SAMPLE CONTENT

MHT-CET 2021

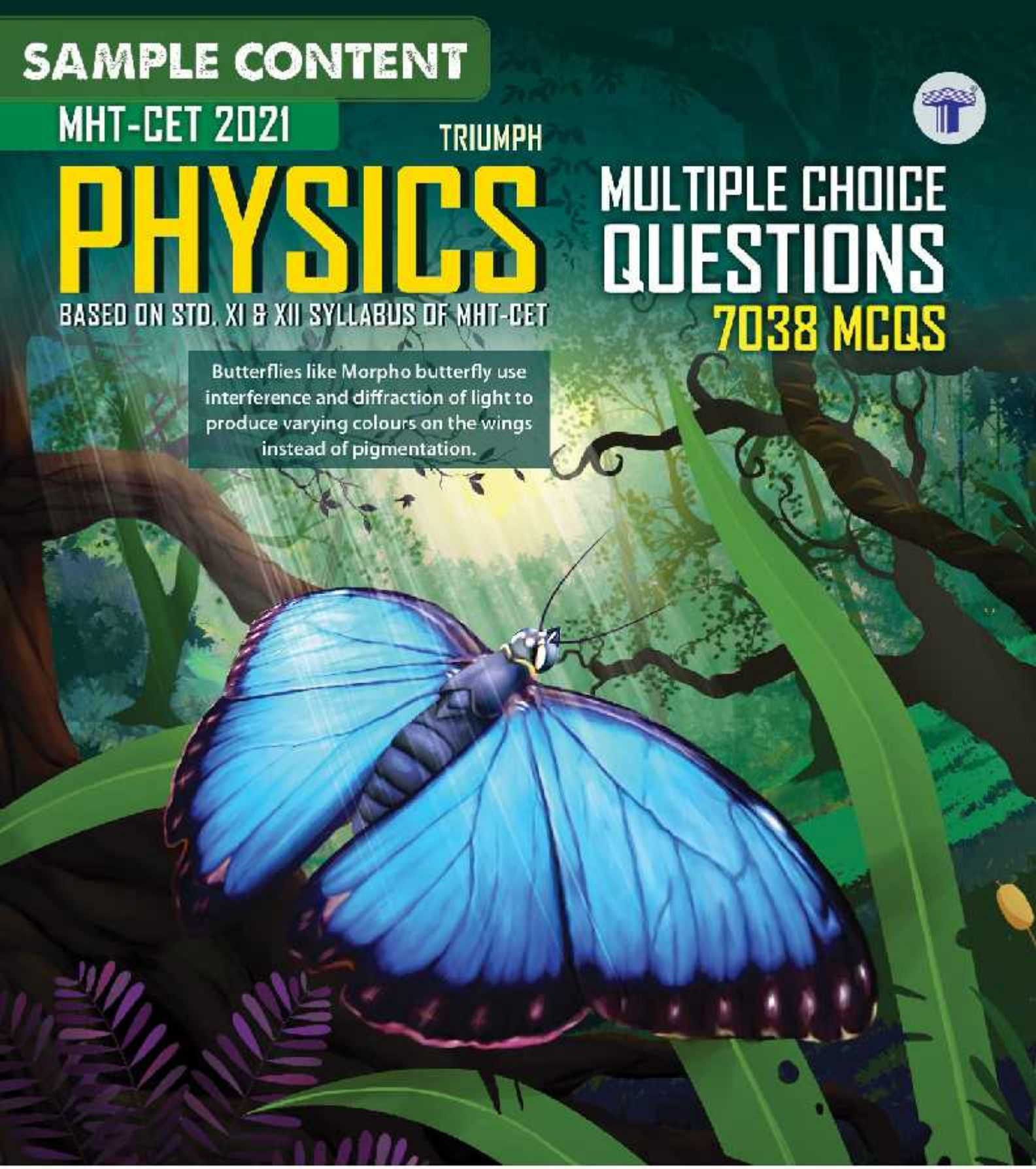
TRIUMPH

PHYSICS

MULTIPLE CHOICE QUESTIONS

BASED ON STD. XI & XII SYLLABUS OF MHT-CET

7038 MCQS



Target Publications® Pvt. Ltd.

Written in accordance with the latest MHT-CET Paper Pattern which includes topics based on Std. XII Sci. and relevant chapters of Std. XI Sci. (Maharashtra State Board)

MHT-CET TRIUMPH PHYSICS

Based on Std. XI & XII Syllabus of MHT-CET

7038 MULTIPLE CHOICE QUESTIONS

Salient Features

- Includes chapters of Std. XII and relevant chapters of Std. XI as per latest MHT-CET Syllabus.
- Exhaustive subtopic wise coverage of MCQs.
- '7038' MCQs including questions from various competitive exams.
- Notes, Shortcuts, Mindbenders, Formulae provided in each chapter.
- Includes MHT-CET 2020 Question Paper (14^{th} October) along with Answer key.
- Various competitive examination questions till the latest year.
- Evaluation test provided at the end of each chapter.
- Inclusion of 'The physics of ...' to engage students in scientific enquiry.
- Two Model Question Papers with answers key and solutions provided in the form of QR Code.

Scan the adjacent QR code to download Model Paper I and Solution.	*Scan the adjacent QR code to download Model Paper II and Solution.*	*Scan the adjacent QR code to download Hints for relevant questions, Solutions to Evaluation Test and MHT-CET paper 2020 in PDF format.*

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PREFACE

"Don't follow your dreams; chase them!"- a quote by Richard Dumbrill is perhaps the most pertinent for one who is aiming to crack entrance examinations held after std. XII. We are aware of an aggressive competition a student appearing for such career defining examinations experiences and hence wanted to create books that develop the necessary knowledge, tools and skills required to excel in these examinations.

For the syllabus of **MHT-CET 2021**, 80% of the weightage is given to the syllabus for XIIth standard wi[th] only 20% is given to the syllabus for XIth standard (with inclusion of only selected chapters).

Although the syllabus for Std. XI and XII and MHT-CET is aligned, the outlook to study the subject should be altered based on the nature of the examination. To score in MHT-CET, a student ha[s] to be not just good with the concepts but also quick to complete the test successfully. Such ingenuity can be developed through sincere learning and dedicated practice.

Having thorough knowledge of theory, derivations and their applications is a prerequisite for beginning with MCQs on a given chapter in Physics. Students must know formulae, conversion factors, units and dimensions of physical quantities involved in the chapter. Physics is conveyed using mathematics; therefore, students should study essential mathematical concepts such as trigonometric functions, identities, derivatives and integration rigorously. They should befriend ideas of tangent, slope, area under the curve and nature of various plots and their equations to resolve graphical intricacy of Physics. It should be kept in mind that every single line of text has potential of generating several MCQs.

As a first step to MCQ solving, students should start with elementary questions. Once a momentum is gained, complex MCQs with higher level of difficulty should be practised. Questions from previous years as well as from other similar competitive exams should be solved to obtain an insight about plausible questions.

