flow of electric charges in a metallic conductor, drift velocity and mobility, and their relation with electric current; Ohm's law, electrical resistance, V-I characteristics (linear and non-linear), electrical energy and power, electrical resistivity and conductivity, Carbon resistors, colour code for carbon resistors; series and parallel combination of resistors; temperature dependence of resistance.

Emf and potential difference of a cell, internal resistance of a cell, combination of cells in series and in parallel.

Kirchhoff's laws and simple applications. Wheatstone bridge, Meter bridge.

Potentiometer - principle and applications to measure potential difference and for comparing emf of two cells; measurement of internal resistance of a cell.

UNIT-III : Magnetic Effects of Current and Magnetism **(Periods 22)**

Chapter-4 : Moving Charge and Magnetism

Concept of magnetic field, Oersted's experiment.

Biot-Savart law and its application to current carrying circular loop.

Ampere's law and its applications to infinitely long straight wire. Straight and toroidal solenoids, Force on a moving charge in uniform magnetic and electric fields. Cyclotron.

Force on current - carrying conductor in a uniform magnetic field. Force between two parallel current carrying conductors -definition of ampere. Torque experienced by a current loop in a uniform magnetic field, moving coil galvanometer - its current sensitivity and conversion to ammeter and voltmeter.

Chapter-5 : Magnetism and Matter

Current loop as a magnetic dipole and its magnetic dipole moment; Magnetic dipole moment of a revolving electron; Magnetic field intensity due to magnetic dipole (bar magnet) along its axis and perpendicular to its axis; Torque on a magnetic dipole (bar magnet) in a uniform magnetic field; Bar magnet as an equivalent solenoid, Magnetic field lines; Earth's magnetic field and magnetic elements; Para-, dia- and ferro-magnetic substances with examples, Electromagnets and factors affecting their strengths. Permanent magnets.

UNIT-IV : Electromagnetic Induction and Alternating Current **(Periods 20)**

Chapter-6 : Electromagnetic Induction

Electromagnetic induction, Faraday's laws, Induced emf and current, Lenz's law, Eddy currents, Self and mutual inductance.

Chapter-7 : Alternating Current

Alternating currents, peak and RMS value of alternating current/voltage, reactance and impedance; LC oscillations (qualitative treatment only), LCR series circuit, resonance; power in AC circuits, wattless current.

AC generator and transformer.

UNIT-V : Electromagnetic Waves **(Periods 4)**

Chapter-8 : Electromagnetic Waves

Need for Displacement current, Electromagnetic waves and their characteristics their Transverse nature of Qualitative ideas only.

Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, X-rays, gamma rays) including elementary facts about their uses.

UNIT-VI : Optics **(Periods 25)**

Chapter-9 : Ray Optics and Optical Instruments

Ray optics and Reflection of light, spherical mirrors, mirror formula. Refraction of light, total internal reflection and its applications, optical fibres, refraction at spherical surfaces, lenses, thin lens formula, lens maker's formula; Magnification, Power of a lens, combination of thin lenses in contact; combination of a lens and a mirror, refraction and dispersion of light through a Prism Scattering of light - blue colour of sky and reddish appearance of the sun at sunrise & sunset; optical Instruments; microscopes and astronomical telescopes (refflecting and refracting and their magnifying powers.

Chapter-10 : Wave optics

Wave front and Huygen's principle; Reflection and refraction of plane wave at a plane surface using wave fronts. Proof of laws of reflection and refraction using Huygens' Principle. Interference, coherent sources and sustained interferance of light, Young's double slit experiment and expression for fringe width. Diffraction due to a single slit, width of central maximum. Polarisation, Plane polarised light, Brewster's law, Use of plane polarised light and Polaroids.

UNIT-VII : Dual Nature of Matter and Radiation **(Periods 8)**

Chapter-11 : Dual Nature of Radiation and Matter

Dual nature of radiation. Photoelectric effect, Experimental observation and their significance, Hertz and Lenard's observations; Einstein Photoelectric equation - particle nature of light.

Matter waves - wave nature of particles, de-Broglie relation, Davisson and Germer experiments.

(Experimental details should be omitted, Only Conclusion should be explained)

UNIT VIII : Atoms and Nuclei **(Periods 18)**

Chapter-12 : Atoms

Alpha-particle scattering, experiment; Rutherford's model of atom; Bohr model, energy levels, hydrogen spectrum.

Chapter-13 : Nuclei

Composition and size of nucleus, atomic masses, isotopes, isobars; isotones. Radioactivity - Alpha, Beta and Gamma particles/rays and their properties, radioactive decay law. Mass-energy relation, mass defect, binding energy per nucleon, its variation with mass number, nuclear fission and nuclear fusion.

