## DPP - Daily Practice Problems

## Chapter-wise Sheets

**Date :** 　　　　　**Start Time :** 　　　　　**End Time :**

# PHYSICS  CP28

**SYLLABUS :** Semiconductor Electronics: Materials, Devices and Simple Circuits

**Max. Marks : 180**　　**Marking Scheme :** (+4) for correct & (–1) for incorrect answer　　**Time : 60 min.**

**INSTRUCTIONS :** This Daily Practice Problem Sheet contains 45 MCQs. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. A change of 8.0 mA in the emitter current bring a change of 7.9 mA in the collector current. The values of parameters $\alpha$ and $\beta$ are respectively
   (a) 0.99, 90　(b) 0.96, 79　(c) 0.97, 99　(d) 0.99, 79

2. A pure semiconductor has equal electron and hole concentration of $10^{16}$ m$^{-3}$. Doping by indium increases number of hole concentration $n_h$ to $5 \times 10^{22}$ m$^{-3}$. Then, the value of number of electron concentration $n_e$ in the doped semiconductor is
   (a) $10^6$/m$^3$　　　　　(b) $10^{22}$/m$^3$
   (c) $2 \times 10^6$/m$^3$　　(d) $2 \times 10^9$/m$^3$

3. For LED's to emit light in visible region of electromagnetic light, it should have energy band gap in the range of:
   (a) 0.1 eV to 0.4 eV　　(b) 0.5 eV to 0.8 eV
   (c) 0.9 eV to 1.6 eV　　(d) 1.7 eV to 3.0 eV

4. A common emitter amplifier has a voltage gain of 50, an input impedance of 100$\Omega$ and an output impedance of 200$\Omega$. The power gain of the amplifier is
   (a) 1000　(b) 1250　(c) 100　(d) 500

5. Which logic gate with inputs A and B performs the same operation as that performed by the following circuit?
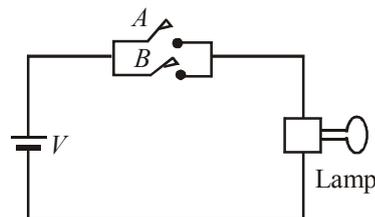


   (a) NAND gate　　　　(b) OR gate
   (c) NOR gate　　　　　(d) AND gate

6. In an unbiased p-n junction, holes diffuse from the p-region to n-region because of
   (a) the potential difference across the p-n junction
   (b) the attraction of free electrons of n-region
   (c) the higher hole concentration in p-region than that in n-region
   (d) the higher concentration of electrons in the n-region than that in the p-region

7. A silicon diode has a threshold voltage of 0.7 V. If an input voltage given by 2 sin($\pi$t) is supplied to a half wave rectifier circuit using this diode, the rectified output has a peak value of
   (a) 2V　(b) 1.4V　(c) 1.3V　(d) 0.7V

| RESPONSE GRID | 1. ⓐⓑⓒⓓ | 2. ⓐⓑⓒⓓ | 3. ⓐⓑⓒⓓ | 4. ⓐⓑⓒⓓ | 5. ⓐⓑⓒⓓ |
|---|---|---|---|---|---|
| | 6. ⓐⓑⓒⓓ | 7. ⓐⓑⓒⓓ | | | |

*Space for Rough Work*

**8.** The current gain for a transistor working as common-base amplifier is 0.96. If the emitter current is 7.2 mA, then the base current is
(a) 0.29 mA (b) 0.35 mA (c) 0.39 mA (d) 0.43 mA

**9.** In a npn transistor $10^{10}$ electrons enter the emitter in $10^{-6}$ s. 4% of the electrons are lost in the base. The current transfer ratio will be
(a) 0.98 (b) 0.97 (c) 0.96 (d) 0.94