Competitive exams challenge the understanding of students about the subject by combining concepts from different chapters in a single question. To figure these questions out, cognitive understanding of subject is required. Therefore, students should put in extra effort to practise such questions.

Promptness being virtue in these exams, students should wear time saving short tricks and alternate methods upon their sleeves and should be able to apply them with accuracy and precision as required.

Such a holistic preparation is the key to success in the examination!
To quote Dr. A.P.J. Abdul Kalam, **"If you want to shine like a sun, first burn like a sun."**

Our **Triumph Physics** book has been designed to achieve the above objectives. Commencing from basic MCQs the book proceeds to develop competence to solve complex MCQs. It offers ample practice of recent questions from various competitive examination. While offering standard solutions in the form of concise hints, it also provides Shortcuts and Alternate Methods. Each chapter ends with an Evaluation test to allow self-assessment.

Features of the book presented on the next page will explicate more about the same!

We hope the book benefits the learner as we have envisioned.

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've needlessly missed something or want to applaud us for our triumphs, we'd love to hear from you.
Please write to us on: mail@targetpublications.org

A book affects eternity; one can never tell where its influence stops.

Best of luck to all the aspirants!

From,
Publisher

Edition: First

FEATURES

Formulae

1. Angular velocity:

i. $\omega = \frac{v}{r}$ ii. $\omega = \frac{\theta}{t}$

iii. $\omega = 2\pi n$ iv. $\omega = \frac{2\pi}{T}$

2. Angular displacement:

i. $\theta = \omega t$ ii. $\theta = \frac{2\pi t}{T}$

iii. $\theta = 2\pi nt$

Formulae

Formulae includes key formu[illegible] of the chapter.

This is our attempt t[illegible] mak[illegible] tools [illegible]f formulae accessible [illegible]r t[illegible] s[illegible]dents while solving p[illegible]ems [illegible]d rev[illegible]ng at last minute at a gl[illegible]e.

Notes

Notes provides compilation of comprehensive points which elaborate textual concepts or cover missing fragments of concept essential for the complete understanding of the concept.

This is our attempt to offer gist [illegible]f knowledge required from examination point of view.

Notes

2. *Since [illegible]ecific heat* $C = \frac{\Delta Q}{m\Delta T}$

In isothermal expansion, ΔT being zero, specific heat is ∞.

ii. *For an adiabatic change, ΔQ being zero, specific heat is zero.*

Mi[illegible]bend[illegible]s

2. [illegible] so[illegible]d a[illegible] hollow sphere of same radius and mat[illegible]ial [illegible]e heated to the same temperature then [illegible]xpan[illegible]n of both will be equal. It means the e[illegible]ansion of cavity is same as if it has been a solid b[illegible]dy of the same material. But if same heat is given to the two spheres, due to lesser mass, rise in temperature of hollow sphere will be more.

Mindbenders

Mindbenders presents thought provoking snippets of concepts.

This is our attempt to enable the students perceive underlying depth and implications of concept.

FEATURES

Shortcuts

Shortcuts comprises important theoretical or formula based short tricks considering their utility in solving MCQ.

This is our attempt to highlight content that would come handy while solving questions.

Shortcuts

1. For a particle executing S.H.M:

i. From mean position in order to travel half of amplitude, time required is given by, $t = \frac{T}{12}$

ii. From extreme position, in order to travel half of amplitude, time required is given by $t = \frac{T}{6}$ s

Classical Thinking

5.1 Introduction

1. Which of the following is NOT a characteristic of gravitational force?
   (A) Gravitational force is always attractive.
   (B) Gravitational force has a finite range.
   (C) Gravitational force does not depend upon intervening medium.
   (D) Gravitational force is a weak force.

Classical Thinking

Classical Thinking section encompasses straight forward questions including knowledge-based questions.

This is our attempt to revise chapter in its basic form and warm up the students to deal with complex MCQs.

Critical Thinking

Critical Thinking section encompasses challenging questions which test understanding, rational thinking and application skills of the students.

This is our attempt to take the students from beginner to proficient level in smooth steps.

Critical Thinking

6.2 Progressive Wave

1. A travelling wave passes through a point of observation. At this point, the time interval between successive crests is 0.2 s, then,
   (A) wavelength is 5 m.
   (B) frequency is 5 Hz.
   (C) velocity of propagation is 5 m/s
   (D) wavelength is 0.2 m.

FEATURES

Competitive Thinking

7.2 Nature of Light

1. According to corpuscular theory of light which is NOT the property of light? **[MHT CET 2019]**
   (A) The velocity of light in air is greater than in glass.
   (B) Light travels in straight lines.
   (C) The velocity of light does not change after reflection.
   (D) The velocity of light changes after reflection.

Competitive Thinking

Competitive Thinking sectio encompasses questions from various competitive examinations MHT CET, JEE, AIPMT/NEET-UG tc.

This is our attempt to give the students practice of competitive questions and advance them to acquire knack essential to solve such questions.

Subtopic wise segregation

Every section is **segregated sub-topic wise.**

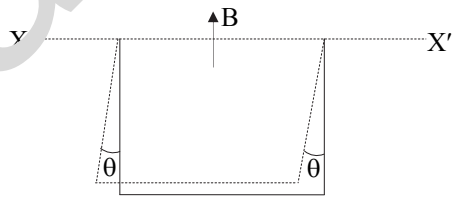
This is our attempt to cater to individualistic pace and preferences of studying a chapter in the students and enable easy assimilation of questions based on the specific concept.

Subtopics

9.1 Introductio
9.2 Kirchhoff's Laws of Electrical Network
9.3 W... one Bridge
9.4 Potentiometer
9.5 Galvanometer

Miscellaneous

93. A wire of cross-sectional ar... A forms 3 sides of a square and is free to turn about axis XX′. If the structure is deflected by θ from vertical when current I is passed through it, in a magnetic field B acting vertically upward and density of wire is ρ, the value of B is given by



(A) $\frac{2A\rho g}{I}\cot\theta$ (B) $\frac{2A\rho g}{I}\tan\theta$
(C) $\frac{A\rho g}{I}\sin\theta$ (D) $\frac{A\rho g}{2I}\cos\theta$

Miscellaneous

Every section, in general, ends with a sub-topic; miscellaneous.

Miscellaneous incorporates MCQs whose solutions require knowledge of concepts covered in different sub-topics of same chapter or from different chapters.

This is our attempt to develop cognitive thinking in the students essential to solve questions involving fusion of multiple key concepts.

