BE-01 Basic of Science and Engineering (MCQs)

❖ Units and Measurement

1. **What is the absolute error in a measurement?**

- A) The difference between the measured value and the true value
- B) The ratio of the absolute error to the true value
- C) The ratio of the absolute error to the measured value
- D) The difference between the measured value and the average value
- **Answer:** A

2. **How is relative error calculated?**

- A) Absolute error divided by the measured value
- B) Absolute error divided by the true value
- C) Absolute error multiplied by 100
- D) Absolute error divided by the average value
- **Answer:** B

3. **If the true value of a quantity is 50 units and the measured value is 48 units, what is the absolute error?**

- A) 2 units
- B) 4 units
- C) 2%
- D) 4%
- **Answer:** A

4. **What does a percentage error of 5% indicate?**

- A) The measurement is 5% less than the true value
- B) The measurement is 5% more than the true value
- C) The absolute error is 5% of the true value
- D) The relative error is 5%
- **Answer:** C

5. **Which of the following is true about the propagation of errors?**

- A) Errors always cancel out when combined
- B) Errors add algebraically when quantities are added or subtracted
- C) Errors multiply when quantities are multiplied
- D) Both B and C are correct
- **Answer:** D

6. **If two measurements have absolute errors of 0.1 and 0.2 units respectively, and they are added together, what is the total absolute error?**

- A) 0.3 units
- B) 0.1 units
- C) 0.2 units
- D) 0.05 units
- **Answer:** A

7. **The true value of a length is 100 cm. If a measurement gives 98 cm, what is the relative error?**

- A) 2%
- B) 2 cm
- C) 0.02%
- D) 0.02 cm
- **Answer:** A

8. **Which of the following is a source of error in measurements?**

- A) Instrumental limitations
- B) Environmental factors
- C) Human mistakes
- D) All of the above
- **Answer:** D

9. **If the true value of a quantity is 200 units and the measured value is 198 units, what is the percentage error?**

- A) 1%
- B) 2%
- C) 0.5%
- D) 0.25%

- **Answer:** A

10. **In the propagation of errors, when quantities are multiplied, the percentage errors are:**

- A) Added
- B) Subtracted
- C) Multiplied
- D) Divided
- **Answer:** A

11. **A measurement has an absolute error of 0.5 units and a true value of 10 units. What is the relative error?**

- A) 0.05
- B) 0.005
- C) 5%
- D) 0.5%
- **Answer:** C

12. **If the measured value of a quantity is 50 units with an absolute error of 2 units, what is the percentage error?**

- A) 4%
- B) 2%
- C) 0.4%
- D) 0.2%
- **Answer:** A

13. **Which of the following operations does not affect the relative error?**

- A) Addition
- B) Subtraction
- C) Multiplication
- D) Division
- **Answer:** A

14. **The true value of a quantity is 100 units. If the measured value is 105 units, what is the absolute error?**

- A) 5 units
- B) 5%

- C) 0.05 units
- D) 0.05%
- **Answer:** A

15. **If the absolute error in a measurement is 0.1 units and the true value is 50 units, what is the relative error?**

- A) 0.002
- B) 0.02
- C) 0.2
- D) 2
- **Answer:** B

16. **A measurement has a relative error of 0.01. What is the percentage error?**

- A) 0.1%
- B) 1%
- C) 10%
- D) 0.01%
- **Answer:** B

Which of the following is a base quantity in the SI system?

- A) Velocity
- B) Force
- C) Mass
- D) Energy
- **Answer:** C

What is the SI unit of electric current?

- A) Ampere
- B) Volt
- C) Coulomb
- D) Ohm
- **Answer:** A

Which of the following is a derived quantity?

- A) Length
- B) Time

- C) Speed
- D) Temperature
- **Answer:** C

 The unit of force in the SI system is:

- A) Newton
- B) Joule
- C) Watt
- D) Pascal
- **Answer:** A

 Which of the following is the correct SI unit for pressure?

- A) Newton per square meter
- B) Joule per cubic meter
- C) Watt per square meter
- D) Ampere per meter
- **Answer:** A

 If a quantity has the dimensions of [M L^2 T^{-2}], which of the following is it?

- A) Force
- B) Energy
- C) Power
- D) Pressure
- **Answer:** B

 What is the SI unit of energy?

- A) Newton
- B) Joule
- C) Watt
- D) Pascal
- **Answer:** B

 Which of the following is a base quantity?

- A) Velocity
- B) Acceleration
- C) Mass

- D) Force
- **Answer:** C

 The unit of luminous intensity in the SI system is:

- A) Candela
- B) Lux
- C) Lumen
- D) Watt
- **Answer:** A

 Which of the following is a derived unit?

- A) Meter
- B) Kilogram
- C) Second
- D) Hertz
- **Answer:** D

 If a physical quantity has the dimensions [M L T^{-2}], it represents:

- A) Force
- B) Energy
- C) Power
- D) Pressure
- **Answer:** A

 The SI unit of temperature is:

- A) Celsius
- B) Kelvin
- C) Fahrenheit
- D) Rankine
- **Answer:** B

 Which of the following is the correct SI unit for mass?

- A) Gram
- B) Kilogram
- C) Pound
- D) Ounce

- **Answer:** B

 The unit of acceleration in the SI system is:

- A) m/s
- B) m/s^2
- C) m^2/s
- D) m^2/s^2
- **Answer:** B

 Which of the following is a derived unit?

- A) Meter
- B) Second
- C) Newton
- D) Ampere
- **Answer:** C

 If a physical quantity has the dimensions $[M L^2 T^{-3}]$, it represents:

- A) Energy
- B) Power
- C) Force
- D) Pressure
- **Answer:** B

- **What is the equivalent of 1 meter (m) in centimeters (cm)?**
- A) 10 cm
- B) 100 cm
- C) 1000 cm
- D) 10000 cm
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    - **Answer:** B

1. **Which of the following is an example of a systematic error?**
   a) Fluctuation in temperature affecting a measurement
   b) Misreading the instrument scale
   c) Personal error due to incorrect observation
   d) A zero error in a measuring instrument
    - **Answer:** d) A zero error in a measuring instrument
2. **Which type of error occurs due to unpredictable variations in measurements?**
   a) Systematic Error
   b) Gross Error

c) Random Error
d) Instrumental Error
   - **Answer:** c) Random Error

3. **What is the absolute error in a measurement?**
   a) The ratio of the measured value to the true value
   b) The difference between the measured and true values
   c) The sum of all measurement errors
   d) The percentage of systematic errors in measurement
   - **Answer:** b) The difference between the measured and true values

4. **Which error can be minimized by taking repeated measurements?**
   a) Systematic Error
   b) Random Error
   c) Gross Error
   d) Instrumental Error
   - **Answer:** b) Random Error

5. **What is the formula for percentage error?**
   a) Absolute Error/True Value
   b) Measured Value/Absolute Error
   c) (Absolute Error/True Value) ×100%
   d) (True Value/Absolute Error)×100%
   - **Answer:** c) (Absolute Error/True Value) ×100%

6. **Which of the following best describes propagation of errors?**
   a) Errors accumulate as calculations proceed
   b) Errors cancel out automatically
   c) Errors only occur in direct measurements
   d) Errors are always negligible
   - **Answer:** a) Errors accumulate as calculations proceed

7. A measurement of length is recorded as 5.12±0.02 cm. What is the absolute error?
   a) 5.12 cm
   b) 0.02 cm
   c) 0.004 cm
   d) 2.0 cm
   - **Answer:** b) 0.02 cm

8. A student measures the mass of an object as 20.5 g with a true mass of 20.7 g. Find the percentage error.
   a) 0.2%
   b) 1%
   c) 2%
   d) 3%
   - **Answer:** b) 1%

9. If two quantities A and B have relative errors of 2% and 3% respectively, what is the relative error in $Z=A\times B$?
   a) 5%
   b) 6%
   c) 1%
   d) 3%
   - **Answer:** b) 6%

10. A student measures a time interval as 4.56 s with an absolute error of 0.02 s. What is the relative error?

a) 0.4%
b) 2%
c) 1%
d) 0.44%
- **Answer:** d) 0.44%

11. The temperature measured is 37.5°C with an error of 0.5°C. Find the percentage error.
a) 1.33%
b) 5%
c) 10%
d) 0.5%
- **Answer:** a) 1.33%

12. If a measured value of resistance is 5.0±0.1 Ω, what is the percentage error?
a) 0.2%
b) 2%
c) 5%
d) 10%
- **Answer:** b) 2%

13. What is the propagated error in V=IR if errors in III and R are 3% and 4%, respectively?
a) 1%
b) 3%
c) 7%
d) 12%
- **Answer:** c) 7%

- **1 kilogram (kg) is equal to how many grams (g)?**
  - A) 100 grams
  - B) 1000 grams
  - C) 10000 grams
  - D) 100000 grams
  - **Answer:** B
- **What is the SI unit for pressure?**
  - A) Pascal (Pa)
  - B) Dyne (dyn)
  - C) Newton (N)
  - D) Erg (erg)
  - **Answer:** A
- **Convert 500 grams (g) to kilograms (kg).**
  - A) 0.05 kg
  - B) 0.5 kg
  - C) 5 kg
  - D) 50 kg
  - **Answer:** B
- **How many dynes are in 1 newton (N)?**
  - A) 10 dynes
  - B) 100 dynes
  - C) 10^5 dynes
  - D) 10^6 dynes
  - **Answer:** C
- **If you have 10 meters (m), how many centimeters (cm) is this equivalent to?**

    - A) 100 cm
    - B) 1000 cm
    - C) 10000 cm
    - D) 100000 cm
    - **Answer:** B
- **1 joule (J) is equivalent to how many ergs (erg)?**
    - A) 10^2 erg
    - B) 10^4 erg
    - C) 10^6 erg
    - D) 10^7 erg
    - **Answer:** D
- **Convert 1500 centimeters (cm) to meters (m).**
    - A) 1.5 m
    - B) 15 m
    - C) 0.15 m
    - D) 150 m
    - **Answer:** A
- **Which of the following is true about the relationship between MKS and CGS systems?**
    - A) MKS system uses meters, kilograms, and seconds as base units
    - B) CGS system uses centimeters, grams, and seconds as base units
    - C) The units in both systems are completely unrelated
    - D) Both A and B are true
    - **Answer:** D
- **1 watt (W) is equivalent to how many ergs per second (erg/s)?**
    - A) 10^3 erg/s
    - B) 10^4 erg/s
    - C) 10^5 erg/s
    - D) 10^7 erg/s
    - **Answer:** D
- **Convert 3 kilograms (kg) to grams (g).**
    - A) 30 g
    - B) 300 g
    - C) 3000 g
    - D) 30000 g
    - **Answer:** C
- **Convert 5000 dyne (dyn) to newtons (N).**
    - A) 0.05 N
    - B) 0.5 N
    - C) 5 N
    - D) 50 N
    - **Answer:** A
- **Which of the following is the correct conversion for 1000 joules (J) to ergs (erg)?**
    - A) 10^4 erg
    - B) 10^5 erg
    - C) 10^6 erg
    - D) 10^7 erg
    - **Answer:** D
- **Convert 5 pascals (Pa) to dyne per square centimeter (dyne/cm²).**
    - A) 5 dyne/cm²

- B) 50 dyne/cm²
- C) 500 dyne/cm²
- D) 5000 dyne/cm²
- **Answer:** B

- **Convert 0.1 meters (m) to centimeters (cm).**
  - A) 0.01 cm
  - B) 1 cm
  - C) 10 cm
  - D) 100 cm
  - **Answer:** C
- **What is the equivalent of 2 newtons (N) in dynes (dyn)?**
  - A) 2 × 10^3 dynes
  - B) 2 × 10^5 dynes
  - C) 2 × 10^6 dynes
  - D) 2 × 10^7 dynes
  - **Answer:** B
- • The Vernier caliper is mainly used for measuring:
  a) Mass
  b) Small angles
  c) Small lengths with high precision
  d) Electrical resistance
  Answer: c) Small lengths with high precision
- • What is the typical least count of a standard Vernier caliper?
  a) 1 mm
  b) 0.01 mm
  c) 0.1 mm
  d) 0.5 mm
  Answer: c) 0.1 mm
- • What is the primary function of the ratchet stop in a micrometer screw gauge?
  a) To lock the spindle
  b) To prevent excessive force on the object
  c) To reset the scale
  d) To change the pitch of the screw
  Answer: b) To prevent excessive force on the object
- • The pitch of a screw in a micrometer gauge is 0.5 mm. What does this mean?
  a) The screw moves 0.5 mm per one full rotation
  b) The screw can measure up to 0.5 mm
  c) The least count of the micrometer is 0.5 mm
  d) The screw moves 5 mm per rotation
  Answer: a) The screw moves 0.5 mm per one full rotation
- • How many divisions are typically present on the thimble of a standard micrometer screw gauge?
  a) 10
  b) 20
  c) 50
  d) 100
  Answer: c) 50
- • Why is the Vernier scale used in Vernier calipers?
  a) To increase range
  b) To measure depth

c) To increase measurement accuracy
d) To replace the main scale
Answer: c) To increase measurement accuracy

- • If a Vernier caliper has 10 divisions on its Vernier scale that match with 9 divisions of the main scale (1 mm each), what is its least count?
  a) 0.1 mm
  b) 0.01 mm
  c) 0.05 mm
  d) 1 mm
  Answer: a) 0.1 mm
- • If the sleeve of a micrometer gauge shows 5 mm and the thimble shows 20 divisions, what is the final reading? (Least count = 0.01 mm)
  a) 5.02 mm
  b) 5.20 mm
  c) 7.02 mm
  d) 5.40 mm
  Answer: b) 5.20 mm
- • A Vernier caliper has a main scale reading of 20 mm. The 5th division of the Vernier scale coincides with the main scale. The least count is 0.1 mm. What is the final reading?
  a) 20.5 mm
  b) 25.5 mm
  c) 20.05 mm
  d) 20.1 mm
  Answer: a) 20.5 mm
- • A micrometer screw gauge gives a main scale reading of 10 mm, and the thimble shows 35 divisions. The least count is 0.01 mm. What is the final measurement?
  a) 10.35 mm
  b) 13.50 mm
  c) 10.53 mm
  d) 10.03 mm
  Answer: a) 10.35 mm
- • A student measures an object with a Vernier caliper and records a main scale reading of 15 mm and a Vernier scale reading of 6. If the least count is 0.1 mm, what is the final measurement?
  a) 15.6 mm
  b) 16.5 mm
  c) 15.06 mm
  d) 15.16 mm
  Answer: a) 15.6 mm
- • A micrometer screw gauge gives a main scale reading of 5 mm and a thimble reading of 25. The least count is 0.01 mm. What is the final measurement?
  a) 5.25 mm
  b) 5.50 mm
  c) 5.75 mm
  d) 6.25 mm
  Answer: a) 5.25 mm

❖ Classical Mechanics

1. What is the SI unit of force?
   a) Joule
   b) Newton
   c) Pascal
   d) Watt
   Answer: b) Newton

2. A ball is thrown straight up with an initial velocity of 20 m/s. What will be its velocity at the highest point?
   a) 10 m/s
   b) 20 m/s
   c) 0 m/s
   d) 9.8 m/s
   Answer: c) 0 m/s

3. According to Newton's First Law, what will happen to an object moving in space with no external forces?
   a) It will gradually slow down and stop
   b) It will continue moving at constant velocity
   c) It will change direction randomly
   d) It will move in a circle
   Answer: b) It will continue moving at constant velocity

