TEST: AUDIOMETRY

Choose the correct answer

1) SOUND IS LONGITUDINAL MECHANICAL WAVES PERCEIVED BY THE HUMAN EAR, WITH A FREQUENCY:
   a) 0 - 10 Hz
   b) 20 - 20,000 Hz
   C) 20,000 - 30,000 Hz.
2) A PERSON WILL HEAR MECHANICAL WAVES WITH A FREQUENCY:
   a) 0.5 Hz
   b) 5000 Hz
   c) 30,000 Hz
   D) 1 Hz.
3) THE HIGHER WILL BE THE TONE WITH THE FREQUENCY:
   a) 500 Hz
   b) 1000 Hz
   c) 3000 Hz
   D) 4000 Hz.
4) ACOUSTIC PRESSURE FORMULA:
   a) $P = \rho A\, \omega \upsilon$
   b) $E = k \lg \frac{I_x}{I_0}$
   C) $L = \lg \frac{I_x}{I_{\min}}$
5) SOUND INTENSITY IS MEASURED IN:
   a) Watt/m^2
   b) N/m
   C) J/s
6) THE FREQUENCY IS
   a) time taken for one complete oscillation

b) the amount of energy carried by a wave per unit of time

C) the number of oscillations per unit of time.

7) SOUND INTENSITY LEVEL IS MEASURED IN

a) bels

b) phones

c) Watt/m^2

8) AT FREQUENCY 1 kHz hearing threshold of the human ear is

a) 0 Watt/m^2

b) 10^{-13} Watt/m^2

c) 10^{-12} Watt/m^2

d) 10 Watt/m^2

9) AT FREQUENCY 1 kHz the threshold of pain in the human ear is

a) 0 Watt/m^2

b) 10^{-13} Watt/m^2

c) 10^{-12} Watt/m^2

D) 10 watt/m^2.

10) SOUND VOLUME IS MEASURED IN

a) bels

b) phones

c) Watt/m^2

11) WEBER - FECHNER LAW:

a) $P = \rho A \omega \upsilon$

b) $E = k \lg \frac{I_x}{I_0}$

c) $L = \lg \frac{I_x}{I_{\min}}$

Choose the correct answers

12) The sound research methods in the clinic include

a) audiometry

b) percussion

c) electrocardiography

d) auscultation

e) ultrasound check-up

13) The subjective characteristics of sound include

a) pitch

b) intensity

c) timbre

d) sound pressure

e) volume.

14) Objective sound characteristics include

a) pitch

b) intensity

c) sound pressure

d) acoustic spectrum

e) volume.

15) Weber - Fechner law relates loudness to

a) intensity level

b) frequency

c) timbre

d) pressure.

Complement

16) _____ - method for determining hearing acuity

a) percussion

b) auscultation

c) audiometry.

17) The volume level is measured in _____

a) Watt/m^2

b) phones

c) Pascals.

18) The pitch depends on _____.

a) intensity

b) loudness

c) frequency

d) pressure.

TEST: VISCOSITY

1) POISEUILLE'S LAW IS DEFINED BY THE FORMULA
   a) $R_e = \frac{\rho v D}{\eta}$
   b) $F_R = 6\pi\eta R v$
   c) $F_{Tp} = \eta \frac{dv}{dx} S$
   d) $V = \frac{R^2}{8\eta} \frac{P_1 - P_2}{L}$

2) THE REYNOLDS NUMBER IS DETERMINED BY THE FORMULA
   a) $R_e = \frac{\rho v D}{\eta}$
   b) $F_R = 6\pi\eta R v$
   c) $F_{Tp} = \eta \frac{dv}{dx} S$
   d) $Q = \frac{\pi R^4}{8\eta} \frac{P_1 - P_2}{L}$
   e) $V = \frac{R^2}{8\eta} \frac{P_1 - P_2}{L}$...