FEATURES

Evaluation test

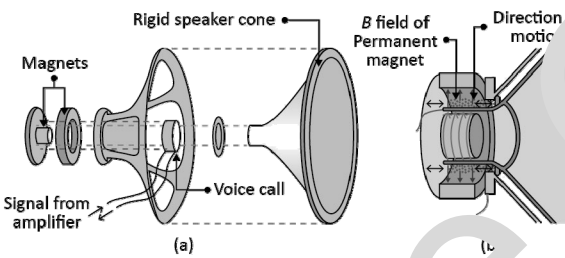
Evaluation Test covers questions from chapter for self-evaluation purpose.
This is our attempt to provide the students with a practice test and help them assess their range of preparation of the chapter.

Evaluation Test

1. The ratio of areas within the electron orbits for the first excited state to the ground state for hydrogen atom is
   (A) 16 : 1 (B) 18 : 1
   (C) 4 : 1 (D) 2 : 1

The physics of …..

How a loudspeaker produces sound….



Loud speakers help us to liste to wo der music. What mechanism in them makes them produce the sound?

The answer is at the end of this chapter.

The physics of …..

The physics of ….. illustrates real life applications or examples related to the concept discussed.
This is our attempt to link learning to the life and make the students conscious of how Physics has touched entire spectrum of life.

MHT-CET PAPER PATTERN

- There will be three papers of Multiple Choice Questions (MCQs) in 'Mathematics', 'Physics and Chemistry' and 'Biology' of 100 marks each.
- Duration of each paper will be 90 minutes.
- Questions will be based on the syllabus prescribed by Maharashtra State Board of Secondary and Higher Secondary Education with approximately 20% weightage given to Std. XI and 80% weightage will be given to Std. XII curriculum.
- Difficulty level of questions will be at par with JEE (Main) for Mathematics, Physics, Chemistry and at par with NEET for Biology.
- There will be no negative marking.
- Questions will be mainly application based.
- Details of the papers are as given below:

Paper	Subject	Approximate No. of Multiple Choice Questions (MCQs) based on		Marks Per Question	Total Marks
		Std. XI	Std. XII		
Paper I	Mathematics	10	40	2	100
Paper II	Physics	10	40	1	100
	Chemistry	10	40		
Paper III	Biology	20	80	1	100

- Questions will be set on
  i. the entire syllabus of Std. XII of 2020-21 of Physics, Chemistry, Mathematics and Biology subjects excluding portion which is deleted by Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune and
  ii. chapters / units from Std. XI curriculum as mentioned below:

Sr. No.	Subject	Chapters / Units of Std. XI
1	Physics	Motion in a plane, Laws of motion, Gravitation, Thermal properties of matter, Sound, Optics, Electrostatics, Semiconductors
2	Chemistry	Some Basic Concepts of Chemistry, Structure of Atom, Chemical Bonding, Redox Reactions, Elements of Group 1 and Group 2, States of Matter: Gaseous and Liquid States, Basic Principles and techniques of Chemistry, Adsorption and Colloids, Hydrocarbons
3	Mathematics	Trigonometry - II, Straight Line, Circle, Measures of Dispersion, Probability, Complex Numbers, Permutations and Combinations, Functions, Limits, Continuity
4	Biology	Biomolecules, Respiration and Energy Transfer, Human Nutrition, Excretion and osmoregulation

CONTENTS

Note: Subtopics/Questions belonging to the reduced syllabus for year 2020-21 are represented with ® mark. Questions of Standard XI are indicated by '*' in each Model Question Paper.

Textbook
Chapter No.

16 Semiconductor Devices

Subtopics

16.1 Introduction

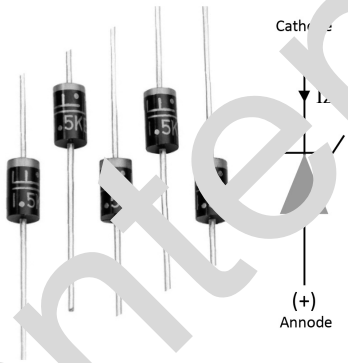
16.2 p-n Junction Diode as a Rectifier

16.3 Special Purpose Junction Diodes

16.4 Bipolar Junction Transistor (BJT)

16.5 Logic gates

***[Note:** The article number 16.3.1, Zener Diode is not a part of 16.3 – Special Purpose Junction Diodes, as per Reduced syllabus 2020-21]*



Zener diode is a unique form of a bipolar device which permits the current flow in the reverse direction when the voltage applied is above a certain characteristic value called zener voltage or break down voltage, most commonly finds applications in voltage regulators to protect other semiconductor devices from fluctuations in voltage.

Formulae

1. Zener diode:

i. Zener current:

a. $\left(I_{Z_{min}}\right) = \left(I_{Z_{max}}\right) - I_L$

b. $I_L = \frac{V_Z}{R_L}$

c. $\left(I_{Z_{max}}\right) = \frac{V_s - V_Z}{R_s}$

ii. Series resistance:

$R_s = \frac{(V_s - V_Z)}{I_{Z_{max}}}$

iii. Zener voltage:

$V_Z = I_L R_L$

2. Current in the transistor:

$I_E = I_B + I_C$

3. Current Gain of transistor:

i. DC current gain (α_{DC}): $\alpha_{DC} = \frac{I_C}{I_E}$

ii. Current amplification factor (β): $\beta_{DC} = \frac{I_C}{I_B}$

iii. Relation between $\alpha$and β:

a. $\alpha_{DC} = \frac{\beta_{DC}}{1+\beta_{DC}}$

b. $\beta_{DC} = \frac{\alpha_{DC}}{1-\alpha_{DC}}$

iv. AC current gain:

$\beta_{AC} = \frac{\Delta I_C}{\Delta I_B} = \frac{i_C}{i_B}$

4. Resistance of transistor:

i. Input dynamic resistance:

$r_i = \frac{\Delta V_{BE}}{\Delta I_B}$

ii. Output dynamic resistance:

$r_o = \frac{\Delta V_{CE}}{\Delta I_C}$

5. Voltage gain:

i. $A_V = \frac{V_o}{V_{in}}$

ii. $A_V = -\frac{\Delta V_{CE}}{r_i \Delta I_B}$

iii. $A_V = -\frac{\beta_{AC} R_L}{r_i}$

Notes

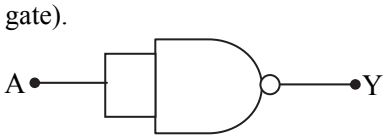
1. *Magnitude of direct current which can be handled by diode is called current rating of diode.*
2. *In a common base transistor amplifier,*
   i. *the input and output signals are in the same phase.*
   ii. *there is no amplification in current of a given signal.*
   iii. *there is an amplification in voltage and power of the given signal.*
3. *In a common emitter transistor amplifier,*
   i. *the input and output signals are out of phase by π or 180°.*
   ii. *there is amplification in the current, voltage and power of the given signal.*
4. *Common emitter transistor amplifier is preferred over common base transistor amplifier due to large current gain.*
5. *The d.c. current gain is always less than 1.*
6. *NOR and NAND gates are called universal gates.*

Mindbenders

1. Material used for fabricating a solar cell should fulfil two important requirements. Firstly, it must be photosensitive material which absorbs light and raises electrons to a higher energy state. Secondly, the higher energy electrons thus generated should be taken from the solar cell into an external circuit. The electrons then dissipate their energy while passing through the external circuit and return to the solar cell. Almost all photovoltaic devices use semiconductor materials in the form of a p-n junction.

