

Examination Questions

1. Thermodynamic systems.
2. Heat, internal energy, work done by a gas at constant pressure.
3. The first law of thermodynamics and living systems.
4. Entropy. The second law of thermodynamics and living systems.
5. Thermodynamic potentials.
6. Cell membrane structure. Cell membrane functions.
7. Physical properties of cell membrane.
8. Passive and active membrane transport; gradients across the plasma membrane. Theorell equation. Nernst–Planck equation.
9. The main kinds of passive transport.
10. Active transport, sodium-potassium pump.
11. Resting membrane potential, theory of Bernstein, Nernst equation.
12. Goldman-Hodgkin-Katz voltage equation.
13. Action potential.
14. Nerve impulse propagation, saltatory conduction.
15. Electric field, intensity of electric field.
16. Potential of electric field.
17. Dipole, potential of electric field of dipole.
18. Electrograms as the way of study of electric fields of organs and tissues.
19. Electrocardiography, the Einthoven theory.
20. Galvanic current.
21. Conductivity of electrolytes for DC.
22. Conductivity of biological tissues for DC.
23. Medical iontophoresis.
24. Alternating current. Parameters of AC.
25. Resistor in the AC electric circuit.
26. Capacitor in the AC electric circuit.
27. Inductor in the AC electric circuit.
28. Impedance.
29. Power in AC electric circuit. Power factor.
30. Conductivity of biological tissues for AC.
31. Determining the viability of living tissue.
32. Reography.
33. Electric pulse. Parts and parameters of trapezoidal and smooth pulse.
34. Pulsed current, its parameters.
35. Pulse current generator. Differentiator. Integrator.
36. The biological tissue excitation dependence on the pulsed current parameters. Strength-duration curve for an electrically excitable tissue.
37. Electrical stimulation of biological organs and tissues.
38. LC Oscillator. LC Oscillator, high frequency generator of electromagnetic oscillations. Patient circuit.
39. Influence by the high frequency alternating magnetic field on biological tissues. Inductothermy.
40. Influence by the high frequency alternating electric field on biological tissues. UHF- therapy.
41. Influence by the high frequency electromagnetic waves on biological tissues. Microwave therapy, DMW- therapy, EHF- therapy.
42. Darsonvalization. Electrosurgery techniques.
43. Active and passive sensors. Sensors characteristics.
44. Piezoelectric effect. Piezoelectric sensor.
45. Thermoelectricity. Temperature sensors.
46. Capacitive and inductive sensors.

47. Resistive sensors and strain gauge.
48. Amplifier. Amplitude and frequency characteristics of amplifier.
49. Geometrical optics laws.
50. Total internal reflection. Fiber optics.
51. Converging and diverging lenses.
52. Thin lens equation. Lens maker's equation.
53. Aberrations of lenses and their correction
54. Optical structure of the human eye. Lens system of the eye. Resolving power of the eye.
55. Defects in Vision and their correction.
56. The compound microscope. Magnification and resolution of optical microscope.
57. Wave optics. Electromagnetic waves and their properties
58. Interference of light waves.
59. Diffraction of light waves.
60. Polarization of light. Malus' law.
61. Energy levels of atoms and molecules.
62. Absorption of light. Beer–Lambert–Bouguer law. Colourimetry.
63. Emission and absorption spectrochemical analysis in medicine.
64. Luminescence. Photoluminescence. Stokes shift.
65. Light scattering. Rayleigh scattering
66. Thermal radiation, its characteristics.
67. Thermal radiation laws.
68. Thermography and thermal vision.
69. Bohr model of atom.
70. Spectrum of atomic hydrogen.
71. De Broglie hypothesis. Electron diffraction.
72. Electron microscopy.
73. Wave function. Schrodinger equation for the hydrogen atom. Quantum numbers.
74. Basics of laser physics.
75. Magnetic field characteristics.
76. The Magnetic Force on a moving charge and on current-carrying wire
77. Spin and orbital magnetic dipole moment of electron. Gyromagnetic ratio, g-factor. Bohr magneton.
78. Magnetic properties of substances.
79. Electron paramagnetic resonance.
80. Nuclear magnetic resonance.
81. Nuclear magnetic resonance imaging.
82. Bremsstrahlung X-radiation.
83. Characteristic X-radiation. Moseley's law.
84. X-ray generator
85. Interaction of X-radiation with matter. Attenuation of radiation in matter
86. Physical principles of medical uses of X-radiation. X-ray imaging.
87. The basics of computed tomography.
88. The phenomenon of natural radioactive decay
89. The radioactive decay law. The decay rate (activity) of a radioactive isotope.
90. Radiation detectors: gas filled detectors; scintillation detector.
91. Medical uses of radionuclides.
92. Interaction of ionizing radiation with matter.
93. Physical principles of radiation protection.
94. Absorbed dose, exposure, equivalent dose, dose rate.
95. Medical uses of ionizing radiation.
96. Natural background radiation and man-made radiation sources.