**10.** Assuming that the silicon diode having resistance of $20\,\Omega$, the current through the diode is (knee voltage 0.7 V)

$$R = 180\Omega$$

2 V ——▷|——WW—— 0 V
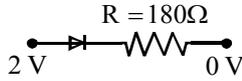
(a) 0 mA (b) 10 mA (c) 6.5 mA (d) 13.5 mA

**11.** Transfer characteristics [output voltage $(V_0)$ vs input voltage $(V_i)$] for a base biased transistor in CE configuration is as shown in the figure. For using transistor as a switch, it is used
(a) in region III
(b) both in region (I) and (III)
(c) in region II
(d) in region (I)

**12.** A half-wave rectifier is being used to rectify an alternating voltage of frequency 50 Hz. The number of pulses of rectified current obtained in one second is
(a) 50 (b) 25 (c) 100 (d) 2000

**13.** A diode having potential difference 0.5 V across its junction which does not depend on current, is connected in series with resistance of $20\Omega$ across source. If 0.1 A current passes through resistance then what is the voltage of the source?
(a) 1.5 V (b) 2.0 V (c) 2.5 V (d) 5 V

**14.** In common emitter amplifier, the current gain is 62. The collector resistance and input resistance are 5 k$\Omega$ an 500$\Omega$ respectively. If the input voltage is 0.01V, the output voltage is
(a) 0.62 V (b) 6.2 V (c) 62 V (d) 620 V

**15.** On doping germanium with donor atoms of density $10^{17}$ cm$^{-3}$ its conductivity in mho/cm will be
[Given : $\mu_e = 3800$ cm$^2$/V–s and $n_i = 2.5 \times 10^{13}$ cm$^{-13}$]
(a) 30.4 (b) 60.8 (c) 91.2 (d) 121.6

**16.** The voltage gain of an amplifier with 9% negative feedback is 10. The voltage gain without feedback will be
(a) 90 (b) 10 (c) 1.25 (d) 100

**17.** A system of four gates is set up as shown. The 'truth table' corresponding to this system is :
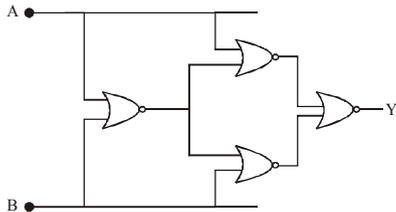
(a)

| A | B | Y |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

(b)

| A | B | Y |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

(c)

| A | B | Y |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

(d)

| A | B | Y |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 0 | 0 |
| 1 | 1 | 0 |

**18.** The intrinsic conductivity of germanium at 27° is 2.13 mho m$^{-1}$ and mobilities of electrons and holes are 0.38 and 0.18 m$^2$V$^{-1}$s$^{-1}$ respectively. The density of charge carriers is
(a) $2.37 \times 10^{19}$ m$^{-3}$ (b) $3.28 \times 10^{19}$ m$^{-3}$
(c) $7.83 \times 10^{19}$ m$^{-3}$ (d) $8.47 \times 10^{19}$ m$^{-3}$

**19.** The logic circuit shown below has the input waveforms 'A' and 'B' as shown. Pick out the correct output waveform

Output is
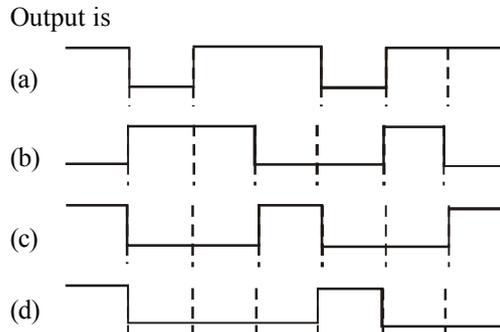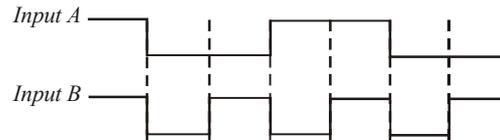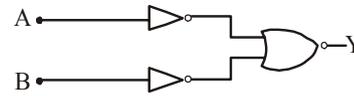
**20.** Pure Si at 500K has equal number of electron $(n_e)$ and hole $(n_h)$ concentrations of $1.5 \times 10^{16}$ m$^{-3}$. Doping by indium increases $n_h$ to $4.5 \times 10^{22}$ m$^{-3}$. The doped semiconductor is of
(a) n–type with electron concentration $n_e = 5 \times 10^{22}$ m$^{-3}$
(b) p–type with electron concentration $n_e = 2.5 \times 10^{10}$ m$^{-3}$
(c) n–type with electron concentration $n_e = 2.5 \times 10^{23}$ m$^{-3}$
(d) p–type having electron concentration $n_e = 5 \times 10^9$ m$^{-3}$

