TUTORIAL 1

1. Atom is the smallest particle in an element that maintains the element's characteristics.
    (a) True
    (b) False

2. N-type semiconductor has a small number of free electrons
    (a) True
    (b) False

3. The term bias means
    (a) the value of the ac voltage in a signal
    (b) current condition flowing across a p-n junction
    (c) the value of the dc voltage that enables the device to operate
    (d) the status of the p-n junction

4. Doping a semiconductor material means
    (a) to use sticky substance to stick two materials together
    (b) to add impurities into a material to increase its resistivity
    (c) to add impurities into a material to lower its resistivity
    (d) all impurities are extracted to obtain pure Silicon

5. The movement of free electrons in a conductor is called
    (a) voltage
    (b) current
    (c) resistance
    (d) capacitance

6. Reverse breakdown is a condition where the p-n junction
    (a) is supplied with a large reverse bias voltage
    (b) is reverse biased and a leakage current flows
    (c) does not have a current flowing through it
    (d) is heated as a very large forward current is flowing through it

7. Majority carriers are holes in a
    (a) N-type semiconductor
    (b) P-type semiconductor
    (c) p-n junction semiconductor
    (d) none of the above

8. The semiconductor has
    (a) the conductivity property between conductor and insulator
    (b) very good conductivity property
    (c) no conductivity property

9. Voltage is defined as
    (a) the force that causes electrons to move in a wire
    (b) the obstacle to current movement
    (c) the ability of the device to store electron
    (d) free electron movement in a conductor

10. The large current that is flowing when the junction is reverse biased is called
    (a) the forward bias current
    (b) the conventional current
    (c) the reverse avalanche current
    (d) the reverse leakage current

11. The small current that flows when the junction is reverse biased is called
    (a) the forward bias current
    (b) the conventional current
    (c) the reverse avalanche current
    (d) the reverse leakage current

12. When the atom loses an electron, the atom is said to be
    (a) ionized
    (b) excited
    (c) normal
    (d) none of the above

13. When an electron moves to an orbit further away from the nucleus, the atom is said to be
    (a) normal
    (b) ionized
    (c) excited
    (d) damped

14. The valence band is
    (a) the highest band that an electron can occupy and a band which might be fully or partially filled with electrons
    (b) the lowest energy band that is not fully occupied and might be empty or partially filled with electrons

(c) a band in between the forbidden and conduction bands
(d) an internal band that is fully occupied

15. An insulator has
(a) a filled valence band
(b) an empty conduction band
(c) large forbidden band
(d) no free charge carrier under normal condition
(e) all of the above

16. A semiconductor has
(a) overlapped valence and conduction bands
(b) an empty conduction band and a filled valence band at 0°K
(c) current produced by electrons only
(d) all of the above

17. In an intrinsic semiconductor, the number of conduction electrons is
(a) less than the number of holes
(b) equivalent to the number of holes
(c) more than the number of holes

18. Choose the wrong statement on the extrinsic semiconductor:
(a) Pentavalent doping atoms such as arsenic, antimony and phosphorous are known as donor atoms
(b) Trivalent doping atoms such as gallium, indium, aluminium and boron are known as acceptor atoms
(c) Extrinsic-N semiconductor is formed by adding acceptor atoms to the pure Germanium crystal
(d) The current in an extrinsic-P semiconductor is majority contributed by the holes in the valence band
(e) In an extrinsic-P, the Fermi level is shifted close to the valence band

19. An N material has
(a) a larger number of electrons than holes and holes are generated by the increase in temperature
(b) holes as majority carriers
(c) both (a) and (b)
(d) none of the above

20. The mechanism of a directed movement of carrier charges in a semiconductor is
    (a) by the drift process under the influence of the supplied electric field
    (b) the diffusion of charges from a higher charge density region to a lower charge density region
    (c) both (a) and (b)

21. The p-n junction phenomena is
    (a) the formation of depletion regions free from charge carriers on both sides of the junction
    (b) the potential barrier formed across the junction
    (c) both (a) and (b)
    (d) P-impurities are added to the N-type semiconductor

22. The phenomena where a specimen that carries a current I is placed in a horizontal magnetic flux density B and produces an electrical field perpendicular to both I and B is known as
    (a) Fleming's left hand rule
    (b) Hall voltage
    (c) Faraday effect
    (d) Ohm's law
    (e) Hall effect

23. Hall effect is used to
    (a) differentiate between P and N semiconductors
    (b) determine the density and mobility of carriers
    (c) measure the conductivity of the material
    (d) all of the above

24. eV is the unit for
    (a) work performed
    (b) charge
    (c) electron mass
    (d) electronic charge
    (e) none of the above

25. In an unbiased p-n junction, the junction current under equilibrium condition is
    (a) generated by the diffusion of the majority carriers only
    (b) generated by the diffusion of the minority carriers only
    (c) zero, as there are no charges crossing the junction

(d) zero, as currents with the same magnitude but in the opposite direction are crossing the junction
(e) very high

26. Under equilibrium condition and no external voltage supplied to the p-n junction, there is
    (a) excess of holes in the junction region
    (b) excess of electrons in the junction region
    (c) both (a) and (b)
    (d) no majority carriers in the junction region

27. Potential barrier forms a barrier towards
    (a) holes in the P region
    (b) free electrons in the N region
    (c) not holes or electrons
    (d) minority carriers in both P and N regions
    (e) majority carriers in both P and N regions

28. When the negative terminal of a battery is connected to the P region and the positive is connected to the N region, it forms
    (a) a capacitive condition
    (b) an unbiased condition
    (c) a forward-bias condition
    (d) a reverse bias condition
    (e) a rectifying condition

29. Holes diffuse from the P to the N region due to
    (a) higher hole concentration in the P compared with in the N
    (b) the potential barrier
    (c) attraction of the free electrons in the N
    (d) holes are positive charges

30. When holes diffuse from the P to the N, they
    (a) become free electrons
    (b) increase the potential barrier
    (c) lower the potential barrier
    (d) become majority carriers in N
    (e) they become majority carriers in P

31. In an extrinsic semiconductor

(a) the N-type conductivity is $n_n e\mu_n$
(b) the N-type conductivity is $p_p e\mu_p$
(c) both (a) and (b) are correct
(d) $J = neE(\mu_n + e\mu_p)$
(e) $J = peE(\mu_n + e\mu_p)$
(f) Both (d) and (e) are true