UNIT-IX : Electronic Devices **(Periods 18)**

Chapter-14 : Semiconductor Electronics : Materials, Devices and simple Cirtuits

Energy bands in solids, conductor, insulator and semiconductors; semiconductor diode - I-V characteristics in forward and reverse bias, diode as a rectifier; I-V characteristics of LED, photodiode, solar cell and Zener diode; Zener diode as a voltage regulator. Junction transistor, transistor action, characteristics of a transistor; transistor as an amplifier (common emitter configuration) and oscillator. Logic gates (OR, AND, NOT, NAND and NOR). Transistor as switch.

UNIT-X : Communication Systems **(Periods 10)**

Chapter-15 : Communication Systems

Elements of a communication system (block diagram only); bandwidth of signals (speech, TV and digital data); bandwidth of tansmission medium. Propagation of electromagnetic waves in the atmosphere, sky and space wave propagation. Satellite Communication Need for modulation, amplitude modulation and frequency modulation, advantages of frequency modulation over amplitude modulation. Basic ideas about internet, mobile telephony and global positioning system (GPS).

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PHYSICS

QUESTION PAPER DESIGN

Class - XII (2015-16)

S. No.	Typology of Questions	Very Short Answer (VSA) (1 mark)	Short Answer-I (SA-1) (2 marks)	Short Answer-II (SA-II) (3 marks)	Value based question (4 marks)	Long Answer (LA) (5 marks)	Total Marks	% Weightage
1.	**Remembering :** (Knowledge based Simple recall questions, to know specific focus, terms, concepts, principles, or theories, Identify define, or recite. information	2	1	1	–	–	7	10%
2.	**Understanding** (Comprehension : To be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase information)	–	2	4	–	1	21	30%
3.	**Application :** (Use abstract information in concrete situation, to apply knowledge to new situations, use given content to interpret a situation, provide an example, or solve a problem)	–	2	4	–	1	21	30%
4.	**High Order Thinking Skills (Analysis & Synthesis :** Classify, compare, contrast, or differentiate between different pieces of information, organize and/or integrate unique pieces of information from a variety of sources)	2	–	1	–	1	10	14%
5.	**Evaluation and Multi-Disciplinary :** (Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values)	1	–	2	1	–	11	16%
	Total	$5 \times 1 = 5$	$5 \times 2 = 10$	$12 \times 3 = 36$	$4 \times 1 = 4$	$5 \times 3 = 15$	70(26)	100%

QUESTION WISE BREAK UP

Type of Questions	Marks (s) per Questions	Total No. of Questions	Total Marks
VSA	1	5	05
SA-I	2	5	10
SA-II	3	12	36
VBQ	4	1	04
LA	5	3	15
Total		26	70

1. **Internal Choice :** There is no overall choice in the paper. However, there is an internal choice in one question of 2 marks weightage, one question of 3 marks weightage and all three question of 5 marks weightage.
2. The above template is only a sample. Suitable internal variations may be made for generating similar templates keeping the overall weightage to different form of questions and typology of questions same.

SOLVED PAPER	C.B.S.E. 2015 Class–XII Outside Delhi	Physics

Time : 3 Hours **Max. Marks : 70**

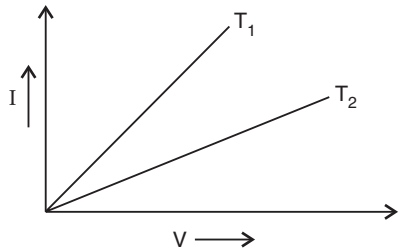
Outside Delhi Set I **Code No. 55/1/RU**

SECTION - A

1. Define the term 'self-inductance' of a coil. Write its S.I. unit. **1**

2. Why does bluish colour predominate in a clear sky ? **1**

3. I—V graph for a metallic wire at two different temperatures, T_1 and T_2 is as shown in the figure. Which of the two temperatures is lower and why ? **1**



4. Which basic mode of communication is used for telephonic communication ? **1**

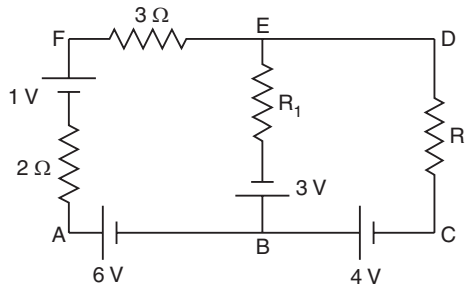
5. Why do the electrostatic field lines not form closed loops ? **1**

SECTION - B

6. When an electron in hydrogen atom jumps from the excited state to the ground state, how would the de-Broglie wavelength associated with the electron change ? Justify your answer. **2**

7. Write two factors which justify the need of modulating a low frequency signal into high frequencies before transmission. **2**

8. Use Kirchhoff's rules to determine the potential difference between the points A and D when no current flows in the arm BE of the electric network shown in the figure. **2**



9. You are given two converging lenses of focal lengths 1.25 cm and 5 cm to design a compound microscope. If it is desired to have a magnification of 30, find out the separation between the objective and the eyepiece. **2**

OR

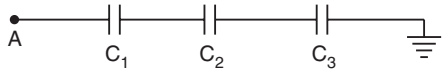
A small telescope has an objective lens of focal length 150 cm and eyepiece of focal length 5 cm. What is the magnifying power of the telescope for viewing distant objects in normal adjustment ?