**21.** Which of the following statements is incorrect?
(a) The resistance of intrinsic semiconductors decrease with increase of temperature
(b) Doping pure Si with trivalent impurities give p-type semiconductors
(c) The majority carriers in n-type semiconductors are holes
(d) A p-n junction can act as a semiconductor diode

RESPONSE GRID

8. ⓐⓑⓒⓓ 9. ⓐⓑⓒⓓ 10. ⓐⓑⓒⓓ 11. ⓐⓑⓒⓓ 12. ⓐⓑⓒⓓ
13. ⓐⓑⓒⓓ 14. ⓐⓑⓒⓓ 15. ⓐⓑⓒⓓ 16. ⓐⓑⓒⓓ 17. ⓐⓑⓒⓓ
18. ⓐⓑⓒⓓ 19. ⓐⓑⓒⓓ 20. ⓐⓑⓒⓓ 21. ⓐⓑⓒⓓ

Space for Rough Work

**22.** The relation between number of free electrons (n) in a semiconductor and temperature (T) is given by
(a) $n \propto T$  (b) $n \propto T^2$  (c) $n \propto \sqrt{T}$  (d) $n \propto T^{3/2}$

**23.** If a PN junction diode of depletion layer width W and barrier height $V_0$ is forward biased, then
(a)  W increases, $V_0$ decreases
(b)  W decreases, $V_0$ increases
(c)  both W and $V_0$ increase
(d)  both W and $V_0$ decrease

**24.** The circuit has two oppositively connected ideal diodes in parallel. The current flowing in the circuit is
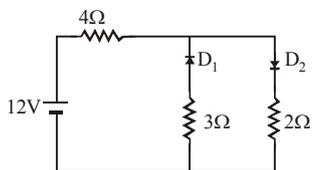


(a)  1.71 A  (b)  2.00 A  (c)  2.31 A  (d)  1.33 A

**25.** For a transistor amplifier in common emitter configuration for load impedance of 1kΩ ($h_{fe} = 50$ and $h_{0e} = 25$) the current gain is
(a)  − 24.8  (b)  − 15.7  (c)  − 5.2  (d)  −48.78

**26.** A PN-junction has a thickness of the order of
(a)  1 cm  (b)  1mm  (c)  $10^{-6}$ m  (d)  $10^{-12}$ cm

**27.** A working transistor with its three legs marked $P$, $Q$ and $R$ is tested using a multimeter. No conduction is found between $P$ and $Q$. By connecting the common (negative) terminal of the multimeter to $R$ and the other (positive) terminal to $P$ or $Q$, some resistance is seen on the multimeter. Which of the following is true for the transistor?
(a)  It is an npn transistor with $R$ as base
(b)  It is a pnp transistor with $R$ as base
(c)  It is a pnp transistor with $R$ as emitter
(d)  It is an npn transistor with $R$ as collector

**28.** If in a p-n junction, a square input signal of 10 V is applied as shown, then the output across $R_L$ will be
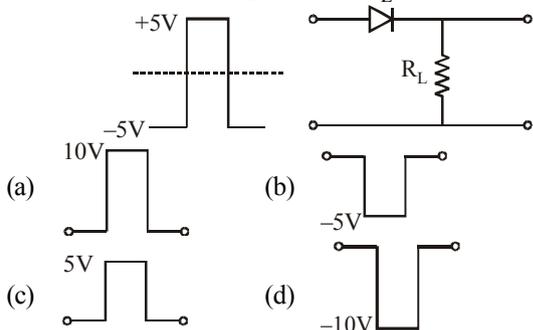


**29.** When $n$-type semiconductor is heated
(a)  number of electrons increases while that of holes decreases
(b)  number of holes increases while that of electrons decreases

(c)  number of electrons and holes remain same
(d)  number of electrons and holes increases equally.

