Sample MCQS for the course PHYSICS (PHY101)

Lecture 23

1) The formula for the energy density (u) in a capacitor, with an electric field (E) is:

$u = 0.5\varepsilon_o E^2$

$u = \varepsilon_o E^2$

$u = E/\varepsilon_o$

$u = 0.5E/\varepsilon_o$

2) Electric field due to oppositely charged parallel plate capacitor is:

σ/ε_o

$\sigma/2\varepsilon_o$

ϕ/ε_o

$\phi/2\varepsilon_o$

Lecture 24

3) Work done between two points on equipotential surface is:

Maximum

Infinite

Zero

Negative

4) What is the relationship between the electric field (E) and the dipole moment (p) at point (r) on the axial line of the dipole?

$E = p$

$E \propto p/r^3$

$E = p/r$

$E \propto p/r^2$

Lecture 25

5) What does effect the introduction of dielectric material have on the relative permittivity (ϵ_r) in a capacitor?

Decreases

Increases

Remains constant

Becomes zero

6) In a dielectric material, what causes the separation of negative and positive charges on each molecule?

Conduction

Polarization

Dissipation

Ionization

Lecture 26

7) If the drift velocity v_d of charge carriers in a conductor increases, what happens to the current density J?

J increases.

J decreases.

J remains unchanged.

J becomes negative.

8) If the cross-sectional area *A* of a conductor is increased while keeping the current *I* constant, what happens to the current density *J*?

J increases

***J* decreases.**

J remains unchanged.

J becomes negative.

Hint: (J = I/A)

Lecture 27

9) Which field(s) are involved in the Lorentz force acting on charged particles in a velocity selector?

Electric field only

Magnetic field only

Gravitational field only

Electric and magnetic fields

10) If a charged particle moves in a magnetic field, what effect does the magnetic force have on the kinetic energy of the particle?

It increases kinetic energy.

It decreases kinetic energy.

It does not change the kinetic energy.

It stops the particle.

Lecture 28

11) Which principle governs the conversion of magnetic variations into an electric current in magnetic recording tapes?

Coulomb's Law

Ampere's Law

Faraday's Law

Ohm's Law

12) What does Faraday's law of electromagnetic induction state regarding induced EMF?

The induced EMF is directly proportional to the magnetic field strength.

The induced EMF is directly proportional to the magnetic flux.

The induced EMF is directly proportional to the rate of change of magnetic flux.

The induced EMF is independent of the magnetic flux.

Lecture 29

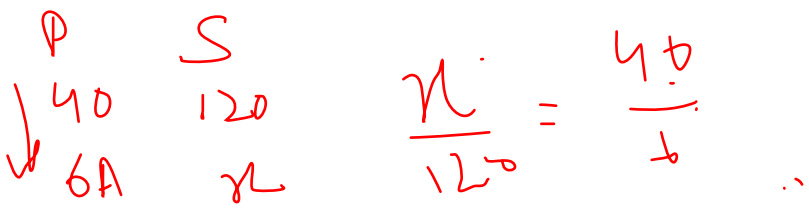
13) In a transformer, the number of turns in the primary and secondary coil is 40 and 120, respectively. If the current in the primary coil is 6 A, the current in the secondary coil is:

2 A

0.2 A

18 A

1.8 A



Ans: 2 A

14)

The quantity that remains unchanged in a transformer is:
Voltage
Current
Frequency
Magnetic field

Ans: frequency

15) If the number of turns in a coil is increased, the induced e.m.f. becomes:

Decreases

Increases

Remains the same

Depends on the resistance

Ans: Increases (Vp/Vs = Np/Ns)

Lecture 30

16) Which of the following is the expression for Lorentz force?
F = qE
F = q (v x B)
F = ma + qE
F = qE + q (v x B)

Ans: F = qE + q (v x B)

17)

If the velocity of a charged particle in perpendicular electric and magnetic field is 7.27 x 10^6 m/s and the Electric field is 6 x 10^6 N/c, what should be the value of the magnetic field?
0.45 T
0.78 T
0.83 T
0.94 T

Answer: 0.83 T
Explanation: As we know, v = E/B
Therefore, B = E/v

$= 6 \text{ X } 10^6/7.27 \text{ X } 10^6$
$= 0.83$ T.

18)

In a vacuum, the conduction current is:

Infinity

Unity

Zero

Undetermined

Answer: Zero

Lecture 31

19) Ole Rømer estimated the value for the speed of light to be:

100,000 meters/sec

225,000 meters/sec

299,792,458.6 meters/sec

500,000 meters/sec

Answer: 299,792,458.6 meters/sec

20)

Which color of light has the shortest wavelength in the visible spectrum?