4. Which of the following is an example of Newton's Third Law?
   a) A car speeding up
   b) A rocket launching into space
   c) A rolling ball coming to a stop
   d) A car moving on a curved road
   Answer: b) A rocket launching into space

5. If a force of 10 N is applied to a 2 kg object, what will be its acceleration?
   a) 5 m/s^2
   b) 20 m/s^2
   c) 2 m/s^2
   d) 10 m/s^2
   Answer: a) 5 m/s^2

6. If two objects have the same momentum but different masses, which one moves faster?
   a) The heavier object
   b) The lighter object
   c) Both move at the same speed
   d) It depends on gravity
   Answer: b) The lighter object

7. Which of the following best describes impulse?
   a) The change in force over time

b) The product of mass and velocity
c) The product of force and time
d) The time it takes for an object to stop
Answer: c) The product of force and time

8. A gun recoils when fired. This is an example of which law?
   a) First Law
   b) Second Law
   c) Third Law
   d) Conservation of Energy
   Answer: c) Third Law

9. A car starts from rest and accelerates at 5 m/s^2 for 4 seconds. What is its final velocity?
   a) 20 m/s
   b) 10 m/s
   c) 15 m/s
   d) 25 m/s
   Answer: b) 20 m/s

10. A 5 kg object is moving at 10 m/s. What is its momentum?
    a) 50 kg·m/s
    b) 5 kg·m/s
    c) 10 kg·m/s
    d) 100 kg·m/s
    Answer: a) 50 kg·m/s

11. A football player kicks a ball with a force of 200 N for 0.1 seconds. What is the impulse?
    a) 2 Ns
    b) 20 Ns
    c) 2000 Ns
    d) 0.02 Ns
    Answer: b) 20 Ns

12. A ball is dropped from a height of 10 m. What will be its velocity just before hitting the ground? (Take g=9.8m/s2g = 9.8 m/s^2g=9.8m/s2)
    a) 10 m/s
    b) 14 m/s
    c) 20 m/s
    d) 30 m/s
    Answer: b) 14 m/s

13. • What is the unit of angular velocity?
    a) m/s
    b) rad/s
    c) rad/s^2
    d) m/s^2
    Answer: b) rad/s
14. • The angular velocity of a wheel increases from 2 rad/s to 10 rad/s in 4 seconds. What is its angular acceleration?
    a) 2 rad/s^2
    b) 4 rad/s^2

c) 1.5 rad/s²
d) 8 rad/s²
Answer: a) 2 rad/s²

15. • A particle moves in a circle of radius rrr with constant speed vvv. The acceleration of the particle is:
a) 000
b) v^2/r directed radially inward
c) v/r directed radially outward
d) v^2/r directed tangentially
Answer: b) v2/r directed radially inward
16. • The force responsible for keeping a car moving in a curved path on a road is:
a) Gravitational force
b) Normal force
c) Centripetal force
d) Frictional force
Answer: c) Centripetal force
17. • If a particle moves in a circle with uniform speed, then:
a) Velocity remains constant
b) Acceleration is zero
c) The direction of velocity changes continuously
d) Angular velocity keeps increasing
Answer: c) The direction of velocity changes continuously
18. • If an object moves in a circle, which force provides the required acceleration?
a) Centripetal force
b) Centrifugal force
c) Normal force
d) Friction
Answer: a) Centripetal force
19. • Which of the following is a fictitious force?
a) Friction
b) Gravity
c) Centrifugal force
d) Magnetic force
Answer: c) Centrifugal force
20. • The relation between frequency and time period is:
a) f=1T
b) f=T
c) f=T2
d) f=2T
Answer: a) f=1T
21. • What is the SI unit of angular acceleration?
a) rad/s
b) rad/s²
c) m/s²
d) m/s
Answer: b) rad/s²
22. • If the radius of a circular path is doubled, what happens to the centripetal force?
a) Increases four times
b) Remains same
c) Becomes half

d) Becomes one-fourth
Answer: c) Becomes half

23. • In uniform circular motion, the net force is:
a) Zero
b) Tangential
c) Radially outward
d) Radially inward
Answer: d) Radially inward

24. • What happens to angular velocity if the moment of inertia increases?
a) Increases
b) Decreases
c) Remains constant
d) Becomes zero
Answer: b) Decreases

25. • When a car turns a corner, which force prevents it from skidding?
a) Gravitational force
b) Centrifugal force
c) Frictional force
d) Normal force
Answer: c) Frictional force

26. • A rotating body with increasing angular velocity has:
a) Zero angular acceleration
b) Positive angular acceleration
c) Negative angular acceleration
d) Constant angular displacement
Answer: b) Positive angular acceleration

27. • Work is done when:
a) A force is applied but no displacement occurs
b) A displacement occurs but no force is applied
c) Force and displacement are perpendicular
d) A force is applied and displacement occurs in the direction of the force
Answer: d) A force is applied and displacement occurs in the direction of the force

28. • The SI unit of work is:
a) Joule
b) Newton
c) Watt
d) Pascal
Answer: a) Joule

29. • A force of 10 N moves an object by 5 m in the direction of the force. What is the work done?
a) 10 J
b) 20 J
c) 50 J
d) 100 J
Answer: c) 50 J

30. • The kinetic energy of an object depends on:
a) Mass only
b) Velocity only
c) Both mass and velocity

d) Neither mass nor velocity
Answer: c) Both mass and velocity

31. • If the speed of an object doubles, its kinetic energy:
    a) Doubles
    b) Triples
    c) Becomes four times
    d) Remains the same
    Answer: c) Becomes four times
32. • Which of the following has potential energy?
    a) A moving car
    b) A stretched rubber band
    c) A rolling ball
    d) A falling stone
    Answer: b) A stretched rubber band
33. • Power is the rate of:
    a) Work done
    b) Energy stored
    c) Force applied
    d) Distance covered
    Answer: a) Work done
34. • A weightlifter lifts a 50 kg mass to a height of 2 meters. What is the work done? (Take $g=9.8g = 9.8g=9.8$ m/s²)
    a) 100 J
    b) 200 J
    c) 980 J
    d) 500 J
    Answer: c) 980 J
35. • Which unit is NOT a unit of power?
    a) Watt
    b) Joule per second
    c) Horsepower
    d) Newton
    Answer: d) Newton
36. • The potential energy of an object at a height hhh is directly proportional to:
    a) Mass and height
    b) Mass and velocity
    c) Velocity and height
    d) None of the above
    Answer: a) Mass and height
37. • A machine with higher power rating:
    a) Works slower
    b) Works faster
    c) Consumes less energy
    d) Does not follow physics laws
    Answer: b) Works faster
38. • If the angle between force and displacement is 90°, work done is:
    a) Maximum
    b) Minimum
    c) Zero

d) Negative
Answer: c) Zero

39. • The energy stored in a stretched spring is:
a) Kinetic energy
b) Gravitational potential energy
c) Elastic potential energy
d) Chemical energy
Answer: c) Elastic potential energy

40. • 1 Horsepower is equal to:
a) 500 W
b) 746 W
c) 1000 W
d) 1500 W
Answer: b) 746 W

❖ ELECTRIC CURRENT

 Ohm's Law states that:
a) V=IRV = IRV=IR
b) P=IVP = IVP=IV
c) F=maF = maF=ma
d) W=mgW = mgW=mg
Answer: a) V=IRV = IRV=IR

 The SI unit of resistance is:
a) Ampere
b) Volt
c) Ohm
d) Watt
Answer: c) Ohm

 If voltage is doubled and resistance remains constant, what happens to the current?
a) Remains the same
b) Doubles
c) Halves
d) Increases four times
Answer: b) Doubles

 If resistance is doubled while keeping voltage constant, what happens to the current?
a) Remains the same
b) Doubles
c) Halves
d) Increases four times
Answer: c) Halves

 What is the SI unit of current?
a) Ohm

b) Ampere
c) Volt
d) Watt
Answer: b) Ampere

 A material that obeys Ohm's Law is called:
a) Non-ohmic
b) Ohmic
c) Semiconductor
d) Superconductor
Answer: b) Ohmic

 Which graph best represents Ohm's Law?
a) Parabola
b) Straight line through origin
c) Hyperbola
d) Circle
Answer: b) Straight line through origin

 Which of the following obeys Ohm's Law?
a) Filament bulb
b) Diode
c) Copper wire
d) Transistor
Answer: c) Copper wire

 A 12 V battery is connected to a 6 Ω resistor. What is the current?
a) 1 A
b) 2 A
c) 6 A
d) 12 A
Answer: b) 2 A

 A circuit contains a 10 Ω resistor and a 2 A current. What is the voltage?
a) 5 V
b) 10 V
c) 20 V
d) 200 V
Answer: c) 20 V

 The power consumed in an electrical circuit is given by:
a) P=VI
b) P=IR
c) P=VR
d) P=I2V
Answer: a) P=VI

 If the resistance of a wire is 4 Ω and the current flowing through it is 3 A, the power dissipated is:
a) 9 W
b) 12 W

c) 36 W
d) 48 W
Answer: c) 36 W

 The heating effect of current is used in:
a) Electric bulbs
b) Electric heaters
c) Geysers
d) All of the above
Answer: d) All of the above

 If a wire's length is doubled, its resistance:
a) Remains the same
b) Doubles
c) Halves
d) Increases four times
Answer: b) Doubles

 The SI unit of charge is:
a) Ampere
b) Volt
c) Coulomb
d) Newton
Answer: c) Coulomb

 The charge of one electron is:
a) 9.1×10−^31 C
b) 1.6×10−^19 C
c) 6.63×10−^34 C
d) 3.0×10^8 C
Answer: b) 1.6×10−19 C

 According to Coulomb's Law, the force between two charges is:
a) Inversely proportional to the square of the distance between them
b) Directly proportional to the square of the distance
c) Independent of distance
d) Inversely proportional to distance
Answer: a) Inversely proportional to the square of the distance between them

 If the distance between two charges is halved, the force between them:
a) Becomes one-fourth
b) Becomes one-half
c) Doubles
d) Increases four times
Answer: d) Increases four times

 The value of Coulomb's constant k is:
a) 9×10^9 $N \cdot m^2/C^2$
b) 8.99×10^9 $N \cdot m^2/C^2$
c) 1.6×10−^19 $N \cdot m^2/C^2$

d) $6.63\times10-\text{^}34\ N\cdot m^2/C^2$
Answer: a)9×10^9 $N\cdot m^2/C^2$

 What happens when two like charges are placed close together?
a) They attract
b) They repel
c) They combine
d) They do nothing
Answer: b) They repel

 If two charges of +2C and −3C are placed close to each other, the force is:
a) Attractive
b) Repulsive
c) Zero
d) None of the above
Answer: a) Attractive

 Two charges of 1 C each are placed 1 m apart. What is the force between them?
a) 9×10^9 N
b) 9×10^8 N
c) 9×10^6 N
d) 9×10^3 N
Answer: a) 9×10^9 N

 If a body loses electrons, it becomes:
a) Positively charged
b) Negatively charged
c) Neutral
d) Unaffected
Answer: a) Positively charged

 The force between two charges increases when:
a) The distance between them increases
b) The distance between them decreases
c) One charge is removed
d) The charges are neutralized
Answer: b) The distance between them decreases

 Which of the following does NOT affect the electrostatic force between two charges?
a) Magnitude of charges
b) Distance between charges
c) Medium between charges
d) Shape of the charges
Answer: d) Shape of the charges

 What happens when a charged rod is brought close to a neutral conducting sphere?
a) The sphere gets charged by induction
b) The sphere gets charged by conduction
c) The sphere remains neutral
d) The sphere moves away
Answer: a) The sphere gets charged by induction

 If the charge of both objects is doubled while keeping the distance the same, the force:
a) Becomes half
b) Remains the same
c) Doubles
d) Increases four times
Answer: d) Increases four times

 The charge on an electron is:
a) Positive
b) Negative
c) Neutral
d) Varies with conditions
Answer: b) Negative

 The SI unit of electric field is:
a) Volt
b) Volt/meter
c) Newton/Coulomb
d) Both b and c
Answer: d) Both b and c

 The direction of the electric field is:
a) Always toward a positive charge
b) Away from a negative charge
c) Away from a positive charge and toward a negative charge
d) Circular around the charge
Answer: c) Away from a positive charge and toward a negative charge

 The electric field due to a point charge varies with distance as:
a) 1/r
b) 1/r^2
c) 1/r^3
d) Constant
Answer: b) 1/r^2

 The SI unit of electric potential is:
a) Coulomb
b) Ampere
c) Volt
d) Ohm
Answer: c) Volt

 If work done in moving a charge is zero, then the two points are at:
a) The same potential
b) Different potentials
c) Infinite potential
d) Zero potential
Answer: a) The same potential

 Electric potential is a:
a) Scalar quantity

b) Vector quantity
c) Depends on charge
d) None of the above
Answer: a) Scalar quantity

 If the electric flux through a closed surface is zero, then:
a) No charge is enclosed
b) The field is uniform
c) Charge is outside the surface
d) Both a and c
Answer: d) Both a and c

 The SI unit of electric flux is:
a) $N \cdot m^2/C$
b) Volt/m
c) Newton/Coulomb
d) None of these
Answer: a) $N \cdot m^2/C$

 The electric current is a:
a) Scalar quantity
b) Vector quantity
c) Can be both
d) None of the above
Answer: a) Scalar quantity

 If charge flows for a longer time, the current:
a) Increases
b) Decreases
c) Remains the same
d) Becomes zero
Answer: c) Remains the same

 The SI unit of electric charge is:
a) Coulomb
b) Ampere
c) Volt
d) Newton
Answer: a) Coulomb

 Which of the following quantities is NOT required to calculate electric current?
a) Charge
b) Time
c) Resistance
d) None of these
Answer: c) Resistance

 The charge of an electron is:
a) +1.6×10−19 C
b) −1.6×10−19 C
c) +9.1×10−31 C

d) −9.1×10−31 C
Answer: b) −1.6×10−19 C

 The net electric flux through a closed surface enclosing a net charge is given by:
a) Gauss's Law
b) Coulomb's Law
c) Ohm's Law
d) Kirchhoff's Law
Answer: a) Gauss's Law

 A charge of 2C is placed in an electric field of 5× 10^3 N/C. Find the force on the charge.
Answer: F = 10^4N

 A charge of 3C is moved from a point at 10V to another at 20V. Find the work done.
Answer: W=30J

1. The SI unit of resistance is:
   a) Volt
   b) Ampere
   c) Ohm
   d) Siemens
   Answer: c) Ohm

2. The SI unit of conductance is:
   a) Ohm
   b) Volt
   c) Siemens
   d) Coulomb
   Answer: c) Siemens

3. If the length of a wire is doubled, its resistance:
   a) Doubles
   b) Halves
   c) Remains the same
   d) Becomes one-fourth
   Answer: a) Doubles

4. If the cross-sectional area of a wire is doubled, its resistance:
   a) Doubles
   b) Halves
   c) Remains the same
   d) Becomes four times
   Answer: b) Halves

5. The resistivity of a material depends on:
   a) Length of the conductor
   b) Cross-sectional area
   c) Nature of the material
   d) Both a and b
   Answer: c) Nature of the material