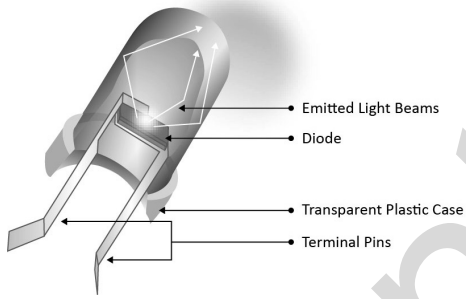
Shortcut

1. The value of potential barrier for germanium p-n junction is 0.3 V and for silicon p-n junction is 0.7 V.
2. If both inputs of NAND gates are shorted, then it becomes NOT gate (similar is applicable for NOR gate).



NOT gate

Semiconductor light emitting diode

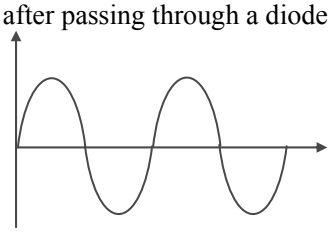


A diode which finds extensive use in rolling displays, traffic control light system etc. A light emitting diode can emit light of a particular colour when forward biased.

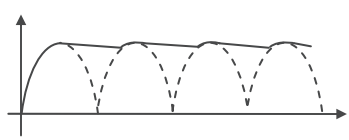
Classical Thinking

16.1 Introduction

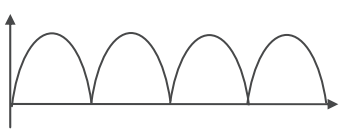
1. Under which of the following conditions does an avalanche breakdown in a semiconductor diode occur?
   (A) When potential barrier is reduced to zero.
   (B) When reverse bias exceeds a certain value.
   (C) When forward bias exceeds a certain value.
   (D) When forward current exceeds a certain value.
2. AC signal is preferred over DC signal because
   (A) Generation of AC at a power station is more cost effective than producing DC power.
   (B) The transmission of AC power is also more economic than transmitting DC power.
   (C) many electronic gadgets require an AC supply.
   (D) both (A) and (B).
3. Which of the following waveforms represent the wave after passing through a diode rectifier?
   (A)

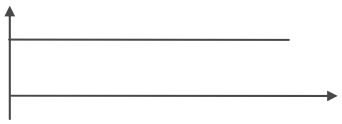


   (B)



   (C)



(D) 

16.2 p-n Junction Diode as a Rectifier

4. The process of conversion of alternating current into direct current is called as
   (A) rectification (B) amplification
   (C) magnification (D) modulation

5. The use of diode for rectification is:
   (A) to produce a steady multidirectional current.
   (B) to produce undirectional current from an alternating one.
   (C) to rectify any phase difference between the current and voltage.
   (D) all of these.

6. A diode rectifier
   (A) converts A.C. into D.C.
   (B) converts D.C. into A.C.
   (C) amplifies A.C. signals.
   (D) amplifies D.C. signals.

7. In a half wave rectifier, the r.m.s value of the A.C. component of the wave is
   (A) equal to D.C. value.
   (B) more than D.C. value.
   (C) less than D.C. value.
   (D) zero.

8. The transformer is used in rectifier circuit
   (A) to isolate the rectifier circuit.
   (B) to protect the diode.
   (C) to step up or step down the AC input as per requirement.
   (D) All of these

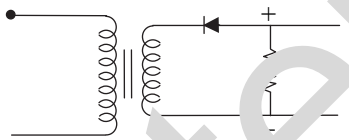
9. In half wave rectifier, the diode
   (A) allows current from both positive and negative half cycles from the input.
   (B) blocks the current from all the positive half cycles.
   (C) blocks the current from all the negative half cycles.
   (D) allows current from alternate positive and negative half cycles.

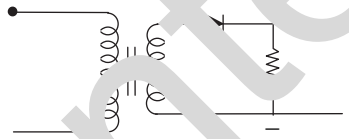
10. To obtain full wave rectification, we require
    (A) only one diode (B) triode
    (C) two diodes (D) transistor

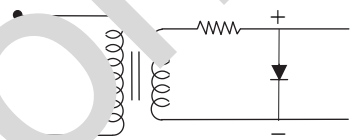
11. What can be said about the output frequency of a rectifier circuit?
    (A) it is always zero.
    (B) it is more in case of half wave rectifier.
    (C) it is more in case of full wave rectifier.
    (D) it is always equal to the input frequency.

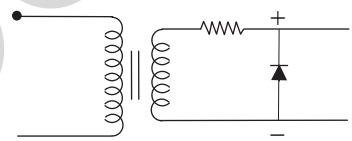
12. The effectiveness of a rectifier depends upon the
    (A) the magnitude of ripple component in its output.
    (B) the value of input voltage.
    (C) the magnitude of reverse voltage of the diode.
    (D) the value of the input frequency.

13. Which is the correct diagram of a half wave rectifier?

(A) 

(B) 

(C) 

(D) 

14. The maximum efficiency of full-wave rectifier is
    (A) 100 % (B) 25.20 %
    (C) 40.6 % (D) 81.2 %

16.3 Special Purpose Junction Diodes

15. A Zener diode
    (A) has negative temperature coefficient of resistance.
    (B) has sharp breakdown at low reverse voltage.
    (C) rectifies Zener voltage.
    (D) works only in forward bias.

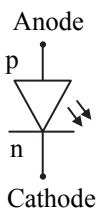
16. Zener breakdown takes place if
    (A) doped impurity is low.
    (B) doped impurity is high.
    (C) less impurity in N-type.
    (D) less impurity in P-type.

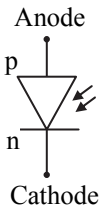
17. When used in a circuit, Zener diode is always
    (A) forward biased.
    (B) reverse biased.
    (C) both forward and reverse.
    (D) connected in series.

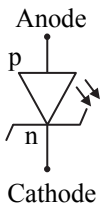
18. Zener diode is used as
    (A) Half-wave rectifier.
    (B) Full-wave rectifier.
    (C) ac voltage stabilizer.
    (D) dc voltage stabilizer.

19. Breakdown voltage of a zener diode is 5 volt. It can regulate the voltage output of a power supply
(A) below 5 volt only.
(B) above 5 volt upto a certain maximum voltage.
(C) from zero volt to a certain maximum voltage.
(D) from zero volt to infinite volt.