**30.** The ratio of electron and hole currents in a semiconductor is 7/4 and the ratio of drift velocities of electrons and holes is 5/4, then the ratio of concentrations of electrons and holes will be
(a)  5/7  (b)  7/5  (c)  25/49  (d)  49/25

**31.** C and Si both have same lattice structure, having 4 bonding electrons in each. However, C is insulator whereas Si is intrinsic semiconductor. This is because :
(a)  In case of C the valence band is not completely filled at absolute zero temperature.
(b)  In case of C the conduction band is partly filled even at absolute zero temperature.
(c)  The four bonding electrons in the case of C lie in the second orbit, whereas in the case of Si they lie in the third.
(d)  The four bonding electrons in the case of C lie in the third orbit, whereas for Si they lie in the fourth orbit.

**32.** Which one of the following represents forward bias diode ?
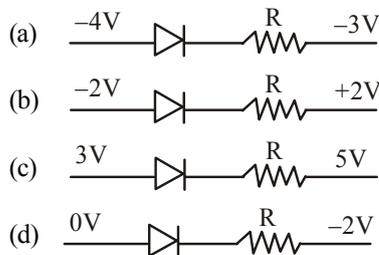


**33.** An oscillator is nothing but an amplifer with
(a)  positive feedback  (b)  negative feedback
(c)  large gain  (d)  no feedback

**34.** The current gain in the common emitter mode of a transistor is 10. The input impedance is 20kΩ and load of resistance is 100kΩ. The power gain is
(a)  300  (b)  500  (c)  200  (d)  100

**35.** The input signal given to a CE amplifier having a voltage gain of 150 is $V_i = 2 \cos \left(15t + \dfrac{\pi}{3}\right)$. The corresponding output signal will be :
(a)  $75\cos\left(15t + \dfrac{2\pi}{3}\right)$  (b)  $2\cos\left(15t + \dfrac{5\pi}{6}\right)$
(c)  $300\cos\left(15t + \dfrac{4\pi}{3}\right)$  (d)  $300\cos\left(15t + \dfrac{\pi}{3}\right)$

**36.** To use a transistor as an amplifier
(a)  the emitter base junction is forward biased and the base collector junction is reverse biased
(b)  no bias voltage is required
(c)  both junctions are forward biased
(d)  both junctions are reverse biased.

| RESPONSE GRID | | | | | |
|---|---|---|---|---|---|
| 22. ⓐⓑⓒⓓ | 23. ⓐⓑⓒⓓ | 24. ⓐⓑⓒⓓ | 25. ⓐⓑⓒⓓ | 26. ⓐⓑⓒⓓ |
| 27. ⓐⓑⓒⓓ | 28. ⓐⓑⓒⓓ | 29. ⓐⓑⓒⓓ | 30. ⓐⓑⓒⓓ | 31. ⓐⓑⓒⓓ |
| 32. ⓐⓑⓒⓓ | 33. ⓐⓑⓒⓓ | 34. ⓐⓑⓒⓓ | 35. ⓐⓑⓒⓓ | 36. ⓐⓑⓒⓓ |

**37.** A piece of copper and another of germanium are cooled from room temperature to 77K. The resistance of
(a) copper increases and germanium decreases
(b) each of them decreases
(c) each of them increases
(d) copper decreases and germanium increases

**38.** A d.c. battery of V volt is connected to a series combination of a resistor R and an ideal diode D as shown in the figure below. The potential difference across R will be
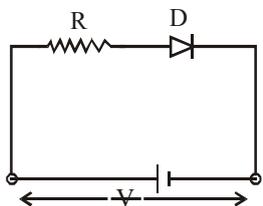