Red

Green

Blue

Violet

Answer: Violet

21) A certain electromagnetic wave has a frequency of 6×10^{14} Hz. What is the wavelength of this wave?

5×10^{-7} meters
600 meters
6×10^{-7} meters
300 nanometers

Answer: 5×10^{-7} meters

Lecture 32

22) The value of Wien's constant is given as_____.
$2.9x10^{-3}$ K
$2.9x10^{-5}$ K
$2.9x10^{-5}$ mK
$2.9x10^{-3}$ mK
Ans: $2.9x10^{-3}$ mk

23) When an iron rod is heated, the colors at different temperatures are noted. Which of the following color shows that the iron rod is at the lowest temperature?

Red

Orange

White

Blue

Ans: Red ($\lambda T = 2.9*10^{-3}$ mK)

24) If the temperature of a black body is tripled, how does the power radiated per unit area change according to the Stefan-Boltzmann Law?

Increases by a factor of 3.
Increases by a factor of 9.
Increases by a factor of 27.
Increases by a factor of 81.

Answer: c. Increases by a factor of 81 ($I = \sigma T^4$)

Lecture 33

25) The condition for constructive interference of a light wave is:

The waves must have a phase difference of 90 degree

The waves must have a phase difference of 180 degree

The waves must have a phase difference of 0 degree

Insufficient information

Ans: The waves must have a phase difference of 0 degrees

26) The points of constructive interference of light are_____.

Always bright

May be bright or dark

Always dark

Neither bright nor dark

Ans: Always bright

27) Which property of light causes the formation of Newton's rings?

Reflection
Refraction
Diffraction
Interference

Ans: Interference

28) In a rainy day, small oil films on water show brilliant colors. This is due to the phenomenon of:

Dispersion

Interference

Diffraction

Polarization

Ans: Interference

Lecture_34

29) How is the kinetic energy of the ejected photoelectrons related to the frequency of the incident light?

Inversely proportional.

Directly proportional.

Unrelated.

Always zero.

Answer: b) Directly proportional.

30) A light source emits photons with a wavelength of 500 nm. What is the frequency of these photons? (Speed of light $c = 3\times10^8$ m/s)

1.5×10^{14} Hz

1.5×10^{15} Hz

6×10^{14} Hz

6×10^{15} Hz

Answer: c) 6×10^{14} Hz

31) "LASER" is the abbreviation of:

Light Amplification by the Synthesized Emission of Radiation

Light Amplification by the Stimulated Emission of Radiation

Luminous Amplification by the Stimulated Emission of Rays

Lightwave Amplification by the Stimulated Emission of Rays

Answer: b) Light Amplification by the Stimulated Emission of Radiation

Lecture_35

32) The condition where distant objects appear blurry due to the focal point being ahead of the retina:

Chromatic aberration

Spherical aberration

Hypermetropia

Myopia

Answer: d) Myopia

33) The relation between the radius of curvature (R) and the focal length (f) of a spherical mirror is given by:

F = R/2

f = R

f = 2R

f = R^2

Answer: a) f=R/2

34) If a lens has a focal length of 15 cm and another has 20 cm, which statement about their strengths in diopters is true?

15 cm lens has higher strength

20 cm lens has higher strength

Both lenses have equal strength

Strength isn't linked to focal length

Answer: a) 15 cm lens has higher strength

Lecture_36

35) If the length of a rod L_o increases by ΔL when it is heated to a temperature of $T+\Delta T$, then the coefficient of linear expansion can be calculated by:

$\alpha = \Delta L/\Delta T$

$\alpha = \Delta L/(L_0\Delta T)$

$\alpha = \Delta T/\Delta L$

$\alpha = L_0\Delta T/\Delta L$

Answer: b) $\alpha=\Delta L/(L_0\Delta T)$

36) Which of the following is not a thermometric property?

Color change

Electrical resistance change

Increase in weight

Expansion

Answer: c) Increase in weight

37) Two objects are said to be in thermal equilibrium when:

They have equal volume.

They have different temperatures.

No net heat transfer between them.

No work is done by them.

Answer: c) No net heat transfer between them.

Lecture_37

38) The efficiency of a machine, such as a heat engine, indicates:

The amount of heat it can absorb.

The amount of work it can perform.

The ratio of work done by the engine to the input heat.

The rate of temperature change.