20. When a zener diode is used as a voltage stabiliser, it is connected
i. in series with a load.
ii. in parallel with a load.
iii. in forward bias.
iv. in reverse bias.
(A) i and iii are correct
(B) i and iv are correct
(C) ii and iv are correct
(D) ii and iii are correct

21. Symbol for photo-diode is
(A) 

(B) 

(C) 

(D) 

22. Electron hole pairs are generated in photodiode
(A) when light enters its depletion region.
(B) when light emerges in its junction.
(C) when photon energy $h\nu > E_g$.
(D) (A) and (C)

23. Photocurrent in a photodiode depends upon
(A) biasing of junction.
(B) number of electron holes.
(C) density of diode material.
(D) intensity of incident radiation.

24. In photodiode, dark current is
(A) the leakage current.
(B) the current due to minority charge carriers.
(C) the current when light energy emerges out of the diode.
(D) the current when no light energy falls on the diode.

25. In remote controlled receivers, the sensor are
(A) LEDs (B) Solar cells
(C) Photodiodes (D) Zener diodes

26. Which of the following is NOT an application of photodiode?
(A) Detection of optical signal
(B) Object counters
(C) Optocouplers
(D) Data profiling

27. Usually Si is used in the designing photodiodes because
(A) it is portable.
(B) it is easily available.
(C) it requires less forward biasing.
(D) current due to thermally generated minority carriers is quite small.

28. Solar cell is based on the principle of
(A) formation of electron-hole pairs with incident light.
(B) formation of electron-hole pairs with heating.
(C) formation of electron-hole pairs with material.
(D) all of these

29. A solar cell
(A) converts the radiant energy of sun into electrical power.
(B) converts the radiant energy of sun into heat.
(C) reflects all the light from sun.
(D) absorbs energy and converts into sound energy.

30. A solar cell works on the principle of
(A) photoelectricity.
(B) photographic camera.
(C) photovoltaic conversion.
(D) photosynthesis.

31. A solar cell is a p-n junction operating in
(A) reverse bias condition.
(B) unbiased condition.
(C) forward bias condition.
(D) in both forward and reverse bias condition.

32. In LED, intensity of emitted light
(A) increases with forward current.
(B) decreases with forward current.
(C) increases with reverse current.
(D) decreases with reverse current.

33. A light emitting diode is
(A) always used in forward biased condition.
(B) always used in reverse biased condition.
(C) never used in forward biased condition.
(D) used in both forward and reverse biased position depending upon its application.

34. Which of the following diode emits red and yellow light?
(A) Ga-As (B) Ga-As-P
(C) Ga-P (D) As-P

35. Colour of light emitted by LED depends on
(A) its reverse bias.
(B) its forward bias.
(C) type of semiconductor.
(D) rectifier.

36. Barrier potential in LED depends on type of
(A) impurity
(B) junction
(C) biasing
(D) semiconductors

37. The brightness of LED can be controlled by
(A) applied potential differences.
(B) by changing the value of series resistance.
(C) by changing the value of parallel resistance.
(D) none of these

38. In LED, to avoid damage to the diode _____ is used.
(A) capacitor (B) resistor
(C) insulator (D) conductor

39. Choose the INCORRECT statement.
(A) LEDs are cheap.
(B) LEDs require high operating voltage.
(C) LEDs have light weight.
(D) LEDs have high operating speed.

40. Barrier potential in Ga-As-P LED is about
(A) 5 volt (B) 0.5 volt
(C) 1.5 volt (D) 2.5 volt

41. In a Zener-regulated power supply, a 10 V battery is connected in series with a resistance of 200 Ω and a zener diode. The zener diode maintains a constant voltage drop of 5 V across a load resistance of 500 Ω. The current drawn by the load resistance will be
(A) 0.025 A (B) 0.05 A
(C) 0.01 A (D) 0.005 A

16.4 Bipolar Junction Transistor (BJT)

42. In a transistor with normal bias, the emitter base junction
(A) has a high resistance.
(B) has low resistance.
(C) is reverse biased.
(D) is forward biased.

43. A transistor consists of two junction diodes which are connected
(A) one after another.
(B) back to back.
(C) one across another.
(D) one upon other.

44. Transistors are essentially
(A) power driven devices.
(B) current driven devices.
(C) voltage driven devices.
(D) resistance driven devices.

45. How many electrodes are there in a transistor?
(A) 2 (B) 3
(C) 4 (D) 5

46. The amplifier converts
(A) A.C. into D.C. voltage.
(B) D.C. into A.C. voltage.
(C) low input signal to high output signal.
(D) high input signal to low output signal.

47. The arrow head on the transistor symbol always points in the direction of
(A) flow of holes in the emitter region.
(B) flow of electrons in the emitter region.
(C) minority carriers flow in the emitter region.
(D) majority carriers flow in the emitter region.

48. In a transistor,
(A) length of emitter is greater than collector.
(B) length of collector is greater than emitter.
(C) length of base is greater than emitter.
(D) length of base is greater than collector.

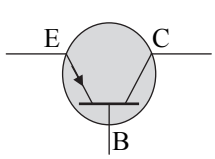
49. In a transistor, the emitter current is
(A) slightly more than collector current.
(B) slightly less than collector current.
(C) equal to the collector current.
(D) equal to the base current.

50. The transistors provide good power amplification when they are used in
(A) common collector configuration.
(B) common emitter configuration.
(C) common base configuration.
(D) any configuration.

51. The part of a transistor which is heavily doped to produce a large number of majority carriers is
(A) Base (B) Emitter
(C) Collector (D) All of these

52. Least doped region in a transistor
(A) Collector
(B) Base
(C) Emitter
(D) Either emitter or collector

53. The symbol given in figure represents
(A) npn transistor
(B) pnp transistor
(C) Forward biased p-n junction diode
(D) Reverse biased p-n junction diode



54. A transistor can be used as _____.
(A) a full-wave rectifier
(B) an amplifier
(C) a half-wave rectifier
(D) an insulator

55. In npn transistor, if I_E = emitter current, I_B = base current and I_C = collector current, then
(A) $I_C = I_E + I_B$ (B) $I_B = I_C + I_E$
(C) $I_E = I_C + I_B$ (D) $I_E = I_C - I_B$

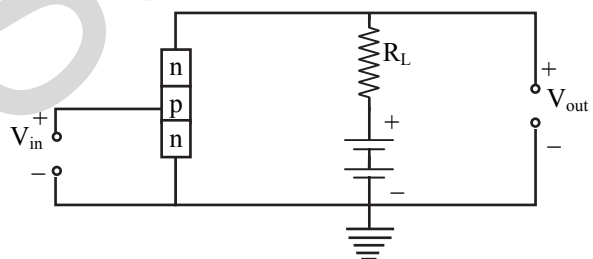
56. When n-p-n transistor is used as an amplifier,
(A) electrons move from base to collector.
(B) holes move from emitter to base.
(C) electrons move from collector to base.
(D) holes move from base to collector.

57. In case of n-p-n transistors, the collector current is always less than the emitter current because
(A) collector side is reverse biased and emitter side is forward biased.
(B) after electrons are lost in the base, only remaining ones reach the collector.
(C) collector side is forward biased and emitter side is reverse biased.
(D) collector being reverse biased attracts less electrons.