If this telescope is used to view a 100 m tall tower 3 km away, what is the height of the image of the tower formed by the objective lens ? **2**

10. Calculate the shortest wavelength in the Balmer series of hydrogen atom. In which region (infra-red, visible, ultraviolet) of hydrogen spectrum does this wavelength lie ? **2**

SECTION - C

11. Calculate the potential difference and the energy stored in the capacitor C_2 in the circuit shown in the figure. Given potential at A is 90 V, $C_1 = 20\ \mu F$, $C_2 = 30\ \mu F$, and $C_3 = 15\ \mu F$, **3**



12. Find the relation between drift velocity and relaxation time of charge carriers in a conductor.

A conductor of length L is conneted to a d.c. source of emf 'E'. If the length of the conductor is tripled by stretching it, keeping 'E' constant, explain how its drift velocity would be affected. **3**

13. State clearly how an unpolarised light gets linearly polarised when passed through a polaroid.

(i) Unpolarised light of intensity I_0 is incident on a polaroid P_1 which is kept near another polaroid P_2 whose pass axis is parallel to that of P_1. How will the intensities of light, I_1 and I_2, transmitted by the polaroids P_1 and P_2 respectively, change on rotating P_1 without disturbing P_2 ?

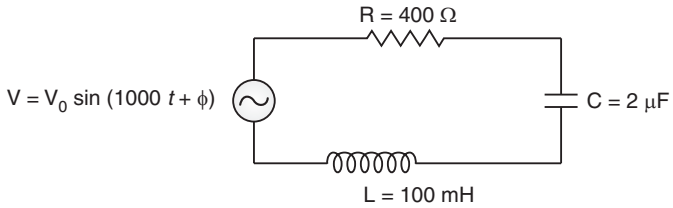
(ii) Write the relation between the intensities I_2 and I_2. **3**

14. Define modulation index. Why is its value kept, in practice, less than one ?

A carrier wave of frequency 1.5 MHz and amplitude 50 V is modulated by a sinusoidal wave of frequency 10 kHz producing 50% amplitude modulation. Calculate the amplitude of the AM wave and frequencies of the side bands produced. **3**

15. A uniform magnetic field $\vec{B}$ is set up along the positive x-axis. A particle of charge 'q' and mass 'm' moving with a velocity $\vec{v}$ enters the field at the origin in X-Y plane such that it has velocity components both along and perpendicular to the magnetic field $\vec{B}$. Trace, giving reason, the trajectory followed by the particle. Find out the expression for the distance moved by the particle along the magnetic field in one rotation. **3**

16. (a) Determine the value of phase difference between the current and the voltage in the given series LCR circuit.

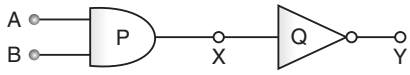


(b) Calculate the value of the additional capacitor which may be joined suitably to the cpacitor C that would make the power factor of the the circuit unity. **3**

17. Write the expression for the generalized form of Ampere's circuital law. Discuss its significance and describe briefly how the concept of displacement current is explained through charging/discharging of a capacitor in an electric circuit. **3**

18. Use Huygens' principle to show how a plane wavefront propagates from a denser to rarer medium. Hence verify Snell's law of refraction. **3**

19. Identify the gates P and Q shown in the figure. Write the truth table for the combination of the gates shown.



Name the equivalent gate representing this circuit and write its logic sympol. **3**

20. Draw a circuit diagram of a C.E. transistor amplifier. Briefly explain its working and write the expression for (i) current gain, (ii) voltage gain of the amplifier. **3**

21. (a) Write three characteristic properties of nuclear force.

(b) Draw a plot of potential energy of a pair of nucleons as a function of their separation. Write two important conclusions that can be drawn from the graph. **3**

22. (a) Describe briefly three experimentally observed features in the phenomenon of photoelectric effect.

(b) Discuss briefly how wave theory of light cannot explain these features. **3**

OR

(a) Write the important properties of photons which are used to establish Einstein's photoelectric equation.

(b) Use this equation to explain the concept of (i) threshold frequency and (ii) stopping potential. **3**

SECTION - D

23. One morning an old man walked bare-foot to replace the fuse wire in kit kat fitted with power supply mains for his house. Suddenly he screamed and collapsed on the floor. His wife cried loudly for help. His neighbour's son Anil heard the cries and rushed to the place with shoes on. He took a wooden baton and used it to switch off the main supply.

Answer the following questions :

(i) What the voltage and frequency of mains supply in India ?

(ii) These days most of the electrical devices we use require a.c. voltage. Why ?

(iii) Can a transformer be used to step up d.c. voltage ?