(a) 2V when diode is forward biased
(b) Zero when diode is forward biased
(c) 5V when diode is reverse biased
(d) 6V when diode is forward biased

**39.** The current gain for a transistor working as common-base amplifier is 0.96. If the emitter current is 7.2 mA, then the base current is
(a) 0.29 mA (b) 0.35 mA (c) 0.39 mA (d) 0.43 mA

**40.** In the circuit given below, *A* and *B* represent two inputs and *C* represents the output.
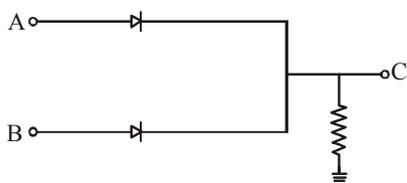


The circuit represents
(a) NOR gate (b) AND gate
(c) NAND gate (d) OR gate

**41.** The I-V characteristic of a P-N junction diode is shown below. The approximate dynamic resistance of the p-n junction when a forward bias voltage of 2 volt is applied is



(a) 1 Ω (b) 0.25 Ω (c) 0.5 Ω (d) 5 Ω
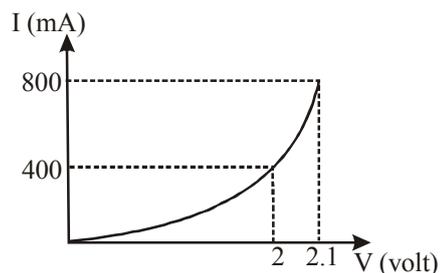
**42.** The circuit diagram shows a logic combination with the states of outputs X, Y and Z given for inputs P, Q, R and S all at state 1. When inputs P and R change to state 0 with inputs Q and S still at 1, the states of outputs X, Y and Z change to
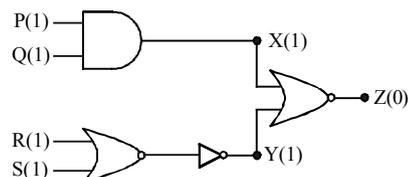


(a) 1, 0, 0 (b) 1, 1, 1 (c) 0, 1, 0 (d) 0, 0, 1

**43.** The following configuration of gate is equivalent to
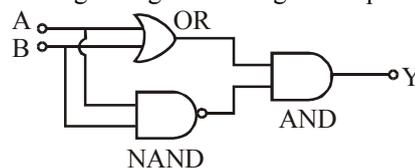


(a) NAND gate (b) XOR gate
(c) OR gate (d) NOR gate

**44.** A p-n photodiode is made of a material with a band gap of 2.0 eV. The minimum frequency of the radiation that can be absorbed by the material is nearly
(a) $10 \times 10^{14}$ Hz (b) $5 \times 10^{14}$ Hz
(c) $1 \times 10^{14}$ Hz (d) $20 \times 10^{14}$ Hz

**45.** The average value of output direct current in a full wave rectifier is
(a) $I_0/\pi$ (b) $I_0/2$ (c) $\pi I_0/2$ (d) $2 I_0/\pi$

| RESPONSE GRID | | | | | |
|---|---|---|---|---|---|
| | 37. ⓐⓑⓒⓓ | 38. ⓐⓑⓒⓓ | 39. ⓐⓑⓒⓓ | 40. ⓐⓑⓒⓓ | 41. ⓐⓑⓒⓓ |
| | 42. ⓐⓑⓒⓓ | 43. ⓐⓑⓒⓓ | 44. ⓐⓑⓒⓓ | 45. ⓐⓑⓒⓓ | |

## DAILY PRACTICE PROBLEM DPP CHAPTERWISE CP28 - PHYSICS

| Total Questions | 45 | Total Marks | 180 |
|---|---|---|---|
| Attempted | | Correct | |
| Incorrect | | Net Score | |
| Cut-off Score | 50 | Qualifying Score | 70 |
| Success Gap = Net Score − Qualifying Score | | | |
| Net Score = (Correct × 4) − (Incorrect × 1) | | | |