58. The dynamic output resistance (r_o) of p-n-p transistor in a common emitter mode is given by
(A) $r_o = \left.\frac{\Delta V_{EB}}{\Delta I_E}\right|_{V_{CE} = \text{constant}}$
(B) $r_o = \left.\frac{\Delta V_{CB}}{\Delta I_C}\right|_{V_{CE} = \text{constant}}$
(C) $r_o = \left.\frac{\Delta V_{CE}}{\Delta I_C}\right|_{V_B = \text{constant}}$
(D) $r_o = \left.\frac{\Delta V_{CE}}{\Delta I_C}\right|_{I_B = \text{constant}}$

59. A transistor when connected in common emitter mode has a
(A) high input resistance and a low output resistance.
(B) low input resistance and low output resistance.
(C) low input resistance and a high output resistance.
(D) high input resistance and a high output resistance.

60. An npn transistor circuit is arranged as shown in figure. It is



(A) a common-base amplifier circuit.
(B) a common-emitter amplifier circuit.
(C) a common-collector amplifier circuit.
(D) rectifier circuit.

61. In a transistor, the value of α is always
(A) less than 1 (B) equal to 1
(C) unpredictable (D) greater than 1

62. In the study of transistor as an amplifier, $\alpha = I_C/I_E$ and $\beta = I_C/I_B$ where, I_C, I_B and I_E are the collector, base and emitter currents, then
(A) $\beta = \frac{1-\alpha}{\alpha}$ (B) $\beta = \frac{\alpha}{1-\alpha}$
(C) $\beta = \frac{\alpha}{1+\alpha}$ (D) $\beta = \frac{1+\alpha}{\alpha}$

63. For a transistor, in a common emitter arrangement, the alternating current gain β is given by
(A) $\beta = \frac{\Delta I_C}{\Delta I_B}$ (B) $\beta = \frac{\Delta I_B}{\Delta I_C}$
(C) $\beta = \frac{\Delta I_C}{\Delta I_E}$ (D) $\beta = \frac{\Delta I_E}{\Delta I_C}$

16.5 Logic gates

64. Boolean algebra is essentially based on
(A) symbol (B) logic
(C) numbers (D) truth

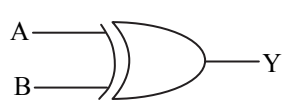
65. The Boolean expression for OR function is
(A) $Y = A + B$ (B) $Y = A \cdot B$
(C) $Y = A - B$ (D) $Y = A$

66. Which logic gate is similar to a function of two series switches?
(A) AND gate (B) OR gate
(C) NAND gate (D) XOR

67. Logic gates are the building blocks of a
(A) digital system.
(B) analog system.
(C) abacus system.
(D) communication system.

68. A combination of AND function and NOT function results in
(A) OR gate (B) inversion
(C) NAND gate (D) NOR gate

69. The figure represents a digital
(A) XOR gate.
(B) OR gate.
(C) AND gate.
(D) NOR gate.



70. An OR gate gives a logic 1 output
(A) only when all inputs are logical 1.
(B) only when any two inputs are logical 1.
(C) when all inputs are logical 0.
(D) when any one input is logical 1.

71. The logic behind 'NOR' gate is that which gives
(A) high output when both the inputs are low.
(B) low output when both the inputs are low.
(C) high output when both the inputs are high.
(D) high output when one of the inputs are is high.

72. The output of a NAND gate is 0
(A) if both inputs are 0.
(B) if one input is 0 and the other input is 1.
(C) if both inputs are 1.
(D) either if both inputs are 1 or if one of the inputs is 1 and the other 0.

73. Truth table given below represents

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

(A) AND gate (B) OR gate
(C) NAND gate (D) NOR gate

74. The following truth table is obtained for

A	B	X
0	0	0
1	0	0
0	1	0
1	1	1

(A) OR gate
(B) AND gate
(C) NAND gate
(D) NOR gate

The physics of …..

Solar cells

When sunlight strikes a solar cell formed using a p-n junction, it acts like a battery, with + and – terminals. How does a solar cell convert solar energy into electricity?

The answer is at the end of this chapter.

Critical Thinking

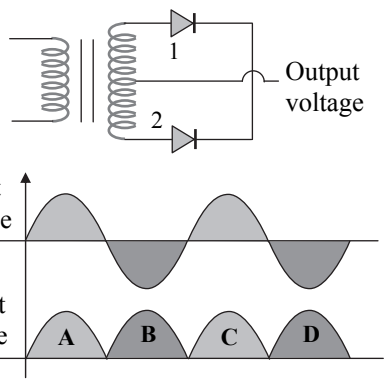
16.2 p-n Junction Diode as a Rectifier

1. Ripple frequency at the output of bridge rectifier when the transformer primary is connected to A.C. mains supply is
(A) 100 Hz (B) 50 Hz
(C) 25 Hz (D) 75 Hz

2. In half-wave rectifier, if in the output waveform pattern (starting from T = 0) the time for first waveform is indicated by T / 2, then the time for third wave form is,
(A) T (B) $\frac{3T}{2}$
(C) 2T (D) $\frac{5T}{2}$

3. In a full wave rectifier, input A.C. current has a frequency 'ν'. The output frequency of current is
(A) $\frac{\nu}{2}$ (B) ν
(C) 2ν (D) 320 Hz

4. A full wave rectifier circuit along with the input and output voltages is shown in the figure



The contribution to output voltage from diode 2 is
(A) A, C (B) B, D
(C) B, C (D) A, D

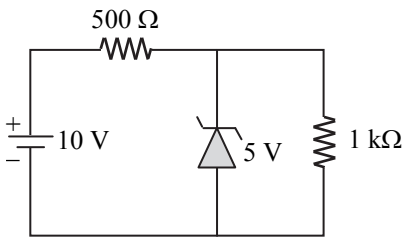
16.3 Special Purpose Junction Diodes

5. Consider the following statements (i) and (ii) and identify the correct choice of the given answers.
(i) A Zener diode is always connected in reverse bias.
(ii) The potential barrier of a p-n junction lies between 0.1 to 0.3 V approximately.
(A) (i) and (ii) are correct.
(B) (i) and (ii) are wrong.
(C) (i) is correct but (ii) is wrong.
(D) (i) is wrong but (ii) is correct.