(iv) Write two qualities displayed by Anil by his action. **4**

SECTION - E

24. (a) Define electric flux. Write its S.I. unit.

"Gauss's law in electrostatics is true for any closed surface, no matter what its shape of size is." Justify this statement with the help of a suitable example.

(b) Use Gauss's law to prove that electric field inside a uniformly charged spherical shell is zero. **5**

OR

(a) Derive the expression for the energy stored in a parallel plate capacitor. Hence obtain the expression for the energy density of the electric field.

(b) A fully charged parallel plate capacitor is connected across an uncharged identical capacitor. Show that the energy stored in the combination is less than that stored initially in the single capacitor. **5**

25. Explain, using a labelled diagram, the principle and working of a moving coil galvanometer. What is the function of (i) uniform radial magnetic field, (ii) soft iron core ?

Define the terms (i) current sensitivity and (ii) voltage sensitivity of a galvanometer. Why does increasing the current sensitivity not necessarily increase voltage sensitivity ? **5**

OR

(a) Write using Biot—Savart law, the expression for the magnetic field $\vec{B}$ due to an element $\vec{dl}$ carring current I at a distance $\vec{r}$ from it in a vector from.

Hence derive the expression for the magnetic field due to a current carrying loop of radius R at a point P distant x from its centre along the axis of the loop.

(b) Explain how Biot—Savart law enables one to express the Ampere's circuital law in the integral form, viz., **5**

$$\oint \vec{B}.\vec{dl} = \mu_0 I$$

where I is the total current passing through the surface.

26. (a) Consider two coherent sources S_1 and S_2 producing monochromatic waves to produce interference pattern. Let the diplacement of the wave produced by S_1 be given by

$$Y_1 = a \cos \omega t$$

and the displacement by S_2 be

$$Y_2 = a \cos (\omega t + \phi).$$

Find out the expression for the amplitude of the resultant displacement at a point and show that the intensity at that point will be

$$I = 4a^2 \cos^2 \phi/2$$

Hence establish the conditions for constructive and destructive interference.

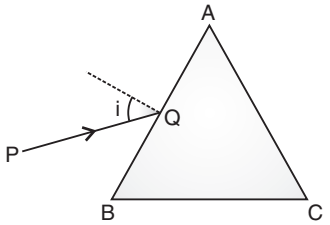
(b) What is the effect on the interference fringes in Young's double slit experiment when (i) the width of the source slit is increased; (i) the monochromatic source is replaced by a source of white light. **5**

OR

(a) A ray 'PQ' of light is incident on the face AB of a glass prism ABC (as shown in the figure) and emerges out of the face AC. Trace the path of the ray. Show that

$$\angle i + \angle e = \angle A + \angle \delta$$

When δ and e denote the angle of deviation and angle of emergence respectively.



Plot a graph showing the variation of the anlge of deviation as a function of angle of incidence. State the condition under which ∠δ is minimum.

(b) Find out the relation between the refractive index (μ) of the glass prism and ∠A for the case when the angle of prism (A) is equal to the angle of minimum deviation (δ_m). Hence obtain the value of the refractive index for angle of prism A = 60°. **5**

Outside Delhi Set II — Code No. 55/2/RU

Note : All questions are from Set I.

Outside Delhi Set III — Code No. 55/3/RU

Note : All questions are from Set I & II.

Delhi Set I — Code No. 55/1/1/D

SECTION A

1. Define capacitor reactance. Write its S.I. units. **1**

2. What is the electric flux through a cube of side 1 cm which encloses an electric dipole ? **1**

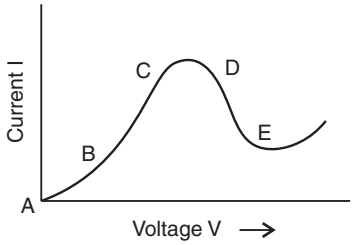
3. A concave lens of refractive index 1.5 is immersed in a medium of refractive index 1.65. What is the nature of the lens ? **1**

4. How are side bands produced ?

5. Graph showing the variation of current versus voltage for a material GaAs is shown in the figure, Identify the region of :

(i) negative resistance

(ii) where Ohm's law is obeyed. **1**



SECTION B

6. A proton and an α-particle have the same de-Broglie wavelength. Determine the ratio of (i) their accelerating potentials (ii) their speeds. **2**

7. Show that the radius of the orbit in hydrogen atom varies as n^2, where n is the principal quantum number of the atom. **2**

8. Distinguish between 'intrinsic' and 'extrinsic' semiconductors. **2**

9. Use the mirror equation to show that an object placed between f and $2f$ of a concave mirror produces a real image beyond $2f$. **2**

OR

Find an expression for intensity of transmitted light when a polaroid sheet is rotated between two crossed polaroids. In which position of the polaroid sheet will the transmitted intensity be maximum ?