6. Which material has the lowest resistivity?
   a) Silver
   b) Copper
   c) Iron
   d) Aluminum
   Answer: a) Silver

7. The reciprocal of resistivity is:
   a) Conductance
   b) Conductivity
   c) Resistance
   d) Voltage
   Answer: b) Conductivity

8. Which of the following is a good conductor?
   a) Rubber
   b) Glass
   c) Copper
   d) Wood
   Answer: c) Copper

9. When resistors are connected in series, the total resistance is:
   a) Less than the smallest resistor
   b) Equal to the smallest resistor
   c) Sum of all resistances
   d) Product of all resistances
   Answer: c) Sum of all resistances

10. When resistors are connected in parallel, the total resistance is:
    a) Less than the smallest resistor
    b) Equal to the smallest resistor
    c) Sum of all resistances
    d) Product of all resistances
    Answer: a) Less than the smallest resistor

11. The unit of resistivity is:
    a) Ohm-meter
    b) Ohm/cm
    c) Siemens
    d) Volt/Ampere
    Answer: a) Ohm-meter

12. If the temperature of a metallic conductor increases, its resistance:
    a) Increases
    b) Decreases
    c) Remains constant
    d) Becomes zero
    Answer: a) Increases

13. The SI unit of electrical conductivity is:
    a) Ohm-meter

b) Siemens per meter
c) Coulomb
d) Ampere
Answer: b) Siemens per meter

14. The resistance of an ideal conductor is:
    a) Infinite
    b) Zero
    c) Very high
    d) Very low but not zero
    Answer: b) Zero

15. A wire has a resistance of 5Ω. If its length is doubled and its area is halved, what is the new resistance?
    a) 5Ω
    b) 10Ω
    c) 20Ω
    d) 40Ω
    Answer: d) 40Ω

16. Three resistors of 6Ω, 3Ω, and 2Ω are connected in parallel. Find the total resistance.
    a) 1Ω
    b) 2Ω
    c) 3Ω
    d) 4Ω
    Answer: a) 1Ω

1. The SI unit of capacitance is:
    a) Coulomb
    b) Farad
    c) Henry
    d) Ohm
    Answer: b) Farad

2. The capacitance of a capacitor depends on:
    a) Charge stored
    b) Voltage applied
    c) Geometry and material of the capacitor
    d) Resistance of the circuit
    Answer: c) Geometry and material of the capacitor

3. The capacitance of a parallel plate capacitor is directly proportional to:
    a) Distance between the plates
    b) Plate area
    c) Charge stored
    d) Voltage applied
    Answer: b) Plate area

4. If the separation between capacitor plates is increased, the capacitance:
    a) Increases
    b) Decreases

c) Remains the same
d) First increases, then decreases
Answer: b) Decreases

5. The presence of a dielectric in a capacitor:
   a) Increases capacitance
   b) Decreases capacitance
   c) Does not affect capacitance
   d) Reduces charge stored
   Answer: a) Increases capacitance

6. The capacitance of a parallel plate capacitor is given by:
   a) $C=Q/V$
   b) $C=\varepsilon_0\varepsilon_r A/d$
   c) $C=V/Q$
   d) $C=d/A$
   Answer: b) $C=\varepsilon_0\varepsilon_r A/d$

7. The unit of permittivity (ε_0\varepsilon) is:
   a) F/m
   b) C/m^2
   c) V/m
   d) A/m
   Answer: a) F/m

8. Which of the following statements is true for a parallel combination of capacitors?
   a) The total capacitance is less than the smallest capacitance.
   b) The total capacitance is the sum of all capacitances.
   c) The total charge is the same for all capacitors.
   d) The total voltage is different across each capacitor.
   Answer: b) The total capacitance is the sum of all capacitances.

9. In a series combination of capacitors, the total capacitance is:
   a) Equal to the smallest capacitance
   b) Less than the smallest capacitance
   c) Equal to the largest capacitance
   d) More than the largest capacitance
   Answer: b) Less than the smallest capacitance

10. The charge stored in capacitors connected in series is:
    a) The same for each capacitor
    b) Different for each capacitor
    c) Maximum for the smallest capacitor
    d) Minimum for the largest capacitor
    Answer: a) The same for each capacitor

11. The dielectric constant of vacuum is:
    a) 1
    b) 8.85
    c) Zero

d) Infinity
Answer: a) 1

12. A capacitor stores energy in the form of:
    a) Magnetic field
    b) Electric field
    c) Mechanical energy
    d) Chemical energy
    Answer: b) Electric field

13. If the voltage across a capacitor is doubled, the charge stored will:
    a) Remain the same
    b) Double
    c) Half
    d) Become four times
    Answer: b) Double

14. What is the function of a capacitor in an AC circuit?
    a) To store charge
    b) To store energy
    c) To block DC and allow AC
    d) All of the above
    Answer: d) All of the above

15. Three capacitors of 6μF, 3μF, and 2μF are connected in series. What is the total capacitance?
    a) 1μF
    b) 2μF
    c) 3μF
    d) 4μF
    Answer: a) 1μF

16. Two capacitors of 5μF and 10μF are connected in parallel. What is their total capacitance?
    a) 3.33μF
    b) 15μF
    c) 5μF
    d) 10μF
    Answer: b) 15μF

❖ Heat and thermometry

1. The SI unit of heat is:
    a) Newton
    b) Joule
    c) Watt

d) Kelvin
Answer: b) Joule

2. Which mode of heat transfer requires direct contact between particles?
   a) Conduction
   b) Convection
   c) Radiation
   d) None of the above
   Answer: a) Conduction

3. Which mode of heat transfer occurs only in fluids?
   a) Conduction
   b) Convection
   c) Radiation
   d) Reflection
   Answer: b) Convection

4. Heat transfer by convection occurs due to:
   a) Molecular collisions
   b) Free electron movement
   c) Density differences
   d) Electromagnetic waves
   Answer: c) Density differences

5. The Sun's heat reaches the Earth by:
   a) Conduction
   b) Convection
   c) Radiation
   d) Reflection
   Answer: c) Radiation

6. Which of the following is the best conductor of heat?
   a) Wood
   b) Copper
   c) Plastic
   d) Water
   Answer: b) Copper

7. Which surface is the best absorber of heat?
   a) Shiny and smooth
   b) Black and rough
   c) White and smooth
   d) Transparent glass
   Answer: b) Black and rough

8. Heat transfer through a vacuum occurs by:
   a) Conduction
   b) Convection
   c) Radiation
   d) None of these
   Answer: c) Radiation

9. The thermal conductivity of a perfect insulator is:
   a) Infinite
   b) Zero
   c) 1
   d) Very high
   Answer: b) Zero

10. Cooking pots are made of metal because:
    a) Metals are poor conductors
    b) Metals are good conductors of heat
    c) Metals do not expand when heated
    d) Metals reduce heat transfer
    Answer: b) Metals are good conductors of heat

11. The transfer of heat in a metal rod is an example of:
    a) Conduction
    b) Convection
    c) Radiation
    d) None of the above
    Answer: a) Conduction

12. Why do black surfaces absorb more heat?
    a) They reflect radiation
    b) They have high emissivity
    c) They are poor absorbers
    d) They do not conduct heat
    Answer: b) They have high emissivity

13. The greenhouse effect is due to:
    a) Conduction
    b) Convection
    c) Radiation
    d) None of the above
    Answer: c) Radiation

14. Land and sea breezes are caused by:
    a) Conduction
    b) Convection
    c) Radiation
    d) Reflection
    Answer: b) Convection

15. A metal rod is heated at one end. If the rod's length is doubled, what happens to the rate of heat transfer?
    a) Doubles
    b) Halves
    c) Remains the same
    d) Becomes one-fourth
    Answer: b) Halves

16. A body at 300 K radiates energy. If the temperature increases to 600 K, how much more energy will it emit?
    a) 2 times
    b) 4 times
    c) 8 times
    d) 16 times
    Answer: d) 16 times

1. What is the freezing point of water in the Celsius scale?
    a) 100°C
    b) 0°C
    c) 273°C
    d) 32°C
    Answer: b) 0°C

2. The SI unit of temperature is:
    a) Celsius
    b) Fahrenheit
    c) Kelvin
    d) Rankine
    Answer: c) Kelvin

3. What is the value of absolute zero in Celsius?
    a) -273.15°C
    b) 0°C
    c) -100°C
    d) 273.15°C
    Answer: a) -273.15°C

4. The boiling point of water in Fahrenheit is:
    a) 100°F
    b) 32°F
    c) 373.15°F
    d) 212°F
    Answer: d) 212°F

5. Which of the following is an absolute temperature scale?
    a) Celsius
    b) Fahrenheit
    c) Kelvin
    d) Centigrade
    Answer: c) Kelvin

6. The relation between Kelvin and Celsius is:
    a) K = °C + 273.15
    b) K = °C - 273.15
    c) K = 1.8 × °C + 32
    d) None of these
    Answer: a) K = °C + 273.15

7. If the temperature of an object is 0°C, what is its temperature in Kelvin?
   a) 0 K
   b) 100 K
   c) 273.15 K
   d) -273.15 K
   Answer: c) 273.15 K

8. The Fahrenheit equivalent of 0°C is:
   a) 32°F
   b) 0°F
   c) -32°F
   d) 100°F
   Answer: a) 32°F

9. The unit of absolute temperature is:
   a) Degree Celsius
   b) Kelvin
   c) Fahrenheit
   d) Rankine
   Answer: b) Kelvin

10. What is the Fahrenheit equivalent of 273.15 K?
    a) 0°F
    b) 32°F
    c) 100°F
    d) 212°F
    Answer: b) 32°F

11. What is the boiling point of water in Kelvin?
    a) 100 K
    b) 212 K
    c) 273.15 K
    d) 373.15 K
    Answer: d) 373.15 K

12. Who developed the Fahrenheit scale?
    a) Lord Kelvin
    b) Daniel Gabriel Fahrenheit
    c) Anders Celsius
    d) James Joule
    Answer: b) Daniel Gabriel Fahrenheit

13. Absolute zero is defined as:
    a) The lowest temperature theoretically possible
    b) The temperature of boiling water
    c) The freezing point of water
    d) The standard room temperature
    Answer: a) The lowest temperature theoretically possible

14. Which temperature scale is used in scientific calculations?
    a) Celsius

b) Fahrenheit
c) Kelvin
d) Rankine
Answer: c) Kelvin

15. Convert 50°C to Fahrenheit.
    a) 100°F
    b) 122°F
    c) 212°F
    d) 150°F
    Answer: b) 122°F

16. Convert 400 K to Celsius.
    a) 100°C
    b) 126.85°C
    c) 150°C
    d) 200°C
    Answer: b) 126.85°C

1. The SI unit of heat capacity is:
    a) J/kg
    b) J/K
    c) J/kg·K
    d) cal/g°C
    Answer: b) J/K

2. The SI unit of specific heat capacity is:
    a) J/K
    b) J/kg·K
    c) cal/g
    d) cal/g°C
    Answer: b) J/kg·K

3. Which substance has the highest specific heat capacity?
    a) Copper
    b) Water
    c) Mercury
    d) Iron
    Answer: b) Water

4. Heat capacity depends on:
    a) Only the mass of the object
    b) Only the type of material
    c) Both mass and material of the object
    d) Neither mass nor material
    Answer: c) Both mass and material of the object

5. The heat energy required to raise the temperature of 1 kg of a substance by 1 K is called:
    a) Heat capacity
    b) Specific heat capacity
    c) Latent heat

d) Thermal conductivity
Answer: b) Specific heat capacity

6. If a substance has a high specific heat capacity, it:
   a) Heats up quickly
   b) Heats up slowly
   c) Does not absorb heat
   d) Cools down very fast
   Answer: b) Heats up slowly

7. If a 500 g block of metal and a 500 g of water absorb the same heat, which will show a greater temperature change?
   a) Metal
   b) Water
   c) Both will show the same change
   d) Cannot be determined
   Answer: a) Metal

8. What is the specific heat capacity of water?
   a) 1000 J/kg·K
   b) 4200 J/kg·K
   c) 500 J/kg·K
   d) 900 J/kg·K
   Answer: b) 4200 J/kg·K

9. If the heat energy supplied to a substance is doubled, what happens to the temperature change?
   a) It remains the same
   b) It is halved
   c) It is doubled
   d) It becomes zero
   Answer: c) It is doubled

10. A substance with **high heat capacity** will:
    a) Heat up quickly
    b) Cool down quickly
    c) Heat up and cool down slowly
    d) Not absorb heat
    Answer: c) Heat up and cool down slowly

11. What is the formula for heat energy?
    a) $Q=mcT$
    b) $Q=mc\Delta T$
    c) $Q=T/mc$
    d) $Q=\Delta T/m$
    Answer: b) $Q=mc\Delta T$

12. The amount of heat required to raise the temperature of 1 g of water by 1°C is:
    a) 1 J
    b) 4.186 J
    c) 10 J

d) 100 J
Answer: b) 4.186 J

13. A substance with a low specific heat capacity will:
    a) Require more heat to change temperature
    b) Heat up and cool down quickly
    c) Heat up and cool down slowly
    d) Absorb no heat
    Answer: b) Heat up and cool down quickly

14. Which of the following has the lowest specific heat capacity?
    a) Water
    b) Iron
    c) Aluminum
    d) Copper
    Answer: d) Copper

15. A **2 kg** block of iron with **specific heat capacity 450 J/kg·K** is heated from **20°C to 70°C**. Find the heat required.
    a) 10,000 J
    b) 20,000 J
    c) 45,000 J
    d) 50,000 J
    Answer: b) 20,000 J
    Solution: $Q=mc\Delta T=(2)(450)(70-20)=20,000J$

16. A **1 kg** metal block absorbs **5000 J** of heat and its temperature rises by **25°C**. What is its specific heat capacity?
    a) 200 J/kg·K
    b) 300 J/kg·K
    c) 400 J/kg·K
    d) 500 J/kg·K
    Answer: d) 500 J/kg·K
    Solution: $c=Q/m\Delta T=5000/1\times25=500J/kg\cdot K$

1. Thermal conductivity is the property of a material to:
    a) Absorb heat
    b) Transfer heat
    c) Expand when heated
    d) Change state
    Answer: b) Transfer heat

2. The SI unit of thermal conductivity is:
    a) J/kg·K
    b) W/mK
    c) J/m^2K
    d) N/m^2
    Answer: b) W/mK

3. Which of the following has the highest thermal conductivity?
   a) Copper
   b) Glass
   c) Rubber
   d) Water
   Answer: a) Copper

4. What happens to the thermal conductivity of metals when temperature increases?
   a) Increases
   b) Decreases
   c) Remains constant
   d) First increases, then decreases
   Answer: b) Decreases

5. Which of the following is a poor conductor of heat?
   a) Silver
   b) Copper
   c) Wood
   d) Iron
   Answer: c) Wood

6. What is the physical significance of thermal conductivity?
   a) Ability to store heat
   b) Ability to conduct electricity
   c) Ability to transfer heat
   d) Ability to expand when heated
   Answer: c) Ability to transfer heat

7. Which of the following materials is the best insulator?
   a) Aluminum
   b) Copper
   c) Air
   d) Steel
   Answer: c) Air

8. What is the relation between heat transfer and thermal conductivity?
   a) Directly proportional
   b) Inversely proportional
   c) No relation
   d) Exponential relation
   Answer: a) Directly proportional