6. A Zener diode has a breakdown voltage of 5 V with a maximum power dissipation of 240 mW. The maximum current the diode can handle will be
(A) 50 mA (B) 48 mA
(C) 46 mA (D) 44 mA

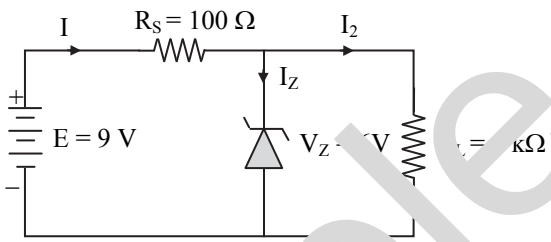
7. In a Zener regulator, if source voltage is 30 V, series resistance is of 1.5 kΩ, load resistance is of 2 kΩ and V_Z = 10 V, the Zener current will be
(A) 13.33 mA (B) 5 mA
(C) 10 mA (D) 8.33 mA

8. In the following circuit, the current flowing through 1 kΩ resistor is



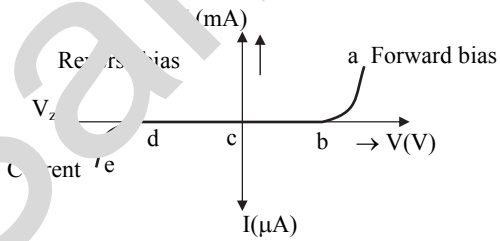
(A) 0 mA (B) 5 mA
(C) 10 mA (D) 15 mA

9. In the circuit shown below, the power dissipated in Zener diode is,



(A) 0.0144 W (B) 0.1 W
(C) 1.44 W (D) 14.4 W

10. The graph given below represents the I – V characteristics of a Zener diode. Which part of the characteristics curve is most relevant for its operation as a voltage regulator?



(A) ab (B) bc (C) cd (D) de

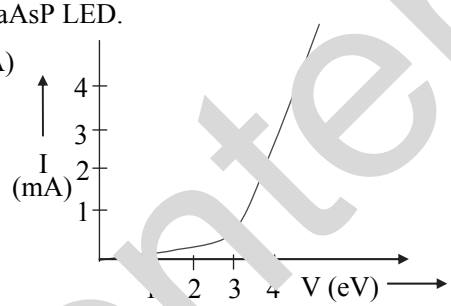
11. For obtaining maximum power from a solar cell, it should be operated in
(A) knee portion of V-I characteristics.
(B) any portion of V-I characteristics.
(C) level part of V-I characteristics.
(D) falling part of V-I characteristics.

12. A typical solar cell develops a voltage of about
(A) 5 V (B) 10 V to 15 V
(C) 0.5 V to 1 V (D) 0.5 mV

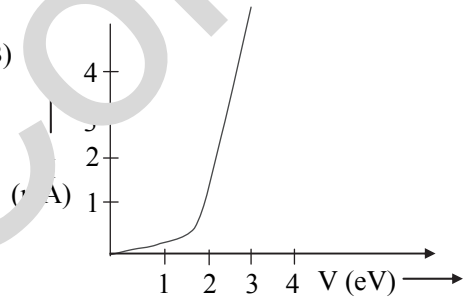
13. LED constructed by Silicon carbide, Zinc selenide emit radiation of _____.
(A) blue colour
(B) red colour
(C) orange colour
(D) brown colour

14. Choose the correct I-V characteristic curve for GaAsP LED.

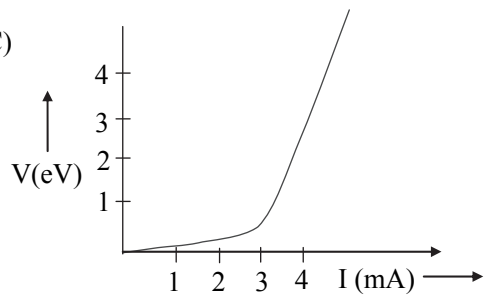
(A)



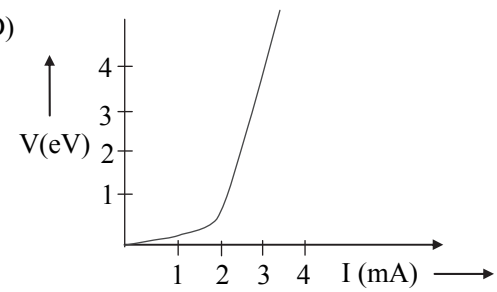
(B)



(C)



(D)



16.4 Bipolar Junction Transistor (BJT)

15. n-p-n transistors are preferred to p-n-p transistors because they have
(A) low cost.
(B) low dissipation energy.
(C) capability of handling large power.
(D) electrons having high mobility than holes.

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To see complete chapter buy **Target Notes** or **Target E-Notes**

Answer Key

Classical Thinking

1.	(B)	2.	(D)	3.	(C)	4.	(A)	5.	(B)	6.	(A)	7.	(B)	8.	(D)	9.	(C)	10.	(C)
11.	(B)	12.	(A)	13.	(B)	14.	(D)	15.	(B)	16.	(B)	17.	(B)	18.	(C)	19.	(B)	20.	[illegible]
21.	(B)	22.	(D)	23.	(D)	24.	(D)	25.	(C)	26.	(D)	27.	(D)	28.	(A)	29.	(A)	30.	[illegible]
31.	(B)	32.	(A)	33.	(A)	34.	(B)	35.	(C)	36.	(D)	37.	(A)	38.	(B)	39.	(B)	40.	(C)
41.	(C)	42.	(B)	43.	(B)	44.	(B)	45.	(B)	46.	(C)	47.	(A)	48.	(B)	49.	(A)	50.	[illegible]
51.	(B)	52.	(B)	53.	(B)	54.	(B)	55.	(C)	56.	(A)	57.	(B)	58.	(D)	59.	(C)	[illegible]	(B)
61.	(A)	62.	(B)	63.	(A)	64.	(B)	65.	(A)	66.	(A)	67.	(A)	68.	(C)	69.	(A)	[illegible]	(D)
71.	(A)	72.	(C)	73.	(D)	74.	(B)												

Critical Thinking

1.	(A)	2.	(D)	3.	(C)	4.	(B)	5.	(C)	6.	(B)	7.	(D)	8.	(B)	[illegible]		(B)	10.	(D)
11.	(A)	12.	(C)	13.	(A)	14.	(B)	15.	(D)	16.	(A)	17.	(B)	[illegible]		[illegible]		19.	[illegible]	20.	(B)
21.	(D)	22.	(C)	23.	(A)	24.	(A)	25.	(B)	26.	(C)	27.	(A)	[illegible]		(B)		29.	(B)	30.	(C)
31.	(C)	32.	(A)	33.	(B)	34.	(D)	35.	(A)	36.	(C)	37.	(B)	[illegible]		(C)		[illegible]	(C)	40.	(A)
41.	(C)	42.	(C)	43.	(C)																