10. Use Kirchhoff's rules to obtain conditions for the balance condition in a Wheatstone bridge. **2**

SECTION C

11. Name the parts of the electromagnetic spectrum which is :

(a) suitable for radar systems used in aircraft navigation.

(b) used to treat muscular strain.

(c) used as a diagnostic tool in medicine.

Write in brief, how these waves can be produced. **3**

12. (i) A giant refracting telescope has an objective lens of focal length 15m. If an eye piece of focal length 1.0 cm is used, what is the angular magnification of the telescope ?

(ii) If this telescope is used to view the moon, what is the diameter of the image of the moon formed by the objective lens ? The diameter of the moon is 3.48×10^8 m and the radius of lunar orbit is 3.8×10^8 m. **3**

13. Write Einstein's photoelectric equation and mention which important features in photoelectric effect can be explained with the help of this equation.

The maximum kinetic energy of the photoelectrons gets doubled when the wavelength of light incident on the surface changes from λ_1 to λ_2. Derive the expressions for the threshold wavelength λ_0 and work function for the metal surface.

14. In the study of Geiger-Marsdon experiment on scattering of α-particles by a thin foil of gold, draw the trajectory of α-particles in the coulomb field of target nucleus. Explain briefly how one gets the information on the size of the nucleus from this study.

From the relation $R = R_0 A^{1/3}$, where R_0 is constant and A is the mass number of the nucleus, show that nuclear matter density is independent of A. **3**

OR

Distinguish between nuclear fission and fusion. Show how in both these processes energy is released.

Calculate the energy release in MeV in the deuterium-tritium fusion reaction :

$$^2_1\text{H} + ^3_1\text{H} \rightarrow ^4_1\text{He} + n$$

Using the data :

$$m\left(^2_1\text{H}\right) = 2.014102\ u$$

$$m\left(^3_1\text{H}\right) = 3.016049\ u$$

$$m\left(^4_2\text{He}\right) = 4.002603\ u$$

$$m_n = 1.008665\ u$$

$$1u = 931.5\ \text{MeV/c}^2$$

15. Draw a block diagram of a detector for AM signal and show, using necessary processes and the waveforms, how the original message signal is detected from the input AM wave. **3**

16. A cell of emf 'E' and internal resistance 'r' is connected across a variable load resistor R. Draw the plots of the terminal voltage V versus (i) R and (ii) the current I. **3**

It is found that when $R = 4\ \Omega$, the current is 1 A when R is increased to $9\ \Omega$, the current reduces to 0.5 A. Find the values of the emf E and internal resistance r.

17. Two capacitors of unknown capacitances C_1 and C_2 are connected first in series and then in parallel across a battery of 100 V. If the energy stored in the two combinations is 0.045 J and 0.25 J respectively, determine the value of C_1 and C_2. Also calculate the charge on each capacitor in parallel combination. **3**

18. State the principle of working of a galvanometer.

A galvanometer of resistance G is converted into a voltmeter to measure upto V volts by connecting a resistance R_1 in series with the coil. If a resistance R_2 is connected in series with it, then it can measure upto V/2 volts. Find the resistance, in terms of R_1 and R_2, required to be connected to convert it into a voltmeter that can read upto 2 V. Also find the resistance G of the galvanometer in terms of R_1 and R_2. **3**

19. With what considerations in view, a photodiode is fabricated ? State its working with the help of a suitable diagram.

Eventhough the current in the forward bias is known to be more than in the reverse bias, yet the photodiode works in reverse bias. what is reason ? **3**

20. Draw a circuit diagram of a transistor amplifier in CE configuration.

Define the terms : (i) Input resistance and (ii) Current amplification factor. How are these determined using typical input and output characteristics ? **3**

21. Answer the following question :

(a) In a double slit experiment using light of wavelength 600 nm, the angular width of the fringe formed on a distant screen is 0.1°. Find the spacing between the two slits.

(b) Light of wavelength 5000 Å propagating in air gets partly reflected from the surface of water. How will the wavelengths and frequencies of the reflected and refracted light be affected ? **3**

22. An inductor L of inductance X_L is connected in series with a bulb B and an ac source. How would brightness of the bulb change when (i) number of turn in the inductor is reduced, (ii) an iron rod is inserted in the inductor and (iii) a capacitor of reactance $X_C = X_L$ is inserted in series in the circuit. Justify your answer in each case. **3**

SECTION D

23. A group of students while coming from the school noticed a box marked "Danger H.T. 2200 V" at a substation in the main street. They did not understand the utility of such a high voltage, while they argued, the supply was only 220 V. They asked their teacher this question the next day. The teacher thought it to be an important question and therefore explained to the whole class.

Answer the following questions :

(i) What device is used to bring the high voltage down to low voltage of a.c. current and what is the principle of its working ?

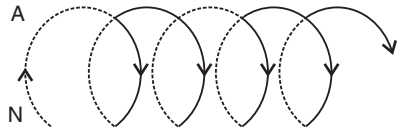
(ii) Is it possible to use this device for bringing down the high d.c. voltage to the low voltage ? Explain.