9. Linear expansion occurs in:
   a) Liquids
   b) Solids
   c) Gases
   d) Plasma
   Answer: b) Solids

10. The coefficient of linear expansion is measured in:
    a) Joules

b) Kelvin
c) 1/K
d) m^2
Answer: c) 1/K

11. The change in length of a rod when heated depends on:
    a) Its original length
    b) Change in temperature
    c) Coefficient of linear expansion
    d) All of the above
    Answer: d) All of the above

12. Which material expands the most when heated?
    a) Steel
    b) Water
    c) Copper
    d) Rubber
    Answer: c) Copper

13. Why are expansion joints provided in railway tracks?
    a) To allow contraction in winter
    b) To allow expansion in summer
    c) To maintain constant track length
    d) To improve electrical conductivity
    Answer: b) To allow expansion in summer

14. Which metal is most suitable for making cooking utensils due to its high thermal conductivity?
    a) Silver
    b) Copper
    c) Aluminum
    d) Iron
    Answer: b) Copper

15. A **1.5 m** long aluminum rod ($\alpha = 24 \times 10^{-6}\ K^{-1}$) is heated from **20°C to 80°C**. Find its increase in length.
    a) 0.002 m
    b) 0.0025 m
    c) 0.0036 m
    d) 0.0045 m
    Answer: c) 0.0036 m
    Solution:

$$\Delta L = (24 \times 10^{-6}) \times 1.5 \times (80 - 20) = 0.0036 \text{ m}$$

16. A **copper rod (k = 385 W/mK)** conducts **2000 J** of heat in **10 s**. The rod has a cross-sectional area of **0.01 m^2** and thickness of **0.02 m**. If the temperature difference is **50°C**, find the rate of heat transfer.
    a) 1925 W
    b) 1975 W
    c) 2000 W

d) 2025 W
Answer: c) 2000 W

❖ WAVE MOTION, OPTICS AND ACOUSTICS

1. Which of the following waves require a medium to propagate?
   a) Light waves
   b) Radio waves
   c) Sound waves
   d) X-rays
   Answer: c) Sound waves

2. Which of the following is a transverse wave?
   a) Sound wave
   b) Water wave
   c) Seismic P-wave
   d) Ultrasound wave
   Answer: b) Water wave

3. In a longitudinal wave, the particles of the medium move:
   a) Perpendicular to the wave motion
   b) Parallel to the wave motion
   c) In a circular motion
   d) At an angle of 45°
   Answer: b) Parallel to the wave motion

4. Which of the following is an example of a mechanical wave?
   a) Radio waves
   b) X-rays
   c) Sound waves
   d) Gamma rays
   Answer: c) Sound waves

5. The regions of high pressure in a longitudinal wave are called:
   a) Troughs
   b) Crests
   c) Rarefactions
   d) Compressions
   Answer: d) Compressions

6. In which type of wave do the particles vibrate perpendicular to the direction of wave propagation?
   a) Longitudinal waves
   b) Transverse waves
   c) Electromagnetic waves
   d) Standing waves
   Answer: b) Transverse waves

7. Which of the following is an example of a standing wave?
   a) Water wave
   b) Sound wave in open air
   c) Vibrations in a stretched string
   d) Light wave
   Answer: c) Vibrations in a stretched string

8. Sound waves in air are:
   a) Transverse waves
   b) Longitudinal waves
   c) Electromagnetic waves
   d) Standing waves
   Answer: b) Longitudinal waves

9. Which of the following waves can travel through a vacuum?
   a) Sound waves
   b) Seismic waves
   c) Light waves
   d) Water waves
   Answer: c) Light waves

10. Which of the following is an example of a progressive wave?
    a) Water waves
    b) Standing waves
    c) String vibration
    d) Oscillations in a pendulum
    Answer: a) Water waves

11. Which of the following is NOT a mechanical wave?
    a) Sound wave
    b) Water wave
    c) Light wave
    d) Seismic wave
    Answer: c) Light wave

12. The points of maximum displacement in a standing wave are called:
    a) Nodes
    b) Antinodes
    c) Crests
    d) Troughs
    Answer: b) Antinodes

13. Which type of wave has both electric and magnetic components?
    a) Sound wave
    b) Electromagnetic wave
    c) Longitudinal wave
    d) Mechanical wave
    Answer: b) Electromagnetic wave

14. The speed of a wave depends on:
    a) Its frequency only

b) The medium in which it travels
c) The amplitude of the wave
d) The color of the wave
Answer: b) The medium in which it travels

15. A sound wave has a wavelength of **0.5 m** and a frequency of **660 Hz**. What is the speed of the wave?
    a) 330 m/s
    b) 1320 m/s
    c) 660 m/s
    d) 165 m/s
    Answer: a) 330 m/s
    Solution:

$$v = f\lambda = (660)(0.5) = 330 \text{ m/s}$$

16. If the frequency of a transverse wave is **50 Hz** and its speed is **200 m/s**, what is its wavelength?
    a) 0.25 m
    b) 4 m
    c) 50 m
    d) 100 m
    Answer: b) 4 m
    Solution:

$$\Lambda \text{ (lambda)} = vf = 200/50 = 4 \text{ m}$$

1. The unit of frequency is:
    a) Second
    b) Meter
    c) Hertz
    d) Joule
    Answer: c) Hertz

2. Wavelength is measured in:
    a) Hertz
    b) Meter
    c) Second
    d) Newton
    Answer: b) Meter

3. The time taken to complete one oscillation is called:
    a) Frequency
    b) Wavelength
    c) Amplitude
    d) Time period
    Answer: d) Time period

4. If the frequency of a wave increases, its wavelength:
    a) Increases
    b) Decreases

c) Remains constant
d) Becomes infinite
Answer: b) Decreases

5. The relation between velocity v frequency f, and wavelength λ is:
   a) $v=f\times\lambda$
   b) $v=\lambda/f$
   c) $v=f^2\lambda$
   d) $v=f/\lambda$
   Answer: a) $v=f\times\lambda$

6. The frequency of a wave is 5 Hz. Its time period is:
   a) 0.5 s
   b) 0.2 s
   c) 2 s
   d) 5 s
   Answer: b) 0.2 s
   Solution: $T=1/f=1/5=0.2$ s

7. If the time period of a wave is 0.01 s, what is its frequency?
   a) 10 Hz
   b) 100 Hz
   c) 0.01 Hz
   d) 1000 Hz
   Answer: b) 100 Hz

8. The distance between two consecutive compressions in a longitudinal wave is called:
   a) Amplitude
   b) Wavelength
   c) Frequency
   d) Time period
   Answer: b) Wavelength

9. What happens to the frequency of a wave if its time period doubles?
   a) Doubles
   b) Halves
   c) Remains the same
   d) Becomes zero
   Answer: b) Halves

10. If the wavelength of a wave is **10 m** and its velocity is **200 m/s**, what is its frequency?
    a) 10 Hz
    b) 20 Hz
    c) 2000 Hz
    d) 2 Hz
    Answer: b) 20 Hz
    Solution: $f=v/\lambda=200/10=20$

11. If the frequency of a sound wave is **256 Hz**, what is its time period?
    a) 0.004 s
    b) 0.01 s

c) 4 s
d) 256 s
Answer: a) 0.004 s
Solution: $T=1/f=1/256=0.0039\approx0.004$ s

12. What happens to the speed of a wave if both its frequency and wavelength are doubled?
    a) Remains the same
    b) Doubles
    c) Quadruples
    d) Halves
    Answer: c) Quadruples
    Solution: Since $v=f\lambda$, if both f and λ double, then v becomes 4v.

13. The SI unit of time period is:
    a) Hertz
    b) Meter
    c) Second
    d) Joule
    Answer: c) Second

14. If the speed of sound in air is **340 m/s** and the frequency is **170 Hz**, what is its wavelength?
    a) 1 m
    b) 2 m
    c) 0.5 m
    d) 5 m
    Answer: b) 2 m
    Solution: $\lambda=v/f=340/170=2$ m

15. A wave moves with a velocity of **300 m/s** and has a frequency of **100 Hz**. What is its wavelength?
    a) 3 m
    b) 30 m
    c) 0.3 m
    d) 300 m
    Answer: a) 3 m
    Solution: $\lambda=vf=300/100=3$ m

16. A water wave has a wavelength of **5 m** and a frequency of **2 Hz**. What is its speed?
    a) 2 m/s
    b) 5 m/s
    c) 10 m/s
    d) 20 m/s
    Answer: c) 10 m/s
    Solution: $v=f\lambda=(2)(5)=10$ m/s

1. Electromagnetic waves can travel through:
    a) Solids only
    b) Liquids only
    c) Gases only

d) Vacuum
Answer: d) Vacuum

2. Which of the following waves requires a medium to propagate?
   a) Radio waves
   b) Sound waves
   c) X-rays
   d) Visible light
   Answer: b) Sound waves

3. The speed of electromagnetic waves in a vacuum is approximately:
   a) 3×10^6 m/s
   b) 3×10^8 m/s
   c) 3×10^4 m/s
   d) 3× 10^2 m/s
   Answer: b) 3× 10^8 m/s

4. The frequency range of audible sound waves is:
   a) 2 Hz – 200 Hz
   b) 20 Hz – 20,000 Hz
   c) 200 Hz – 200,000 Hz
   d) 2,000 Hz – 20,000 Hz
   Answer: b) 20 Hz – 20,000 Hz

5. Which of the following is **not** an application of LASER?
   a) Surgery
   b) Barcode scanning
   c) Cooking food
   d) Optical fiber communication
   Answer: c) Cooking food

6. The **wavelength range** of visible light is:
   a) 100-200 nm
   b) 400-700 nm
   c) 700-1000 nm
   d) 2000-4000 nm
   Answer: b) 400-700 nm

7. What is the main property of LASER light?
   a) It is incoherent
   b) It has multiple wavelengths
   c) It is highly directional and monochromatic
   d) It cannot travel through air
   Answer: c) It is highly directional and monochromatic

8. What is the principle of SONAR?
   a) Reflection of light
   b) Refraction of light
   c) Reflection of ultrasonic waves
   d) Refraction of ultrasonic waves
   Answer: c) Reflection of ultrasonic waves

9. Which of the following devices use ultrasonic waves?
   a) Microwave oven
   b) X-ray machine
   c) Ultrasound scanner
   d) CFL bulb
   Answer: c) Ultrasound scanner

10. The electromagnetic wave with the **highest frequency** is:
    a) Radio waves
    b) Infrared rays
    c) X-rays
    d) Gamma rays
    Answer: d) Gamma rays

11. The property that distinguishes sound waves from electromagnetic waves is:
    a) Sound waves travel faster than electromagnetic waves
    b) Sound waves require a medium to propagate
    c) Sound waves are transverse in nature
    d) Sound waves do not follow the laws of wave motion
    Answer: b) Sound waves require a medium to propagate

12. Ultrasonic waves are used in:
    a) UV radiation therapy
    b) Satellite communication
    c) Blood flow measurement
    d) Optical fiber communication
    Answer: c) Blood flow measurement

13. What happens to the speed of sound when it moves from air to water?
    a) Increases
    b) Decreases
    c) Remains the same
    d) First increases, then decreases
    Answer: a) Increases

14. The fundamental principle of ultrasound scanning in the medical field is:
    a) Light reflection
    b) Infrared radiation
    c) Ultrasonic wave reflection
    d) UV ray absorption
    Answer: c) Ultrasonic wave reflection

15. If a LASER beam has a wavelength of **500 nm**, what is its frequency?
    (Speed of light = 3×10^8 m/s)
    a) 6×10^14 Hz
    b) 5×10^14 Hz
    c) 3×10^14 Hz
    d) 4×10^14 Hz
    Answer: b) 5×10^14 Hz
    Solution: f=c/λ=3×10^8/500×10^−9=6×10^14 Hz

16. A sonar wave travels with a velocity of **1500 m/s** in water and is reflected back after **2 seconds**. What is the depth of the object?
    a) 1500 m
    b) 3000 m
    c) 750 m
    d) 6000 m
    Answer: b) 1500 m
    Solution: Depth=velocity×time/2=1500×2/2=1500m

1. The amplitude of a wave represents:
    a) The speed of the wave
    b) The frequency of the wave
    c) The maximum displacement from equilibrium
    d) The phase of the wave
    Answer: c) The maximum displacement from equilibrium

2. Intensity of a wave is proportional to:
    a) A
    b) A^2
    c) 1/A
    d) 1/A^2
    Answer: b) A^2

3. What is the SI unit of intensity?
    a) Joule
    b) Watt
    c) Watt per square meter
    d) Newton
    Answer: c) Watt per square meter

4. If the amplitude of a wave is tripled, the intensity increases by:
    a) 3 times
    b) 6 times
    c) 9 times
    d) 12 times
    Answer: c) 9 times

5. Phase difference between two completely out-of-phase waves is:
    a) 0∘
    b) 90∘
    c) 180∘
    d) 360∘
    Answer: c) 180∘

6. Constructive interference occurs when the phase difference is:
    a) 0∘
    b) 90∘
    c) 180∘
    d) 270∘
    Answer: a) 0∘

7. The wave equation $y=A\sin(kx-\omega t)$ represents:
   a) A stationary wave
   b) A progressive wave
   c) A longitudinal wave
   d) A circular wave
   Answer: b) A progressive wave

8. What is the phase difference between a crest and a trough of a wave?
   a) 0∘
   b) 90∘
   c) 180∘
   d) 360∘
   Answer: c) 180∘

9. Which of the following parameters does not change when a wave moves from one medium to another?
   a) Frequency
   b) Wavelength
   c) Speed
   d) Amplitude
   Answer: a) Frequency

10. The wave equation **$y=5\sin(2x-3t)$** represents a wave with an amplitude of:
    a) 5 units
    b) 2 units
    c) 3 units
    d) 10 units
    Answer: a) 5 units

11. A sound wave travels from air to water. What happens to its speed?
    a) Increases
    b) Decreases
    c) Remains constant
    d) First increases, then decreases
    Answer: a) Increases

12. A phase difference of **0∘** means the waves are:
    a) Out of phase
    b) In phase
    c) Perpendicular
    d) Traveling in different directions
    Answer: b) In phase

13. What is the unit of wave number k?
    a) Hz
    b) m
    c) m^−1
    d) s^−1
    Answer: c) m^−1

14. If the time period of a wave is **0.02 s**, its frequency is:
    a) 2 Hz
    b) 10 Hz
    c) 50 Hz
    d) 100 Hz
    Answer: c) 50 Hz

15. A wave has a wavelength of **4 m** and a speed of **8 m/s**. What is its frequency?
    a) 2 Hz
    b) 4 Hz
    c) 8 Hz
    d) 16 Hz
    Answer: a) 2 Hz
    Solution: f=v/λ=8/4=2 Hz

16. A wave equation is given by **y=3sin(4x−6t)**. Find its angular frequency ω\omega.
    a) 4 rad/s
    b) 6 rad/s
    c) 8 rad/s
    d) 10 rad/s
    Answer: b) 6 rad/s

1. The angle of incidence and angle of reflection are:
    a) Always equal
    b) Sometimes equal
    c) Independent of each other
    d) Always different
    Answer: a) Always equal

2. Refraction occurs because of a change in:
    a) Frequency
    b) Speed
    c) Wavelength
    d) Both b and c
    Answer: d) Both b and c

3. The refractive index of a medium is given by:
    a) v/c
    b) c/v
    c) sini/sinr
    d) Both b and c
    Answer: d) Both b and c