Competitive Thinking

1.	(C)	2.	(A)	3.	(B)	4.	(A)	5.	(A)	[illegible]		(C)	7.	(D)	8.	(A)	9.	(B)	10.	(A)
11.	(A)	12.	(C)	13.	(A)	14.	(B)	15.	(C)	[illegible]		(B)	17.	(B)	18.	(A)	19.	(B)	20.	(C)
21.	(D)	22.	(B)	23.	(C)	24.	(A)	25.	(B)	[illegible]		(C)	[illegible]	(B)	28.	(B)	29.	(C)	30.	(D)
31.	(B)	32.	(A)	33.	(A)	34.	(A)	35.	(C)	36.	[illegible]		[illegible]	(B)	38.	(C)	39.	(B)	40.	(A)
41.	(B)	42.	(B)	43.	(A)	44.	(C)	45.	(A)	46.	(D)	47.	(C)	48.	(A)	49.	(B)	50.	(B)	
51.	(D)	52.	(A)	53.	(B)	54.	(C)	[illegible]		[illegible]		56.	(B)	57.	(D)	58.	(B)	59.	(C)	60.	(B)
61.	(A)	62.	(C)	63.	(C)	64.	(C)	65.	[illegible]	66.	(B)	67.	(A)	68.	(A)	69.	(A)	70.	(B)		
71.	(D)	72.	(B)	73.	(C)																

Evaluation Test

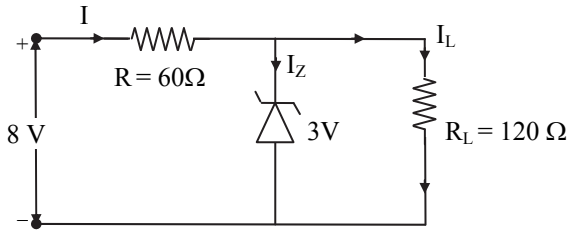
R 1. A zener-regulated power supply consists of a 9 V battery connected in series with a resistance of 100 Ω and a zener diode. The zener diode maintains a constant voltage drop of 4 V across a load resistance of 200 Ω. The current drawn by the load resistance will be

(A) 0.[illegible] A
(B) [illegible].050 A
(C) 0.01[illegible] A
(D) 0.015 A

2. The current gain α of a transistor is 0.94. The change in collector current corresponding to a change of 0.5 mA in the base current in a common emitter arrangement is

(A) 1.52 mA
(B) 2.38 mA
(C) 3.45 mA
(D) 7.83 Ma

R 3. In the circuit shown below, current passing through R_L and zener diode is,



(A) $\frac{1}{12}$A , $\frac{3}{40}$A
(B) $\frac{1}{40}$A , $\frac{1}{120}$A
(C) $\frac{1}{40}$A , $\frac{7}{120}$A
(D) $\frac{1}{30}$A , $\frac{7}{30}$A

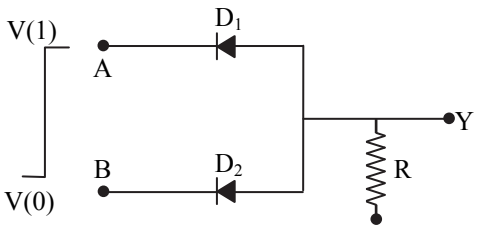
4. **Assertion:** A transistor has its base made thin.
Reason: A thin base makes the transistor stable.

(A) If both assertion and reason are true and reason is the correct explanation of assertion
(B) If both assertion and reason are true but reason is not be correct explanation of assertion

(C) If assertion is true but reason is false
(D) If assertion is false but reason is true

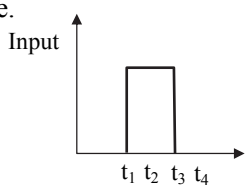
5. The input resistance of a CE amplifier is 400 Ω and the load resistance is 4 kΩ. A change of base current by 10 μA results in the change of collector current by 2 mA. The voltage gain of the amplifier is
(A) 500 (B) 1000
(C) 1500 (D) 2000

6. The circuit below represents a

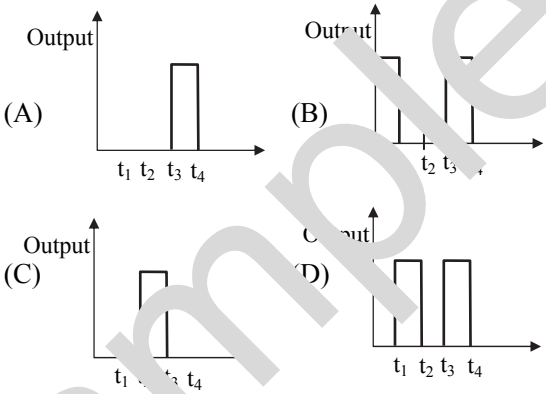


(A) OR gate (B) AND gate
(C) NOR gate (D) NAND gate

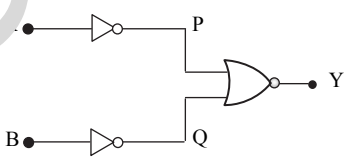
7. The following input voltage is passed through a NOT gate.



Which one of the following is the output?



8. In the following circuit, Y = 1 for the inputs A and B respectively equal to



(A) 0, 0 (B) 0, 1
(C) 1, 0 (D) 1, 1

9. A common-emitter amplifier, has an input resistance of 500 Ω and an output resistance of 40 kΩ. If the current gain is 75, then power gain of the transistor is
(A) 1.2×10^5 (B) 2.3×10^5
(C) 3.6×10^5 (D) 4.5×10^5

10. A transistor has α = 0.96. If the emitter current is 8 mA, what are the values of collector and base currents?
(A) 7.8 mA, 0.5 mA (B) 7.7 mA, 0.3 mA
(C) 7.6 mA, 0.2 mA (D) 7.5 mA, 0.1 mA

11. A transistor is connected in common-emitter (CE) configuration. The collector-supply is 10 V and the voltage drop across 5[illegible] Ω in the collector circuit is 4 V. If the current-gain factor (α) is 0.96, the base-current is
(A) 0.11 mA (B) 0.2[illegible] mA
(C) 0.33 mA (D) [illegible].44 mA

12. The maximum wavelength which a photodiode can detect with E[illegible]0.74 eV is
(A) 1680 nm (B) 1764 nm
(C) 1847 nm (D) 1932 nm

Answers to Evaluation Test

1. (C) 2. (D) 3. (C) 4. (C)
5. (C) 6. (B) 7. (B) 8. (D)
9. (D) 10. (B) 11. (C) 12. (A)

The Answers to Physics of…..

Solar Cell

Solar cell uses p-n junction to convert sunlight directly into electricity. The solar cell consists of p-type semiconductor surrounding an n-type semiconductor. Charge layers form at the junction between the two types of semiconductors leading to an electric field E pointing from the n-type towards the p-type layer. The outer covering of p-type material is so thin that sunlight penetrates into the charge layers and ionizes some of the atoms there. In the process of ionization, the energy of the sunlight causes a negative electron to be ejected from the atom, leaving behind a positive hole. The electric field in the charge layers causes the electron and the hole to move away from the junction. The electron moves into the n-type material, and the hole moves into the p-type material. As a result, the sunlight causes the solar cell to develop negative and positive terminals much like the terminals of a battery. The current that a single solar cell can provide is small, so applications of solar cells often use many of them mounted to form large panels.

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