(iii) Write the values displayed by the students and the teacher. **4**

SECTION E

24. (a) State Ampere's circuital law. Use this law to obtain the expression for the magnetic field inside an air cored toroid of average radius '*r*', having '*n*' turnper unit length and carrying a steady current I.

(b) An observer to the left of a solenoid of N turns each of cross section area 'A' Observes that a steady current I in it flows in the clockwise direction. Depict the magnetic field lines due to the solenoid specifying its polarity and show that acts as a bar magnet of magnetic moment m = NIA. **5**



OR

(a) Define mutual inductance and write its S.I. units.

(b) Derive an expression for the mutual inductance of two long co-axial solenoids of same length wound one over the other.

(c) In an experiment, two coils c_1 nad c_2 are placed closed to each other. Find out the expression for the emf induced in the coil c_1 due to a change in the current through the coil c_2. **5**

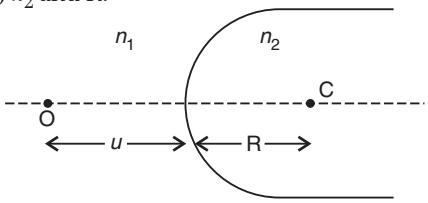
25. (a) Using Huygens's construction of secondary wavelets explain how a diffraction pattern is obtained on a screen due to a narrow slit on which a monochromatic beam of light is incident normally.

(b) Show that the angular width of first diffraction fringe is half that of the central fringe.

(c) Explain why the maxima at $\theta = \left(n+\frac{1}{2}\right)\frac{\lambda}{a}$ become weaker and weaker with increasing *n*. **5**

OR

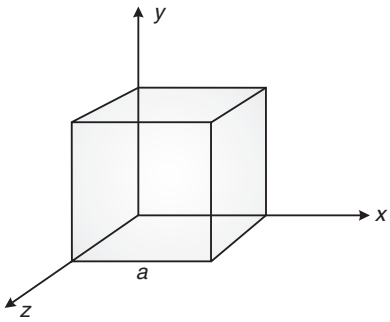
(a) A point object 'O' is kept in a medium of refractive index n_1 in front of a convexspherical surface of radius of curvature R which separates and second medium refractive index n_2 from the first one, as shown in the figure. Draw the ray diagram showing the image formation and deduce the relationship between the object distance and the image distance in terms of n_1, n_2 and R.



(b) When the image formed above acts as a virtual object for a concave spherical surface separating the medium n_2 from n_1 ($n_2 > n_1$). draw this ray diagram and a write the similar [similar to (a)] relation. Hence obtain the expression for the lens maker's formula. **5**

26. (a) An electric dipole of dipole moment $\vec{p}$ consists of point charges $+q$ and $-q$ separated by a distance $2a$ apart. Deduce the expression for the electric field $\vec{E}$ due to the dipole at a distance x from the centre of the dipole on its axial line in terms of the dipole moment $\vec{p}$. Hence show that in the limit $x >> a$, $\vec{E} \to 2\vec{p}/(4\pi\varepsilon_0 x^3)$.

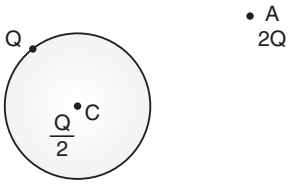
(b) Given the electric field in the region $\vec{E} = 2x\hat{i}$, find the net electric flux through the cube and the charge enclosed by it. **5**



OR

(a) Explain, using suitable diagrams, the differnce in the behaviour of a (i) conductor and (ii) dielectric in the presence of external electric field. Define the terms polarization of a dielectric and write its relation with susceptibility.

(b) A thin metallic spherical shell of radius R carries a charge Q on its surface. A point charge $\frac{Q}{2}$ is placed at its centre C and an other charge +2Q is placed outside the shell at a distance x from the centre as shown in the figure. Find (i) the force on the charge at the centre of shell and at the point A, (ii) the electic flux through the shell. **5**



Delhi Set II — Code No. 55/1/2/D

Note : All questions are from Set I.

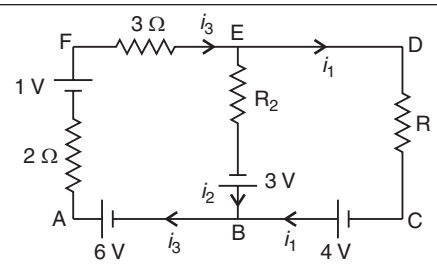
Delhi Set III — Code No. 55/1/3/D

Note : All questions are from Set I & II.