4. If a ray of light travels from air to water, it bends:
    a) Toward the normal
    b) Away from the normal
    c) Does not bend
    d) Back into air
    Answer: a) Toward the normal

5. Which of the following materials has the highest refractive index?
   a) Water
   b) Air
   c) Glass
   d) Diamond
   Answer: d) Diamond

6. Total internal reflection occurs when light travels from:
   a) Rarer to denser medium
   b) Denser to rarer medium
   c) Denser to denser medium
   d) Rarer to rarer medium
   Answer: b) Denser to rarer medium

7. The critical angle for water (n = 1.33) is approximately:
   a) 30°
   b) 42°
   c) 48°
   d) 60°
   Answer: c) 48°

8. Which condition is necessary for total internal reflection?
   a) i>C
   b) i<C
   c) i=C
   d) i=90∘
   Answer: a) i>C

9. Optical fibers use:
   a) Reflection
   b) Refraction
   c) Total internal reflection
   d) Dispersion
   Answer: c) Total internal reflection

10. Which part of an optical fiber has a lower refractive index?
    a) Core
    b) Cladding
    c) Buffer coating
    d) Glass layer
    Answer: b) Cladding

11. If the speed of light in a medium is 2×10^8 m/s, what is its refractive index?
    a) 1.5
    b) 1.33
    c) 2.0
    d) 1.25
    Answer: a) 1.5
    Solution: n=c/v=(3×10^8)/(2×108)=1.5

12. A light ray passes from glass (n=1.5) to water (n=1.33). If the incident angle is 50°, what is the refracted angle?
    a) 40°
    b) 45°
    c) 60°
    d) 30°
    Answer: a) 40°

1. Reverberation is caused due to:
    a) Absorption of sound
    b) Reflection of sound
    c) Refraction of sound
    d) Diffraction of sound
    Answer: b) Reflection of sound

2. Reverberation time is defined as:
    a) Time taken for sound to become inaudible
    b) Time taken for sound to reduce by 10 dB
    c) Time taken for sound to decrease by 60 dB
    d) Time taken for sound to travel a certain distance
    Answer: c) Time taken for sound to decrease by 60 dB

3. The reverberation time of a hall depends on:
    a) Volume of the hall
    b) Total absorption in the hall
    c) Both (a) and (b)
    d) Neither (a) nor (b)
    Answer: c) Both (a) and (b)

4. Sabine's formula is used to calculate:
    a) Speed of sound
    b) Reverberation time
    c) Wavelength of sound
    d) Sound intensity
    Answer: b) Reverberation time

5. The ideal reverberation time for speech auditoriums is:
    a) 0.1 to 0.3 sec
    b) 0.5 to 1.0 sec
    c) 1.5 to 2.0 sec
    d) 2.5 to 3.0 sec
    Answer: b) 0.5 to 1.0 sec

6. An echo occurs when the reflected sound reaches the listener after at least:
    a) 0.01 sec
    b) 0.1 sec
    c) 1 sec
    d) 2 sec
    Answer: b) 0.1 sec

7. The minimum distance required to hear an echo in air is:
   a) 10 meters
   b) 17.2 meters
   c) 30 meters
   d) 50 meters
   Answer: b) 17.2 meters

8. The absorption coefficient (α\alphaα) of a perfect absorber is:
   a) 0
   b) 0.5
   c) 1
   d) ∞
   Answer: c) 1

9. Which of the following materials is best for soundproofing?
   a) Glass
   b) Carpet
   c) Concrete
   d) Metal
   Answer: b) Carpet

10. A room with excessive reverberation will have:
    a) Clear sound
    b) Echoing and unclear sound
    c) No sound reflection
    d) Low intensity sound
    Answer: b) Echoing and unclear sound

11. What happens if reverberation time is too high in a concert hall?
    a) Sound becomes more clear
    b) Sound gets distorted and unclear
    c) Sound travels faster
    d) Music sounds sharper
    Answer: b) Sound gets distorted and unclear

12. Which of the following reduces reverberation?
    a) Adding soft materials
    b) Using hard surfaces
    c) Increasing the volume of the room
    d) Reducing the size of the room
    Answer: a) Adding soft materials

13. If a room has a volume of **500 m^3** and an absorption of **50 m^2**, what will be the approximate reverberation time?
    a) 0.5 sec
    b) 1.61 sec
    c) 2.5 sec
    d) 3.2 sec
    Answer: b) 1.61 sec

14. Which of the following best describes reverberation?
    a) Prolonged sound due to repeated reflection
    b) Sound completely absorbed by walls
    c) Sound traveling in a straight line
    d) Sound losing intensity immediately
    Answer: a) Prolonged sound due to repeated reflection

15. A hall has a volume of **400 m^3** and an absorption of **80 m^2**. What is the reverberation time?
    Answer:

TR=0.161×400/80=0.805 sec

16. If the absorption coefficient of curtains is **0.6**, how much sound is absorbed by **10 m^2** of curtains?
    Answer:

$$10 \times 0.6 = 6\ m^2$$

❖ Chemical Reactions and Equations

1. What does a chemical equation represent?
    a) Number of molecules in a reaction
    b) Reactants and products of a reaction
    c) Speed of the reaction
    d) Only products of a reaction
    Answer: b) Reactants and products of a reaction

2. Which law is used to balance a chemical equation?
    a) Law of Multiple Proportions
    b) Law of Conservation of Mass
    c) Avogadro's Law
    d) Law of Constant Proportions
    Answer: b) Law of Conservation of Mass

3. What is the correct chemical equation for the reaction of iron with oxygen?
    a) Fe+O2→FeO
    b) 4Fe+3O2→2Fe2O3
    c) 2Fe+O2→2FeO
    d) Fe+O2→Fe2O3
    Answer: b) 4Fe+3O2→2Fe2O3

4. What is the coefficient of oxygen in the balanced equation for the combustion of methane?

CH4+O2→CO2+H2O

a) 1
b) 2
c) 3
d) 4
Answer: b) 2

5. The reaction $2H_2O_2 \rightarrow 2H_2O + O_2$ is an example of:
   a) Combination reaction
   b) Decomposition reaction
   c) Displacement reaction
   d) Double displacement reaction
   Answer: b) Decomposition reaction

6. Which of the following represents a **balanced equation**?
   a) $Na + H_2O \rightarrow NaOH + H_2$
   b) $2Na + 2H_2O \rightarrow 2NaOH + H_2$
   c) $Na + H_2O \rightarrow NaOH$
   d) $Na + H_2O \rightarrow H_2O + NaOH$
   Answer: b) $2Na + 2H_2O \rightarrow 2NaOH + H_2$

7. What is the missing coefficient in the balanced equation?

   $$C_3H_8 + O_2 \rightarrow CO_2 + H_2O$$

a) 3
b) 5
c) 4
d) 2
Answer: b) 5

8. The reaction $2KClO_3 \rightarrow 2KCl + 3O_2$ is an example of:
   a) Combination reaction
   b) Decomposition reaction
   c) Displacement reaction
   d) Redox reaction
   Answer: b) Decomposition reaction

9. Which of the following is a **correctly balanced equation**?
   a) $2H_2 + O_2 \rightarrow H_2O$
   b) $H_2 + O_2 \rightarrow 2H_2O$
   c) $2H_2 + O_2 \rightarrow 2H_2O$
   d) $H_2 + O_2 \rightarrow H_2O_2$
   Answer: c) $2H_2 + O_2 \rightarrow 2H_2O$

10. The sum of coefficients in the balanced equation for rust formation ($4Fe + 3O_2 \rightarrow 2Fe_2O_3$) is:
    a) 7
    b) 9
    c) 10
    d) 5
    Answer: b) 9

21. Balance the equation:

$$Al+O2 \rightarrow Al2O3$$

Answer:

$$4Al+3O2 \rightarrow 2Al2O3$$

22. Balance the equation:

$$C2H6+O2 \rightarrow CO2+H2O$$

Answer:

$$2C2H6+7O2 \rightarrow 4CO2+6H2O$$

23. Balance the reaction for the reaction of ammonia and oxygen:

$$NH3+O2 \rightarrow NO+H2O$$

Answer:

$$4NH3+5O2 \rightarrow 4NO+6H2O$$

24. What are the missing coefficients in the balanced equation?

$$C6H12O6+O2 \rightarrow CO2+H2O$$

Answer:

$$C6H12O6+6O2 \rightarrow 6CO2+6H2O$$

25. Find the coefficient of HCl in the reaction:

$$Mg+HCl \rightarrow MgCl2+H2$$

Answer:

$$Mg+2HCl \rightarrow MgCl2+H2$$

1. What is the product in the combination reaction of hydrogen and oxygen?
   a) $H2O2$
   b) $H2O$
   c) $O2$
   d) $H2$
   Answer: b) $H2O$

2. Which of the following is a **combination reaction**?
   a) $2H2O \rightarrow 2H2+O2$
   b) $2H2+O2 \rightarrow 2H2O$
   c) $Fe+CuSO4 \rightarrow FeSO4+Cu$
   d) $AgNO3+NaCl \rightarrow AgCl+NaNO3$
   Answer: b) $2H2+O2 \rightarrow 2H2O$

3. The reaction $2KClO3 \rightarrow 2KCl+3O2$ is an example of:
   a) Combination reaction

b) Decomposition reaction
c) Displacement reaction
d) Double displacement reaction
Answer: b) Decomposition reaction

4. Which type of reaction occurs when **calcium carbonate** decomposes?
   a) Combination
   b) Decomposition
   c) Displacement
   d) Double displacement
   Answer: b) Decomposition

5. What type of reaction is this?

$$Zn+H2SO4 \rightarrow ZnSO4+H2$$

a) Combination
b) Decomposition
c) Displacement
d) Double displacement
Answer: c) Displacement

6. Which type of reaction is represented by the equation?

$$BaCl2+Na2SO4 \rightarrow BaSO4\downarrow+2NaCl$$

a) Combination
b) Decomposition
c) Displacement
d) Double displacement
Answer: d) Double displacement

7. A reaction where a single compound breaks into simpler substances is called:
   a) Combination
   b) Decomposition
   c) Displacement
   d) Double displacement
   Answer: b) Decomposition

8. What type of reaction is **neutralization**?
   a) Combination
   b) Decomposition
   c) Displacement
   d) Double displacement
   Answer: d) Double displacement

9. Which reaction type follows the **reactivity series**?
   a) Combination
   b) Decomposition
   c) Displacement
   d) Double displacement
   Answer: c) Displacement

10. Identify the **double displacement** reaction:
    a) $CuSO4+Zn \rightarrow ZnSO4+Cu$
    b) $2H2O2 \rightarrow 2H2O+O2$
    c) $HCl+NaOH \rightarrow NaCl+H2O$
    d) $C+O2 \rightarrow CO2$
    Answer: c) $HCl+NaOH \rightarrow NaCl+H2O$

21. Balance the reaction:

$$Na+Cl2 \rightarrow NaCl$$

Answer:

$$2Na+Cl2 \rightarrow 2NaCl$$

22. Balance the reaction:

$CaCO3 \rightarrow CaO+CO2$

Answer: Balanced equation is already correct.

23. Balance the reaction:

$$KClO3 \rightarrow KCl+O2$$

Answer:

$2KClO3 \rightarrow 2KCl+3O2$

24. Identify the **product** of:

$$Fe+CuSO4 \rightarrow ?$$

Answer: $FeSO4+Cu$

25. Predict the reaction:

$$AgNO3+NaCl \rightarrow ?$$

Answer: $AgCl\downarrow+NaNO3$

❖ Acids, Bases and Salts

1. Which of the following is a **strong acid**?
    a) H_2O
    b) HCl
    c) NH_3
    d) NaOH
    Answer: b) HCl

2. What gas is released when an acid reacts with a metal?
    a) Oxygen
    b) Nitrogen
    c) Hydrogen
    d) Carbon dioxide
    Answer: c) Hydrogen

3. What happens when blue litmus paper is dipped in acid?
   a) Turns red
   b) Turns blue
   c) Turns yellow
   d) No change
   Answer: a) Turns red

4. What happens when red litmus paper is dipped in a base?
   a) Turns red
   b) Turns blue
   c) Turns green
   d) No change
   Answer: b) Turns blue

5. Which of the following is a **neutralization reaction**?
   a) $NaOH + HCl \rightarrow NaCl + H_2O$
   b) $NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$
   c) $H_2SO_4 + Zn \rightarrow ZnSO_4 + H_2$
   d) $CaCO_3 + HCl \rightarrow CaCl_2 + CO_2 + H_2O$
   Answer: a) $NaOH + HCl \rightarrow NaCl + H_2O$

6. What product is formed when **acids react with metal carbonates**?
   a) Hydrogen gas
   b) Oxygen gas
   c) Carbon dioxide gas
   d) Ammonia gas
   Answer: c) Carbon dioxide gas

7. What is the **nature of soap solution**?
   a) Acidic
   b) Basic
   c) Neutral
   d) Amphoteric
   Answer: b) Basic

8. Which of the following bases is **soluble in water**?
   a) $Fe(OH)_3$
   b) $NaOH$
   c) $Cu(OH)_2$
   d) $Zn(OH)_2$
   Answer: b) $NaOH$

9. Which of the following **metal oxides** forms a **base** when dissolved in water?
   a) CO_2
   b) SO_2
   c) Na_2O
   d) NO_2
   Answer: c) Na_2O

10. What are the **products of the reaction** between calcium carbonate and hydrochloric acid?

a) Calcium chloride, carbon dioxide, and water
b) Calcium hydroxide, oxygen, and water
c) Calcium sulfate, hydrogen, and water
d) Calcium bicarbonate and carbon monoxide
Answer: a) Calcium chloride, carbon dioxide, and water

11. Balance the equation:

$$H_2SO_4 + NaOH \rightarrow Na_2SO_4 + H_2O$$

Answer:

$$H2SO4+2NaOH\rightarrow Na2SO4+2H2O$$

12. Balance the equation:

$$CaCO3+HCl\rightarrow CaCl2+H2O+CO2$$

Answer: Balanced equation is already correct.

13. Which gas is evolved when Zn reacts with HCl?
Answer: Hydrogen gas (H2)

14. Predict the color change when litmus paper is added to vinegar.
Answer: Blue litmus turns red (acidic solution).

15. Identify the reaction:

$$2NaOH+Zn\rightarrow Na2ZnO2+H2$$

Answer: Reaction of a base with metal.

16. Predict the reaction:

$$Ca(OH)2+H2SO4\rightarrow ?$$

Answer: $CaSO_4$ + H_2O (Neutralization reaction).