Answer: c) The ratio of work done by the engine to the heat put in.

39) During a process, a gas absorbs 150 J of heat and does 100 J of work. What is the change in the internal energy of gas?

50 J
100 J
150 J
250 J

Answer: a) 50 J

40) In thermodynamics, the term "adiabatic" refers to a process in which:

No heat is exchanged with the surroundings.

The system's internal energy is constant.

No work is done on or by the system

The temperature remains constant.

Answer: a) No heat is exchanged with the surroundings.

Lecture_38

41) During the process of vaporization, how does the temperature of a substance change?

Temperature will increase.

Temperature will decrease.

No change in temperature.

Temperature will oscillate.

Answer: c) No change in temperature.

42) Which of the following has the highest disorder in terms of particle arrangement?

Solid

Liquid

Gas

Plasma

Answer: d) Plasma

43) In a reversible isothermal process, 600 J of heat is absorbed by a system at a constant temperature of 300 K. The change in entropy (ΔS) for the system is:

ΔS = 1.67 J/K
ΔS = 2.0 J/K
ΔS = 20 J/K
ΔS = 180 J/K

Answer: b) ΔS=2.0 J/K

Lecture 39

44) As an object approaches the speed of light, the relatistic factor (γ) is:

Decreases

Increases

Remains constant

Reaches zero

Ans: Increases

45) The speed of light in a vacuum is approximately:

300,000 km/s

3,000 km/s

30,000 km/s

300 km/s

Ans: 300,000 km/s

Lecture 40

46) In special relativity, the formula for the invariant interval I is given by:

$I = (c\Delta t)^2 - (\Delta x)^2$

$I = (c\Delta t)^2 + (\Delta x)^2$

$I = \sqrt{(c\Delta t)^2 - (\Delta x)^2}$

$I = (c\Delta t)^2$

Explanation: $I = (c\Delta t)^2 - (\Delta x)^2$

47) The relativistic Doppler effect is primarily concerned with:

Water waves

Sound waves

Light waves

Wave produced on rope

Explanation: Light waves

48) What happens to the observed frequency, when an observer approaches a source of light at relativistic speed?

It increases

It decreases

It remains constant

It becomes zero

Explanation: It increases

Lecture 41

49) Based on Einstein's proposal, what is the relationship between the energy of the emitted electrons and the frequency of the light?

Electron energy is inversely proportional to light frequency.

Electron energy is directly proportional to light frequency.

Electron energy is independent of light frequency.

Electron energy decreases with increasing light frequency.

Explanation: The answer is B. Electron energy is directly proportional to light frequency, as per Einstein's proposal.

50)

What term is used for the packets of energy that light is transmitted in?

Electrons

Photons

Protons

Neutrons

Explanation: The answer is B. Photons, as mentioned in the text.

Lecture 42

51) In which situations can Newton's Laws of Motion be successfully applied?

At the surface of an atom

When studying quantum mechanics

Observing large objects

At the surface of a nucleus

Correct Answer: C) Observing large objects

Explanation: Newton's Laws are suitable for macroscopic objects but not at the quantum level.

52)

Which fundamental problems had no solution in classical physics?

Maxwell's Equations

Planetary motion

Photoelectric Effect

Mass spring system

Correct Answer: C) Black Body Radiation,

Lecture 43

53) What is the primary impact of the Pauli Exclusion Principle on the arrangement of electrons in atoms?

a. It determines the energy levels of electrons in an atom.
b. It restricts the number of electrons with the same spin that can occupy a single orbital.
c. It dictates the overall size of an atom.
d. It controls the speed of electrons within the nucleus.

54) The half-life of a radioactive substance is:

a. half the time it takes for the entire substance to decay
b. usually about 50 years
c. the time for radium to change into lead
d. the time for half the substance to decay

Lecture 44

55) What did Ernest Rutherford discover in 1911 about the atom?

a. Electrons
b. Neutrons
c. Nucleus
d. Protons

56) What is the primary force responsible for holding neutrons and protons together in the nucleus?

a. Electromagnetic force
b. Gravitational force
c. Strong nuclear force
d. Centripetal force

Lecture 45

57) What is the primary composition of the Sun?

a. 50% helium, 50% hydrogen
b. 75% hydrogen, 25% helium
c. 90% helium, 10% hydrogen

72% hydrogen, 25% helium

58) What is the role of carbon dioxide in the greenhouse effect?

a. Reflecting sunlight
b. Absorbing outgoing radiation and trapping heat
c. Cooling the atmosphere
d. Enhancing ozone layer