SOLUTIONS
(CBSE Marking Scheme, 2015)

Outside Delhi Set I, II, III **SET-55/1/RU**

Q. No.	Expected Answer / Value Points	Marks	Total Marks
	SECTION - A		
Set 1, Q. 1. **Set 2, Q. 5.** **Set 3, Q. 4.**	Self inductance of the coil is numerically equal to magnetic flux linked with it when unit current flow through it. Self inductance is numerically equal to induced emf in the coil when rate of change of current is unity. Unit-Henry or / volt-second/ampere / weber ampere^{-1}	½ ½	1
Set 1, Q. 2. **Set 2, Q. 3.** **Set 3, Q. 1.**	Scattering of the blue colour is maximum due to its shorter wavelenth / As per Rayleigh scattering law, the amount of scattering varies inversely with the fourth power of wavelenght.	1	1
Set 1, Q. 3. **Set 2, Q. 4.** **Set 3, Q. 5.**	T_1 Since slope ($= \frac{1}{\text{Resistance}}$) of T_1 is greater / Resistance of the wire at T_1 is lower.	½ ½	1
Set 1, Q. 4. **Set 2, Q. 2.** **Set 3, Q. 3.**	Point to Point communication mode.	1	1
Set 1, Q. 5. **Set 2, Q. 1.** **Set 3, Q. 2.**	Due to conservative nature of electric field / These lines start from the positive charges and terminate at the negative charges. **Alternatively** There are two kinds of electric charges (positive and negative) (which acts as the 'source' and 'sink' for the electric field lines.)	1	1
	SECTION - B		
Set 1, Q. 6. **Set 2, Q. 8.** **Set 3, Q. 10.**	Formula for Energy ½ Formula for de-Broglie wavelength ½ Calculation ½ Effect on wavelength ½ $\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mK}}$ $\frac{\lambda_1}{\lambda_4} = \sqrt{\frac{K_4}{K_1}}$ But $K_n(= -E_n) \propto \frac{1}{n^2}$ Hence, $\frac{\lambda_1}{\lambda_4} = \sqrt{\frac{1}{16}}$ $\therefore \frac{\lambda_1}{\lambda_4} = \frac{1}{4}$ $\lambda_4 = 4\lambda_1$ *i.e.* $\lambda_4 > \lambda_1$ **Alternatively** $\lambda_n = \frac{h}{p_n} = \frac{\lambda}{mv_n}$ Velocity of electron in nth state $v_n \propto \frac{1}{n}$	½ ½ ½ ½ ½ ½	2

	$\lambda_n \propto \frac{1}{v_n}$ $\therefore \lambda \propto n$	½	
	$\therefore \quad \frac{\lambda_4}{\lambda_1} = \frac{n_4}{n_1} = \frac{4}{1}$	½	**2**
Set 1, Q. 7. **Set 2, Q. 6.** **Set 3, Q. 9.**	Any two Factors 1 + 1 **1.** Size of the antenna or aerial or $(L \sim \frac{\lambda}{4})$ **2.** Increase in effective power radiated by an antenna (OR Power radiated $\alpha\left(\frac{1}{\lambda}\right)^2$) **3.** To minimize mixing of signals from different transmitters. (Any two)	**1 + 1**	**2**
Set 1, Q. 8. **Set 2, Q. 9.** **Set 3, Q. 7.**	Labeling of current in different branches of the circuit ½ Calculation **1** Result ½  According to Kirchoff's Junction law at B $i_3 = i_1 + i_2 \therefore i_3 = i_1$ (As $I_2 = 0$ (given)) Apply second law to loop AFEB $i_3 \times 2 + i_3 \times 3 + i_2R_1 = 1 + 3 + 6$ $\therefore \quad i_3 = i_1$ 2A From A to D along AFD $\therefore \quad V_{AD} = 2i_3 - 1 + 3 \times i_3$ $= (4 - 1 + 6)V$ $= 9V$ [**Alternatively**, if the student determine value of V_{AD} by finding the value of R, award full marks.] [**Note :** If the student just writes Kirchoff's rules, award ½ mark]	½ ½ ½ ½	**2**
Set 1, Q. 9. **Set 2, Q. 10.** **Set 3, Q. 8.**	Formula for magnification ½ Substitution and Calculation **1** Result ½ $m = m_0 \times m_e$ $= \frac{L}{f_0}\left(1 + \frac{D}{f_e}\right)$ $\therefore \quad 30 = \frac{L}{1.25}\left(1 + \frac{25}{5}\right)$ $30 \times 1.25 = L \times 6$ $L = 5 \times 1.25$ $= 6.25$ em	½ ½ ½ ½	**2**