1. What is the nature of metallic oxides?
a) Acidic
b) Basic
c) Neutral
d) Amphoteric
Answer: b) Basic

2. What is formed when a metallic oxide reacts with an acid?
a) Hydrogen gas
b) Salt and water
c) Carbon dioxide
d) Oxygen gas
Answer: b) Salt and water

3. Which of the following is a metallic oxide?
a) SO_2

b) CO_2
c) MgO
d) H_2O
Answer: c) MgO

4. What happens when calcium oxide (CaO) reacts with nitric acid (HNO_3)?
   a) Calcium hydroxide is formed
   b) Calcium nitrate and water are formed
   c) Calcium carbonate is formed
   d) Hydrogen gas is released
   Answer: b) Calcium nitrate and water are formed

5. What is the **color of copper sulfate ($CuSO_4$)** formed in the reaction of CuO with H_2SO_4?
   a) White
   b) Green
   c) Blue
   d) Yellow
   Answer: c) Blue

6. Which gas is produced when metal oxides react with acids?
   a) Hydrogen
   b) Carbon dioxide
   c) Oxygen
   d) No gas is produced
   Answer: d) No gas is produced

7. Which of the following reactions is correct?
   a) $Na_2O + HCl \rightarrow NaCl + H_2O$
   b) $MgO + H_2SO_4 \rightarrow MgSO_4 + H_2O$
   c) $CuO + HNO_3 \rightarrow Cu(NO_3)_2 + CO_2$
   d) $CaO + H_2O \rightarrow Ca(OH)_2$
   Answer: b) $MgO + H_2SO_4 \rightarrow MgSO_4 + H_2O$

8. What type of reaction occurs when metallic oxides react with acids?
   a) Oxidation
   b) Reduction
   c) Neutralization
   d) Decomposition
   Answer: c) Neutralization

9. What is the formula of zinc oxide?
   a) ZnO
   b) Zn_2O_3
   c) $Zn(OH)_2$
   d) $ZnCl_2$
   Answer: a) ZnO

10. Which of the following metal oxides will react with acid to form sodium chloride?
    a) CuO
    b) Na_2O
    c) ZnO

d) Fe_2O_3
Answer: b) Na_2O

11. What happens to the pH when a metallic oxide is added to an acid?
    a) Increases
    b) Decreases
    c) Stays the same
    d) Becomes neutral
    Answer: d) Becomes neutral

12. The reaction between CuO and H_2SO_4 produces a blue solution. What is the blue compound?
    a) $Cu(OH)_2$
    b) CuO
    c) $CuSO_4$
    d) $CuCl_2$
    Answer: c) $CuSO_4$

13. What is the common name for CaO?
    a) Quicklime
    b) Slaked lime
    c) Limestone
    d) Gypsum
    Answer: a) Quicklime

14. Which metallic oxide is used to neutralize acidic soil?
    a) Fe_2O_3
    b) ZnO
    c) CaO
    d) Na_2O
    Answer: c) CaO

15. What will be the product when Fe_2O_3 reacts with HCl?
    a) $FeCl_3$ and H_2O
    b) $FeCl_2$ and H_2
    c) $Fe(OH)_3$ and H_2O
    d) $FeSO_4$ and H_2O
    Answer: a) $FeCl_3$ and H_2O

16. Balance the following reaction:

$$CuO+HCl\rightarrow CuCl2+H2O$$

Answer:

$$CuO+2HCl\rightarrow CuCl2+H2O$$

17. Predict the products of the reaction:

$$Na_2O + H_2SO_4 \rightarrow ?$$

Answer: $Na_2SO_4 + H_2O$

18. Which oxide reacts with acid to form $FeCl_3$?
    Answer: Fe_2O_3

19. Which metallic oxide will react with H_2SO_4 to form $ZnSO_4$?
    Answer: ZnO

20. What will happen if MgO is added to HCl?
    Answer: $MgCl_2$ and H_2O will be formed.

1. What happens when HCl is dissolved in water?
   a) It forms solid HCl
   b) It produces H^+ and Cl^- ions
   c) It forms a gas
   d) It remains unchanged
   Answer: b) It produces H^+ and Cl^- ions

2. What ion is responsible for the acidic nature of a solution?
   a) OH^-
   b) Na^+
   c) H_3O^+
   d) Cl^-
   Answer: c) H_3O^+

3. Which of the following is a strong acid?
   a) CH_3COOH
   b) HF
   c) HCl
   d) NH_3
   Answer: c) HCl

4. Which of the following bases does not fully dissociate in water?
   a) NaOH
   b) KOH
   c) NH_3
   d) $Ca(OH)_2$
   Answer: c) NH_3

5. What happens when NaOH dissolves in water?
   a) It forms Na^+ and OH^- ions
   b) It releases H^+ ions
   c) It remains neutral
   d) It forms NaCl
   Answer: a) It forms Na^+ and OH^- ions

6. What is the pH of a **strong acid solution**?
   a) Greater than 7
   b) Exactly 7
   c) Less than 7
   d) Cannot be determined
   Answer: c) Less than 7

7. What is the pH of a **strong base solution**?
   a) Less than 7
   b) Exactly 7
   c) Greater than 7
   d) Cannot be determined
   Answer: c) Greater than 7

8. Which of the following acids **partially dissociates** in water?
   a) H_2SO_4
   b) HNO_3
   c) HCl
   d) CH_3COOH
   Answer: d) CH_3COOH

9. Which of the following solutions will conduct electricity best?
   a) Distilled water
   b) A weak acid solution
   c) A strong acid solution
   d) Pure ethanol
   Answer: c) A strong acid solution

10. When NH_3 dissolves in water, what ion does it produce?
    a) NH_4^+
    b) OH^-
    c) H_3O^+
    d) Both NH_4^+ and OH^-
    Answer: d) Both NH_4^+ and OH^-

11. What type of bond is broken when NaOH dissolves in water?
    a) Covalent bond
    b) Hydrogen bond
    c) Ionic bond
    d) Metallic bond
    Answer: c) Ionic bond

12. Which of the following acids is a **monoprotic acid**?
    a) H_2SO_4
    b) HCl
    c) H_3PO_4
    d) H_2CO_3
    Answer: b) HCl

13. What happens to the pH when a **strong base** is added to water?
    a) It increases
    b) It decreases
    c) It remains the same
    d) It becomes neutral
    Answer: a) It increases

14. What ion makes a solution basic?
    a) Cl^-

b) H^+
c) OH^-
d) NO_3^-
Answer: c) OH^-

15. What type of reaction occurs when an acid and a base are mixed?
    a) Oxidation
    b) Reduction
    c) Neutralization
    d) Decomposition
    Answer: c) Neutralization

16. Write the balanced chemical equation for the dissociation of HNO_3 in water.
    Answer:

$$HNO3+H2O→H3O++NO3−$$

17. Predict the products of the reaction:

KOH+HCl→?

Answer: KCl + H_2O

18. What happens when NaOH is added to an acidic solution?
    Answer: The solution becomes neutralized.

19. Name one weak acid and one weak base.
    Answer: Acetic acid (CH_3COOH), Ammonia (NH_3).

20. What is the pH range for acidic solutions?
    Answer: 0 to 6.9

1. What is the pH range of acidic substances?
    a) 0 - 7
    b) 7 - 14
    c) Exactly 7
    d) 6 - 10
    Answer: a) 0 - 7

2. What is the normal pH of blood?
    a) 5.5
    b) 6.5
    c) 7.4
    d) 9.0
    Answer: c) 7.4

3. Which of the following substances has the lowest pH?
    a) Lemon juice
    b) Milk
    c) Pure water
    d) Baking soda
    Answer: a) Lemon juice

4. Why is the pH of the stomach so low?
   a) To digest food
   b) To neutralize acids
   c) To make food alkaline
   d) To increase blood pH
   Answer: a) To digest food

5. What is the pH range of neutral substances?
   a) 0 - 7
   b) 7 - 14
   c) Exactly 7
   d) 6 - 10
   Answer: c) Exactly 7

6. What happens when the pH of saliva is lower than 5.5?
   a) Tooth enamel dissolves
   b) It becomes more basic
   c) It helps digestion
   d) Nothing happens
   Answer: a) Tooth enamel dissolves

7. Which acid is commonly used in food preservation?
   a) Sulfuric acid
   b) Hydrochloric acid
   c) Acetic acid
   d) Nitric acid
   Answer: c) Acetic acid

8. How can acidic soil be neutralized?
   a) By adding gypsum
   b) By adding lime ($CaCO_3$)
   c) By adding more acid
   d) By adding water
   Answer: b) By adding lime ($CaCO_3$)

9. What is the pH of acid rain?
   a) Above 7
   b) Exactly 7
   c) Below 5
   d) Between 6 and 7
   Answer: c) Below 5

10. What is the approximate pH of milk?
    a) 2
    b) 4
    c) 6.5
    d) 10
    Answer: c) 6.5

11. What is the main cause of acid rain?
    a) SO_2 and NO_2 gases

b) CO_2 from plants
c) Dust in the air
d) Ozone layer depletion
Answer: a) SO_2 and NO_2 gases

12. Which of the following liquids is **most basic**?
    a) Vinegar
    b) Lemon juice
    c) Soap water
    d) Milk
    Answer: c) Soap water

13. Which factor does NOT affect soil pH?
    a) Rainfall
    b) Fertilizers
    c) Temperature
    d) Color of the soil
    Answer: d) Color of the soil

14. What is the ideal pH of **drinking water**?
    a) 4 - 5
    b) 6.5 - 8.5
    c) 9 - 10
    d) 1 - 2
    Answer: b) 6.5 - 8.5

15. How does **antacid** work in the stomach?
    a) It increases stomach acid
    b) It neutralizes excess acid
    c) It dissolves food
    d) It makes acid stronger
    Answer: b) It neutralizes excess acid

16. A student tested a liquid and found its pH to be 3. Is the liquid acidic, basic, or neutral?
    Answer: Acidic

17. A farmer finds that his soil is too acidic. What should he add to neutralize it?
    Answer: Lime ($CaCO_3$)

18. If a cleaning product has a pH of 11, is it acidic or basic?
    Answer: Basic

19. If soap has a pH of 9, what type of solution is it?
    Answer: Mildly basic

20. What happens to the pH of rainwater when SO_2 and NO_2 mix with it?
    Answer: It decreases, leading to acid rain.

1. What is a salt?
    a) A type of acid
    b) A type of base

c) A compound formed from an acid and a base
d) A metal oxide
Answer: c) A compound formed from an acid and a base

2. Which of the following salts is neutral?
   a) NaCl
   b) NH_4Cl
   c) Na_2CO_3
   d) $CuSO_4$
   Answer: a) NaCl

3. The pH of a neutral salt is:
   a) Less than 7
   b) Exactly 7
   c) More than 7
   d) Depends on concentration
   Answer: b) Exactly 7

4. What is the pH of ammonium chloride (NH_4Cl) solution?
   a) 7
   b) Less than 7
   c) More than 7
   d) None of these
   Answer: b) Less than 7

5. Which type of salt is formed from a strong acid and a weak base?
   a) Neutral
   b) Acidic
   c) Basic
   d) Double salt
   Answer: b) Acidic

6. Which salt is commonly known as **baking soda**?
   a) NaCl
   b) KNO_3
   c) $NaHCO_3$
   d) $CuSO_4$
   Answer: c) $NaHCO_3$

7. Which acid forms **nitrate salts**?
   a) Hydrochloric acid
   b) Sulfuric acid
   c) Nitric acid
   d) Carbonic acid
   Answer: c) Nitric acid

8. The pH of a **basic salt solution** is:
   a) Less than 7
   b) Equal to 7
   c) Greater than 7

d) Exactly 5
Answer: c) Greater than 7

9. Which of the following is an example of an acidic salt?
   a) NaCl
   b) NH_4Cl
   c) Na_2SO_4
   d) KNO_3
   Answer: b) NH_4Cl

10. Which acid reacts with sodium hydroxide to form sodium sulfate?
    a) Hydrochloric acid
    b) Sulfuric acid
    c) Nitric acid
    d) Acetic acid
    Answer: b) Sulfuric acid

11. What type of salt is formed when a **weak acid reacts with a strong base**?
    a) Neutral
    b) Acidic
    c) Basic
    d) None
    Answer: c) Basic

12. What is the formula of **potassium nitrate**?
    a) K_2CO_3
    b) KNO_3
    c) K_2SO_4
    d) KCl
    Answer: b) KNO_3

13. Which salt is commonly used in fertilizers?
    a) NaCl
    b) NH_4NO_3
    c) Na_2CO_3
    d) KOH
    Answer: b) NH_4NO_3

14. Which compound is commonly used to **neutralize acidic soil**?
    a) NaCl
    b) HCl
    c) $CaCO_3$
    d) KOH
    Answer: c) $CaCO_3$

15. What is the general formula for **carbonates**?
    a) CO_3^{2-}
    b) NO_3^-
    c) SO_4^{2-}
    d) PO_4^{3-}
    Answer: a) CO_3^{2-}

Practice Questions (10%)

16. A salt solution has a pH of 9. Is it acidic, basic, or neutral?
    Answer: Basic

17. Which acid is used to make **potassium chloride (KCl)?**
    Answer: Hydrochloric acid (HCl)

❖ METALS AND NON-METAL

1. Which of the following is a metal?
   a) Oxygen
   b) Carbon
   c) Iron
   d) Sulfur
   Answer: c) Iron

2. Which metal is liquid at room temperature?
   a) Sodium
   b) Mercury
   c) Copper
   d) Zinc
   Answer: b) Mercury

3. Which of the following is NOT a property of metals?
   a) Malleability
   b) Ductility
   c) Poor conductor of electricity
   d) High melting point
   Answer: c) Poor conductor of electricity

4. Which of the following metals is soft and can be cut with a knife?
   a) Iron
   b) Sodium
   c) Copper
   d) Gold
   Answer: b) Sodium

5. Non-metals are generally:
   a) Malleable
   b) Ductile
   c) Poor conductors of electricity
   d) Sonorous
   Answer: c) Poor conductors of electricity

6. Which non-metal is a **good conductor** of electricity?
   a) Sulfur

b) Graphite
c) Phosphorus
d) Bromine
Answer: b) Graphite

7. Which non-metal is **lustrous**?
   a) Oxygen
   b) Iodine
   c) Sulfur
   d) Nitrogen
   Answer: b) Iodine

8. Metals are:
   a) Poor conductors of electricity
   b) Brittle
   c) Good conductors of heat and electricity
   d) Found only in solid state
   Answer: c) Good conductors of heat and electricity

9. The property of **being drawn into thin wires** is called:
   a) Malleability
   b) Conductivity
   c) Ductility
   d) Sonority
   Answer: c) Ductility

10. Which non-metal is liquid at room temperature?
    a) Iodine
    b) Bromine
    c) Carbon
    d) Oxygen
    Answer: b) Bromine

11. The property of **metals producing a ringing sound** is called:
    a) Ductility
    b) Sonority
    c) Conductivity
    d) Brittleness
    Answer: b) Sonority

12. Which of the following metals is the best conductor of electricity?
    a) Iron
    b) Copper
    c) Zinc
    d) Aluminum
    Answer: b) Copper

13. Which of the following is a poor conductor of electricity?
    a) Silver
    b) Copper
    c) Lead

d) Aluminum
Answer: c) Lead

14. Which metal is the most **malleable and ductile**?
    a) Iron
    b) Gold
    c) Zinc
    d) Aluminum
    Answer: b) Gold

15. Which non-metal exists in all three states (solid, liquid, gas)?
    a) Oxygen
    b) Sulfur
    c) Carbon
    d) Phosphorus
    Answer: d) Phosphorus

Practice Questions (10%)

16. Identify the metal from the following: **Na, O_2, S, Cl_2**
    Answer: Na (Sodium)

17. Which property helps metals to be used in **electrical wiring**?
    Answer: Ductility and high conductivity

18. Name a metal that does not corrode easily.
    Answer: Gold or Platinum

19. Why is aluminum used to make aircraft?
    Answer: It is lightweight and strong.

20. What is the main reason for using iron in construction?
    Answer: It has high strength and durability.

1. When a metal reacts with oxygen, it forms:
    a) Acidic oxide
    b) Basic oxide
    c) Neutral oxide
    d) None of these
    Answer: b) Basic oxide

2. Which of the following metals reacts violently with cold water?
    a) Magnesium
    b) Sodium
    c) Copper
    d) Zinc
    Answer: b) Sodium

3. The reaction of iron with steam produces:
    a) $Fe(OH)_3$
    b) Fe_3O_4

c) FeO
d) Fe_2O_3
Answer: b) Fe_3O_4

4. When a metal reacts with an acid, which gas is released?
   a) Oxygen
   b) Hydrogen
   c) Nitrogen
   d) Carbon dioxide
   Answer: b) Hydrogen

5. Which of the following metals does **not** react with acid?
   a) Magnesium
   b) Zinc
   c) Copper
   d) Iron
   Answer: c) Copper

6. Which of the following metals reacts with **both acids and bases**?
   a) Zinc
   b) Copper
   c) Sodium
   d) Gold
   Answer: a) Zinc

7. Metal oxides are generally:
   a) Acidic
   b) Basic
   c) Neutral
   d) Amphoteric
   Answer: b) Basic

8. The rusting of iron is a reaction between iron, oxygen, and:
   a) Acid
   b) Water
   c) Base
   d) Salt
   Answer: b) Water

9. Which metal does not react with oxygen?
   a) Copper
   b) Silver
   c) Gold
   d) Iron
   Answer: c) Gold

10. The reaction of aluminum with sodium hydroxide produces:
    a) Hydrogen gas
    b) Oxygen gas
    c) Carbon dioxide gas

d) Nitrogen gas
Answer: a) Hydrogen gas

11. When calcium reacts with water, the gas produced is:
    a) Oxygen
    b) Hydrogen
    c) Carbon dioxide
    d) Nitrogen
    Answer: b) Hydrogen

12. Which of the following metal oxides is amphoteric?
    a) Na_2O
    b) Al_2O_3
    c) CuO
    d) Fe_2O_3
    Answer: b) Al_2O_3

13. The reaction of sodium with water is:
    a) Slow
    b) Moderate
    c) Violent
    d) No reaction
    Answer: c) Violent

14. Which of the following metal does not react with either acid or base?
    a) Zinc
    b) Copper
    c) Aluminum
    d) Magnesium
    Answer: b) Copper

15. Which gas is formed when zinc reacts with NaOH?
    a) Oxygen
    b) Hydrogen
    c) Nitrogen
    d) Carbon dioxide
    Answer: b) Hydrogen

16. Complete the equation:

Mg+O2→?

Answer: 2MgO

1. Ionic bonds are formed between:
    a) Two metals
    b) Two non-metals
    c) A metal and a non-metal
    d) None of these
    Answer: c) A metal and a non-metal

2. When a metal reacts with a non-metal, it forms:
   a) Covalent compound
   b) Ionic compound
   c) Metallic compound
   d) None of these
   Answer: b) Ionic compound

3. Sodium forms an ionic bond with chlorine by:
   a) Gaining an electron
   b) Losing an electron
   c) Sharing electrons
   d) No reaction
   Answer: b) Losing an electron

4. What is the charge on a sodium ion in NaCl?
   a) -1
   b) +1
   c) -2
   d) +2
   Answer: b) +1

5. Ionic compounds are generally:
   a) Good conductors of electricity in solid state
   b) Poor conductors of electricity in solid state
   c) Poor conductors of electricity in liquid state
   d) Always conductors of electricity
   Answer: b) Poor conductors of electricity in solid state

6. Which of the following is an ionic compound?
   a) CO_2
   b) H_2O
   c) NaCl
   d) CH_4
   Answer: c) NaCl

7. Ionic compounds are soluble in:
   a) Water
   b) Kerosene
   c) Alcohol
   d) Petrol
   Answer: a) Water

8. Why do ionic compounds have high melting points?
   a) Weak forces between molecules
   b) Strong electrostatic forces between ions
   c) High number of protons
   d) Presence of covalent bonds
   Answer: b) Strong electrostatic forces between ions

9. What happens when NaCl is dissolved in water?
   a) It does not conduct electricity

b) Sodium and chloride ions move freely
c) It forms a solid lump
d) It becomes a covalent compound
Answer: b) Sodium and chloride ions move freely

10. The ions in an ionic compound are held together by:
    a) Covalent bonds
    b) Weak Van der Waals forces
    c) Electrostatic forces
    d) Hydrogen bonding
    Answer: c) Electrostatic forces

11. Which of the following is not a property of ionic compounds?
    a) High melting point
    b) Brittle nature
    c) Good electrical conductivity in solid form
    d) Solubility in water
    Answer: c) Good electrical conductivity in solid form

12. What is the name of the force that holds ionic compounds together?
    a) Gravitational force
    b) Electrostatic force
    c) Magnetic force
    d) Nuclear force
    Answer: b) Electrostatic force

13. Which metal will form an ionic bond with chlorine?
    a) Oxygen
    b) Sodium
    c) Carbon
    d) Nitrogen
    Answer: b) Sodium

14. In which state do ionic compounds conduct electricity?
    a) Solid
    b) Liquid and aqueous
    c) Gaseous
    d) None of these
    Answer: b) Liquid and aqueous

15. Which of the following is **not** an ionic compound?
    a) KCl
    b) HCl
    c) MgO
    d) CaF_2
    Answer: b) HCl

Practice Questions (10%)

16. **Fill in the blanks:**

- An ionic bond is formed when a metal ___ electrons and a non-metal ___ electrons.
  Answer: loses, gains

17. **Write the electron transfer for the formation of MgO.**
    Answer:

- **Magnesium loses 2 electrons:** $Mg \rightarrow Mg^{2+} + 2e^-$
- **Oxygen gains 2 electrons:** $O + 2e^- \rightarrow O^{2-}$
- **Ionic bond forms:** $Mg^{2+} + O^{2-} \rightarrow MgO$

1. What is corrosion?
   a) A method of metal extraction
   b) A process of metal deterioration
   c) A type of metal alloying
   d) A way to strengthen metals
   Answer: b) A process of metal deterioration

2. The rusting of iron is an example of:
   a) Physical change
   b) Chemical change
   c) Reversible change
   d) None of the above
   Answer: b) Chemical change

3. Which of the following metals does not rust but still corrodes?
   a) Iron
   b) Copper
   c) Aluminum
   d) Zinc
   Answer: c) Aluminum

4. The chemical formula of rust is:
   a) FeO
   b) Fe_2O_3
   c) Fe_3O_4
   d) $Fe_2O_3 \cdot xH_2O$
   Answer: d) $Fe_2O_3 \cdot xH_2O$

5. Which metal forms a greenish layer due to corrosion?
   a) Iron
   b) Silver
   c) Copper
   d) Gold
   Answer: c) Copper

6. Which gas in the air is mainly responsible for corrosion?
   a) Hydrogen
   b) Oxygen
   c) Carbon dioxide

d) Nitrogen
Answer: b) Oxygen

7. The process of coating iron with zinc to prevent rusting is called:
   a) Electroplating
   b) Galvanization
   c) Alloying
   d) Painting
   Answer: b) Galvanization

8. Why does aluminum not corrode easily?
   a) It does not react with oxygen
   b) It is a non-metal
   c) It forms a protective oxide layer
   d) It is a noble gas
   Answer: c) It forms a protective oxide layer

9. What prevents stainless steel from rusting?
   a) Zinc coating
   b) Protective paint
   c) Chromium content
   d) Carbon content
   Answer: c) Chromium content

10. Which of the following metals does not corrode easily?
    a) Iron
    b) Copper
    c) Gold
    d) Silver
    Answer: c) Gold

11. Which metal is used as a sacrificial anode to protect underground pipelines?
    a) Copper
    b) Magnesium
    c) Iron
    d) Gold
    Answer: b) Magnesium

12. What is the black coating on silver due to corrosion?
    a) Silver nitrate
    b) Silver sulfide
    c) Silver chloride
    d) Silver oxide
    Answer: b) Silver sulfide

13. Why does salt water accelerate corrosion?
    a) It reacts with oxygen
    b) It increases electrical conductivity
    c) It removes rust
    d) It prevents oxidation
    Answer: b) It increases electrical conductivity

14. What is the main reason iron corrodes in moist air?
    a) Reaction with hydrogen
    b) Reaction with carbon dioxide
    c) Reaction with oxygen and water
    d) Reaction with nitrogen
    Answer: c) Reaction with oxygen and water

15. Electroplating is mainly used to:
    a) Increase corrosion
    b) Improve appearance and prevent rusting
    c) Reduce metal weight
    d) Increase reactivity
    Answer: b) Improve appearance and prevent rusting

16. **Fill in the blanks:**

- The process of protecting iron from rusting by coating it with zinc is called ___.
  Answer: Galvanization

❖ COMPUTER PRACTICE

1. Which of the following is the brain of a computer?
    a) Hard Disk
    b) Monitor
    c) CPU
    d) Keyboard
    Answer: c) CPU
2. What is the full form of CPU?
    a) Central Process Unit
    b) Central Processing Unit
    c) Central Programming Unit
    d) Computer Processing Unit
    Answer: b) Central Processing Unit
3. Which of the following is a volatile memory?
    a) Hard Disk
    b) ROM
    c) RAM
    d) SSD
    Answer: c) RAM
4. Which part of the CPU is responsible for performing calculations?
    a) Control Unit
    b) Arithmetic Logic Unit (ALU)
    c) Memory Unit
    d) Registers
    Answer: b) Arithmetic Logic Unit (ALU)
5. Which device is used to provide input to the computer?
    a) Monitor

b) Printer
c) Keyboard
d) Speaker
Answer: c) Keyboard

6. What type of software is an operating system?
   a) Application Software
   b) System Software
   c) Utility Software
   d) Malware
   Answer: b) System Software
7. What is the function of ROM?
   a) Temporary storage
   b) Permanent storage of system instructions
   c) Data processing
   d) Displaying output
   Answer: b) Permanent storage of system instructions
8. Which is an example of an output device?
   a) Keyboard
   b) Mouse
   c) Monitor
   d) Scanner
   Answer: c) Monitor
9. Which type of computer is the most powerful?
   a) Minicomputer
   b) Microcomputer
   c) Supercomputer
   d) Mainframe Computer
   Answer: c) Supercomputer
10. Which of the following is NOT a storage device?
    a) Hard Disk
    b) RAM
    c) Scanner
    d) SSD
    Answer: c) Scanner
11. The basic operations performed by a computer follow which cycle?
    a) Input-Process-Output
    b) Save-Edit-Print
    c) Boot-Load-Execute
    d) Read-Write-Delete
    Answer: a) Input-Process-Output
12. What is the smallest unit of data in a computer?
    a) Byte
    b) Bit
    c) Kilobyte
    d) Megabyte
    Answer: b) Bit
13. Which number system do computers use for processing?
    a) Decimal

b) Octal
c) Binary
d) Hexadecimal
Answer: c) Binary

14. What does GUI stand for?
    a) Graphical User Interaction
    b) General Utility Interface
    c) Graphical User Interface
    d) General User Integration
    Answer: c) Graphical User Interface
15. What is an example of application software?
    a) Windows 10
    b) MS Word
    c) Linux
    d) BIOS
    Answer: b) MS Word

16. **Fill in the blank:** The two main components of a computer system are ___ and ___.
    Answer: Hardware, Software

1. What does HTML stand for?
    a) HyperText Making Language
    b) HyperText Markup Language
    c) HighText Machine Language
    d) Hyper Transfer Markup Language
    Answer: b) HyperText Markup Language

2. Which tag is used to define a paragraph in HTML?
    a) <p>
    b) <para>
    c) <paragraph>
    d) <pg>
    Answer: a) <p>

3. What is the function of a web browser?
    a) To write HTML code
    b) To store data permanently
    c) To display web pages
    d) To convert images into text
    Answer: c) To display web pages

4. What is the purpose of the <title> tag?
    a) To create a heading
    b) To set the title of the webpage
    c) To define a paragraph
    d) To insert an image
    Answer: b) To set the title of the webpage

5. Which protocol is used for secure communication on the internet?
   a) FTP
   b) HTTP
   c) HTTPS
   d) SMTP
   Answer: c) HTTPS

6. What does URL stand for?
   a) Universal Resource Locator
   b) Uniform Resource Locator
   c) Unified Resource Locator
   d) Unique Resource Locator
   Answer: b) Uniform Resource Locator

7. Which HTML tag is used to insert an image?
   a) <img>
   b) <image>
   c) <pic>
   d) <src>
   Answer: a) <img>

8. What is the function of the <a> tag in HTML?
   a) To display images
   b) To create hyperlinks
   c) To define tables
   d) To add background color
   Answer: b) To create hyperlinks

9. What is the full form of HTTP?
   a) Hyper Transfer Text Protocol
   b) Hyper Text Transfer Protocol
   c) Hyperlink Text Transfer Protocol
   d) Hyper Text Transaction Process
   Answer: b) Hyper Text Transfer Protocol

10. Which tag is used to create an ordered list?
    a)
    b)
    c)
    d) <list>
    Answer: b)

11. What does CSS stand for in web development?
    a) Computer Style Sheet
    b) Cascading Style Sheet
    c) Creative Style Sheet
    d) Color Style Sheet
    Answer: b) Cascading Style Sheet

12. Which HTML element is used to insert a table row?
    a) <row>

b) <td>
c) <tr>
d) <table>
Answer: c) <tr>

13. What is an IP address?
    a) Internet Protocol Address
    b) Internal Process Address
    c) Integrated Program Address
    d) Internet Page Address
    Answer: a) Internet Protocol Address

14. What is the function of <form> in HTML?
    a) To create a table
    b) To create a form for user input
    c) To create a hyperlink
    d) To display an image
    Answer: b) To create a form for user input

15. What is the purpose of <meta> tag in HTML?
    a) To add metadata to a webpage
    b) To display images
    c) To create tables
    d) To insert lists
    Answer: a) To add metadata to a webpage

16. Which of the following is NOT a search engine?
    a) Google
    b) Yahoo
    c) Bing
    d) Windows
    Answer: d) Windows

17. Which company developed the first web browser?
    a) Microsoft
    b) Netscape
    c) Google
    d) CERN
    Answer: d) CERN

18. Which HTML tag is used to display the largest heading?
    a) <h1>
    b) <h6>
    c) <h3>
    d) <heading>
    Answer: a) <h1>