	OR Formula for magnification ½ Calculation & Result ½ Angular magnification ½ Height of image ½ $M = \frac{f_0}{f_e}$ $\therefore \quad M = \frac{150}{5} = 30$ For objective lens, $\frac{1}{v_0} - \frac{1}{u_0} = \frac{1}{f_0}$ $\frac{1}{v_0} = \frac{1}{1.5} - \frac{1}{3000}$ $\therefore \quad v_0 = \frac{3000}{1999} \approx 1.5$ $\frac{h_i}{h_0} = \frac{v_0}{u_0}$ $h_i = 100 \times \frac{1.5}{3 \times 10^3} = .05$ m **Alternatively,** Angular size of the object = $\frac{100}{3 \times 1000}$ radian = $\frac{1}{30}$ radian $\therefore$ Angular size of image = $(\frac{1}{30} \times 30)$ radian = 1 radian $\therefore$ Height of image = $1 \times \left(\frac{5}{100}\right)$ m = 0.05 m	½ ½ ½ ½ ½ ½ ½ ½ **1**	**2**
Set 1, Q. 10. **Set 2, Q. 7.** **Set 3, Q. 6.**	Formula ½ Substitution of currect value in formula ½ Value of λ ½ Region of Wavelength ½ $\frac{1}{\lambda} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$ For shortest wavelength in Balmer series $n_1 = 2 \; n_2 = \infty$ $\therefore \quad \frac{1}{\lambda} = R\left(\frac{1}{4} - \frac{1}{\infty}\right)$ $= \frac{R}{4}$ $\because \quad \lambda = 3640$Å $R = 1.09 \times 10^7 \text{ m}^{-1}$ [**Note :** Since the value of R is not given, award full marks to the candidate if he writes $= \frac{4}{R}$] It will lie in Ultra Violet region (Give ½ mark if the student just writes, visible region)	½ ½ ½ ½ ½	**2**

SECTION - C

Set 1, Q. 11.
Set 2, Q. 18.
Set 3, Q. 15.

Formula for net capacitance and its calculation	½ + ½
Calculation for net charge	½
Formula and calculation for P.D.	½
Formula and calculation for energy stored	½ + ½

Net Capacitance, $\frac{1}{c} = \frac{1}{c_1} + \frac{1}{c_2} + \frac{1}{c_3}$ ½

$\frac{1}{c} = \frac{1}{20} + \frac{1}{30} + \frac{1}{15}$

$\therefore \quad C = \frac{20}{3}\mu F$ ½

Net Charge on Capacitors

$q = CV$

$= \frac{20}{3} \times 10^{-6} \times 90\ C$

$= 600 \times 10^{-6}\ C$

$= 600\ \mu\ C(\ 0.6\ mC\ )$ ½

$\therefore \quad P.d$ across $C_2 = \frac{q}{c_2}$

$= \frac{600 \times 10^{-6}}{30 \times 10^{-6}} V$ ½

$= 20\ V$

Energy stored in capacitor across $C_2 = \frac{1}{2}\ C_2\ C_2^2$ ½

$= \frac{1}{2} \times 30 \times 10^{-6} \times 400$ ½

$= 6 \times 10^{-3}\ J(= 6mj)$ **3**

Set 1, Q. 12.
Set 2, Q. 19.
Set 3, Q. 16.

Derivation of the Relation	**2**
Effect on drift velocity	**1**

There being a random distribution, in the velocities of the charge carriers, their average velocity can be taken to be zero. ½

We have, $F = ma = e\ F_E$ (F_E = electric field)

$\therefore \quad a = \frac{eF_E}{m}$ ½

If τ is the average time between collisions (called 'relaxation time') ½

$v_d = \frac{eF_E\tau}{m}$

Now, $F_E = \frac{P.D}{distance}$

$\therefore$ For given E, the field becomes $\frac{1}{3}\ rd$ when the length is made 3 times. Hence,

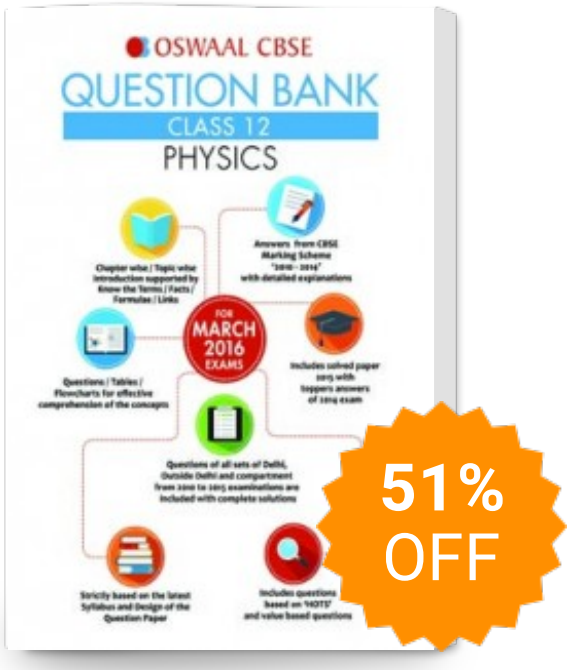
$v'_d\ (New) = \frac{1}{3}\ v_d$ ½

$\therefore \quad v_d' = \frac{vd}{3}$ ½

[**Note :** If explained by an other appropriate method **award 1 mark** for the explantion.]

3

Oswaal CBSE Question Bank chapter-wise solutions For Class 12 Physics



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