19. What is the default extension of an HTML file?
    a) .txt
    b) .doc
    c) .html

d) .htm
Answer: c) .html

20. Which application is used for creating and editing documents?
    a) MS Excel
    b) MS PowerPoint
    c) MS Word
    d) MS Paint
    Answer: c) MS Word
21. In MS Word, which tab contains font and paragraph formatting options?
    a) Home
    b) Insert
    c) Layout
    d) Review
    Answer: a) Home
22. Which function is used to sum a range of values in MS Excel?
    a) `=ADD()`
    b) `=SUM()`
    c) `=TOTAL()`
    d) `=COUNT()`
    Answer: b) `=SUM()`
23. Which MS Office application is best suited for making presentations?
    a) MS Word
    b) MS Excel
    c) MS PowerPoint
    d) MS Access
    Answer: c) MS PowerPoint
24. Which feature in MS Word allows you to combine a letter with a mailing list?
    a) Find and Replace
    b) Mail Merge
    c) Spell Check
    d) Grammar Check
    Answer: b) Mail Merge
25. In MS Excel, which symbol is used to begin a formula?
    a) +
    b) =
    c) -
    d) *
    Answer: b) =
26. Which view in PowerPoint is used to add speaker notes?
    a) Slide Show View
    b) Slide Sorter View
    c) Notes Page View
    d) Reading View
    Answer: c) Notes Page View
27. Which chart type is NOT available in MS Excel?
    a) Pie Chart
    b) Column Chart
    c) Flow Chart

d) Line Chart
Answer: c) Flow Chart

28. What does "CTRL + B" do in MS Word?
    a) Italicizes text
    b) Makes text bold
    c) Underlines text
    d) Copies text
    Answer: b) Makes text bold
29. What is the shortcut key for saving a document in MS Word?
    a) CTRL + S
    b) CTRL + C
    c) CTRL + V
    d) CTRL + P
    Answer: a) CTRL + S
30. What feature in MS Excel allows filtering data?
    a) Sorting
    b) Data Validation
    c) Filter
    d) Pivot Table
    Answer: c) Filter
31. What is the default extension for an MS PowerPoint file?
    a) .docx
    b) .xlsx
    c) .pptx
    d) .pdf
    Answer: c) .pptx
32. In PowerPoint, what is used to add visual movement to elements on a slide?
    a) Animation
    b) Transition
    c) Hyperlink
    d) Slide Master
    Answer: a) Animation
33. What does "CTRL + Z" do in MS Word?
    a) Save
    b) Undo
    c) Redo
    d) Paste
    Answer: b) Undo
34. What is the purpose of a Pivot Table in Excel?
    a) Data entry
    b) Data summarization
    c) Formatting cells
    d) Writing formulas
    Answer: b) Data summarization
35. In PowerPoint, which view displays slides as thumbnails?
    a) Slide Show View
    b) Normal View
    c) Slide Sorter View
    d) Outline View
    Answer: c) Slide Sorter View

36. Which feature in MS Word automatically corrects common spelling errors?
    a) Find and Replace
    b) AutoCorrect
    c) Spell Check
    d) Grammar Check
    Answer: b) AutoCorrect
37. Which key is used to start a PowerPoint presentation?
    a) F2
    b) F5
    c) F8
    d) F10
    Answer: b) F5
38. What is the function of "Merge & Center" in MS Excel?
    a) Joins and centers selected cells
    b) Aligns text to the right
    c) Deletes data
    d) Filters data
    Answer: a) Joins and centers selected cells

❖ Environmental Sciences

1. What is an ecosystem?
    a) A community of organisms
    b) The physical environment
    c) Interaction between living and non-living components
    d) Only plants and animals in a region
    Answer: c) Interaction between living and non-living components

2. Which of the following is a biotic component of an ecosystem?
    a) Water
    b) Sunlight
    c) Soil
    d) Bacteria
    Answer: d) Bacteria

3. Which of the following is NOT an example of an abiotic factor?
    a) Wind
    b) Temperature
    c) Trees
    d) Minerals
    Answer: c) Trees

4. Which organisms are known as primary producers?
    a) Herbivores
    b) Carnivores
    c) Plants
    d) Decomposers
    Answer: c) Plants

5. In a food chain, what do herbivores feed on?
   a) Other herbivores
   b) Plants
   c) Carnivores
   d) Fungi
   Answer: b) Plants

6. Which of the following is an artificial ecosystem?
   a) Desert
   b) Forest
   c) Aquarium
   d) Ocean
   Answer: c) Aquarium

7. What is the role of decomposers in an ecosystem?
   a) Capture sunlight
   b) Break down dead organisms
   c) Convert oxygen into carbon dioxide
   d) Consume herbivores
   Answer: b) Break down dead organisms

8. Which of the following is a terrestrial ecosystem?
   a) Ocean
   b) Lake
   c) Desert
   d) Pond
   Answer: c) Desert

9. Which ecosystem has the highest biodiversity?
   a) Desert
   b) Rainforest
   c) Arctic tundra
   d) Grassland
   Answer: b) Rainforest

10. The top predator in a food chain is also known as:
    a) Primary producer
    b) Primary consumer
    c) Tertiary consumer
    d) Decomposer
    Answer: c) Tertiary consumer

11. What percentage of energy is passed from one trophic level to the next?
    a) 90%
    b) 10%
    c) 50%
    d) 1%
    Answer: b) 10%

12. The term "food web" refers to:
    a) A simple linear food chain

b) A network of interconnected food chains
c) A single producer feeding many consumers
d) A system with no energy loss
Answer: b) A network of interconnected food chains

13. Which factor is NOT a threat to ecosystems?
    a) Deforestation
    b) Pollution
    c) Sustainable agriculture
    d) Overfishing
    Answer: c) Sustainable agriculture

14. What is the primary source of energy in most ecosystems?
    a) Water
    b) Sunlight
    c) Soil
    d) Wind
    Answer: b) Sunlight

15. Which of the following best describes a biome?
    a) A small pond ecosystem
    b) A large geographical area with similar ecosystems
    c) A population of the same species
    d) A group of decomposers
    Answer: b) A large geographical area with similar ecosystems

16. What is the main function of photosynthesis in an ecosystem?
    a) Convert oxygen into carbon dioxide
    b) Store energy in organic molecules
    c) Break down dead organisms
    d) Absorb heat from the sun
    Answer: b) Store energy in organic molecules

Practice Questions (20%)

17. If an ecosystem receives 1000 kcal of energy from sunlight, how much energy will be available at the tertiary consumer level?
    Answer: 1 kcal (as per 10% energy transfer rule)

18. Name two decomposers found in an ecosystem.
    Answer: Bacteria, Fungi

19. Explain the difference between a food chain and a food web.
    Answer: A food chain is a linear sequence of organisms where each is eaten by the next. A food web consists of multiple interconnected food chains.

20. Why are rainforests considered important for biodiversity?
    Answer: They provide habitat for a vast number of species and regulate global climate.

1. Which of the following is a major cause of air pollution?
    a) Planting trees

b) Burning fossil fuels
c) Using solar energy
d) Drinking bottled water
Answer: b) Burning fossil fuels

2. What is the main pollutant responsible for acid rain?
   a) Oxygen
   b) Nitrogen gas
   c) Sulfur dioxide
   d) Water vapor
   Answer: c) Sulfur dioxide

3. Eutrophication is caused by excessive amounts of:
   a) Oxygen
   b) Heavy metals
   c) Nutrients like nitrogen and phosphorus
   d) Carbon dioxide
   Answer: c) Nutrients like nitrogen and phosphorus

4. Which pollutant is a major contributor to global warming?
   a) Sulfur dioxide
   b) Carbon dioxide
   c) Lead
   d) Mercury
   Answer: b) Carbon dioxide

5. Which type of pollution is mainly caused by industrial waste disposal?
   a) Air pollution
   b) Soil pollution
   c) Noise pollution
   d) Thermal pollution
   Answer: b) Soil pollution

6. What type of pollution is caused by excessive use of loudspeakers?
   a) Noise pollution
   b) Thermal pollution
   c) Air pollution
   d) Radioactive pollution
   Answer: a) Noise pollution

7. Oil spills primarily cause:
   a) Soil pollution
   b) Water pollution
   c) Noise pollution
   d) Radioactive pollution
   Answer: b) Water pollution

8. What is a major effect of thermal pollution?
   a) Reduced oxygen levels in water
   b) Increased crop growth
   c) Improved air quality

d) Reduced global warming
Answer: a) Reduced oxygen levels in water

9. The main cause of radioactive pollution is:
   a) Use of fertilizers
   b) Burning fossil fuels
   c) Nuclear waste disposal
   d) Excessive use of plastic
   Answer: c) Nuclear waste disposal

10. Which of the following is an example of biodegradable waste?
    a) Plastic bags
    b) Glass bottles
    c) Banana peels
    d) Aluminum cans
    Answer: c) Banana peels

11. Which law in India regulates air pollution?
    a) Wildlife Protection Act
    b) Air (Prevention and Control of Pollution) Act
    c) Indian Penal Code
    d) Motor Vehicles Act
    Answer: b) Air (Prevention and Control of Pollution) Act

12. The major source of noise pollution in urban areas is:
    a) Factories
    b) Road traffic
    c) Water pollution
    d) Radiation
    Answer: b) Road traffic

13. What is the best way to reduce plastic pollution?
    a) Burning plastic
    b) Dumping plastic in landfills
    c) Recycling and reusing plastic
    d) Increasing plastic production
    Answer: c) Recycling and reusing plastic

14. Which pollution is caused by excessive pesticide use?
    a) Noise pollution
    b) Soil pollution
    c) Water pollution
    d) Air pollution
    Answer: b) Soil pollution

15. The contamination of groundwater is mainly due to:
    a) Air pollution
    b) Overuse of fossil fuels
    c) Dumping of industrial waste
    d) Noise pollution
    Answer: c) Dumping of industrial waste

16. Name two gases responsible for acid rain.
    Answer: Sulfur dioxide (SO_2), Nitrogen oxides (NO_x).

17. How does deforestation contribute to air pollution?
    Answer: It reduces oxygen production and increases carbon dioxide levels.

18. Explain how noise pollution affects human health.
    Answer: It causes stress, hearing loss, and sleep disturbances.

19. Why is plastic pollution harmful to marine life?
    Answer: Marine animals ingest plastic, leading to death and ecosystem imbalance.

20. Suggest two ways to reduce air pollution.
    Answer: Use of public transport, switching to renewable energy.

1. What is the primary cause of climate change?
   a) Ocean currents
   b) Solar radiation changes
   c) Greenhouse gas emissions from human activities
   d) Volcanic eruptions
   Answer: c) Greenhouse gas emissions from human activities

2. Which of the following is a greenhouse gas?
   a) Oxygen
   b) Carbon dioxide
   c) Nitrogen
   d) Helium
   Answer: b) Carbon dioxide

3. What is the main contributor to global warming?
   a) Increased oxygen levels
   b) Burning fossil fuels
   c) Solar radiation decrease
   d) Increased nitrogen levels
   Answer: b) Burning fossil fuels

4. The phenomenon of Earth's temperature rise due to greenhouse gases is called:
   a) Acid rain
   b) Global warming
   c) Ozone depletion
   d) Photosynthesis
   Answer: b) Global warming

5. Which gas is NOT a greenhouse gas?
   a) Methane
   b) Water vapor
   c) Carbon dioxide
   d) Nitrogen
   Answer: d) Nitrogen

6. Deforestation contributes to climate change by:
   a) Increasing oxygen levels

b) Decreasing carbon dioxide levels
c) Reducing carbon absorption
d) Increasing nitrogen levels
Answer: c) Reducing carbon absorption

7. Rising global temperatures have led to:
   a) Decreased sea levels
   b) Increased glacier formation
   c) More frequent extreme weather events
   d) Fewer wildfires
   Answer: c) More frequent extreme weather events

8. The Paris Agreement aims to:
   a) Promote deforestation
   b) Reduce global carbon emissions
   c) Increase greenhouse gas emissions
   d) Encourage fossil fuel use
   Answer: b) Reduce global carbon emissions

9. Which of the following is an adaptation strategy for climate change?
   a) Increasing industrial emissions
   b) Building flood barriers
   c) Burning more fossil fuels
   d) Cutting down trees
   Answer: b) Building flood barriers

10. Melting glaciers lead to:
    a) Decrease in ocean levels
    b) Rise in sea levels
    c) Reduction in atmospheric CO_2
    d) Increase in land area
    Answer: b) Rise in sea levels

11. The primary cause of ocean acidification is:
    a) Excess oxygen absorption
    b) Carbon dioxide absorption
    c) Overfishing
    d) Oil spills
    Answer: b) Carbon dioxide absorption

12. The process of converting fossil fuels into energy releases:
    a) Nitrogen
    b) Oxygen
    c) Carbon dioxide
    d) Water vapor
    Answer: c) Carbon dioxide

13. Which of the following contributes to global warming the most?
    a) Hydroelectric power
    b) Burning coal
    c) Using solar panels

d) Wind energy
Answer: b) Burning coal

14. What is an example of renewable energy?
    a) Coal
    b) Solar power
    c) Natural gas
    d) Petroleum
    Answer: b) Solar power

15. The Kyoto Protocol focused on:
    a) Reducing noise pollution
    b) Controlling greenhouse gas emissions
    c) Encouraging deforestation
    d) Banning the use of plastic
    Answer: b) Controlling greenhouse gas emissions

16. Name two greenhouse gases.
    Answer: Carbon dioxide (CO_2), Methane (CH_4).

17. What is the main effect of melting glaciers?
    Answer: Rising sea levels.

18. Suggest one way to reduce carbon footprint.
    Answer: Using public transportation.

19. How does deforestation affect climate change?
    Answer: Increases CO_2 levels in the atmosphere.

20. What is the role of the Paris Agreement?
    Answer: To limit global warming to below 2°C.

1. What is the primary advantage of renewable energy sources?
    a) They never run out
    b) They are cheaper than fossil fuels
    c) They do not require any infrastructure
    d) They produce more pollution than coal
    Answer: a) They never run out

2. Which of the following is NOT a renewable energy source?
    a) Wind energy
    b) Biomass energy
    c) Natural gas
    d) Tidal energy
    Answer: c) Natural gas

3. Hydropower plants generate electricity using:
    a) Solar panels
    b) Wind turbines
    c) Moving water
    d) Geothermal heat
    Answer: c) Moving water

4. What is the major drawback of solar energy?
   a) It causes pollution
   b) It does not work at night
   c) It requires fossil fuels
   d) It releases harmful gases
   Answer: b) It does not work at night

5. Wind energy is most suitable in:
   a) Forested areas
   b) Coastal regions and open plains
   c) Desert regions
   d) Underground caves
   Answer: b) Coastal regions and open plains

6. What is a major limitation of tidal energy?
   a) It depends on wind speed
   b) It releases CO_2 emissions
   c) It is limited to certain coastal locations
   d) It requires fossil fuels
   Answer: c) It is limited to certain coastal locations

7. Biomass energy is obtained from:
   a) Nuclear reactions
   b) Burning organic materials
   c) Hydroelectric dams
   d) Solar panels
   Answer: b) Burning organic materials

8. Which country is known for its geothermal energy production?
   a) India
   b) Iceland
   c) Brazil
   d) Saudi Arabia
   Answer: b) Iceland

9. Which of the following does NOT produce greenhouse gases?
   a) Coal power plants
   b) Hydropower plants
   c) Biomass combustion
   d) Petroleum-based engines
   Answer: b) Hydropower plants

10. What is the main disadvantage of geothermal energy?
    a) It is highly polluting
    b) It is available everywhere
    c) It has high initial costs
    d) It requires fossil fuels
    Answer: c) It has high initial costs

11. Name two sources of renewable energy.
    Answer: Solar energy, wind energy.

12. Which energy source uses underground heat?
    Answer: Geothermal energy.

13. What is the main reason solar energy is not widely used at night?
    Answer: It requires sunlight to generate power.

14. What type of energy is generated from high and low tides?
    Answer: Tidal energy.

15. Which country produces the most wind energy?
    Answer: China.

16. Which region in India is best for hydropower generation?
    Answer: The Himalayan region.

17. What is the major environmental impact of wind turbines?
    Answer: They can affect birds and create noise pollution.

18. How does biomass energy contribute to reducing waste?
    Answer: It uses agricultural and organic waste as fuel.

19. Which form of energy is harnessed using dams?
    Answer: Hydropower.

20. Why is geothermal energy limited to specific locations?
    Answer: It requires underground heat sources, usually near volcanic regions.