3) THE DEPENDENCE OF THE FLUID FLOW RATE ON ITS VISCOSITY, THE PRESSURE DIFFERENCE AT THE ENDS OF THE PIPE, ITS LENGTH AND RADIUS IS DETERMINED
   a) by Newton's formula
   b) Reynolds number
   c) Poiseuille's law.

4) IF THE VISCOSITY COEFFICIENT DEPENDS ON THE VELOCITY GRADIENT, THEN THIS IS A LIQUID
   a) Newtonian

B)non-newtonian

5) A FLUID IS CALLED NEWTONIAN IF ITS VISCOSITY COEFFICIENT DEPENDS ON
   a) fluid properties and temperature
   B) on the properties of the liquid, temperature and velocity gradient.

6) THE LOWEST VISCOSITY COEFFICIENT OF THE LISTED LIQUIDS HAS
   a) water
   b) lymph
   C)blood

7) RELATIVE BLOOD VISCOSITY IN POLYCYTHEMIA
   a) 2 - 3
   b) 4 - 6
   C)up to 15 - 20

8) IF THE SPEED OF THE PARTICLES IN EACH PLACE CHANGES CONTINUOUSLY AND CHAOTICALLY, THEN THE MOTION IS CALLED
   a) laminar
   B)turbulent.

9) WITH TURBULENT FLUID FLOW THROUGH THE PIPE
   a) layers flow without mixing
   b) vortices are created along the cross section.

10) BLOOD VISCOSITY IS DETERMINED USING A VISCOMETER
   a) Ostwald
   b) Hess (VK-4)
   c) Stokes.

11) BLOOD IS
   a) newtonian fluid
   B)non-newtonian fluid

12) THE MOTION WILL BE LAMINAR IF
   a) Re <Rcr
   B)Re> Rcr.

13) THE MOVEMENT WILL BE TURBULENT IF

a) Re <Rcr
B) Re> Rcr.

14) KINEMATIC VISCOSITY IS DETERMINED BY THE FORMULA

a) $X = \frac{8\,\eta L}{\pi R^4}$

b) $\nu = \eta/\rho_f$

c) $F_{Tp} = \eta \frac{dv}{dx} S$

15) THE VISCOSITY COEFFICIENT OF A NEWTONIAN FLUID DEPENDS ON
a) fluid properties
b) temperature
c) flow regime
D) pressure.

16) THE VISCOSITY COEFFICIENT OF A NON-NEWTONIAN FLUID DEPENDS ON
a) fluid properties
b) temperature
c) flow regime
D) pressure.

17) CAPILLARY VISCOMETERS INCLUDE
a) Stokes viscometer
b) Hess viscometer
c) Ostwald viscometer
D) rotary viscometer.

18) THE NATURE OF THE FLUID FLOW THROUGH THE PIPE DEPENDS ON
a) conditions of the inner surface of the pipe
b) pipe diameter
c) on liquid properties
D) the speed of its movement.

19) THE AMOUNT OF LIQUID FLOWING THROUGH THE PIPE PER UNIT OF TIME DEPENDS ON
a) pipe length
b) fluid viscosity

c) pipe radius
D) the pressure difference at the ends of the pipe.

20) THE VISCOSITY INDEX IS MEASURED IN
a) H*s/m2
b) H*m
c) Tue

21) THE LAYERS OF LIQUID FLOW WITHOUT MIXING, PARALLEL TO EACH OTHER. THIS FLOW IS CALLED _____
a) laminar
B) turbulent.

22) THE MOTION ACCOMPANIED BY NOISE, AT EACH PLACE OF WHICH THE SPEED CHANGES CHAOTICALLY, IS CALLED __
a) laminar
b) turbulent
C) stationary.

23) LIQUID OBEYING AN EQUATION $F_{\text{Тр}} = \eta \frac{\text{dv}}{\text{dx}} S$ IS CALLED ____.
a) newtonian
b) non-Newtonian
C) perfect.

24) POISEUILLE'S FORMULA IS VALID FOR _____ FLOW...
a) any
b) turbulent
c) laminar.

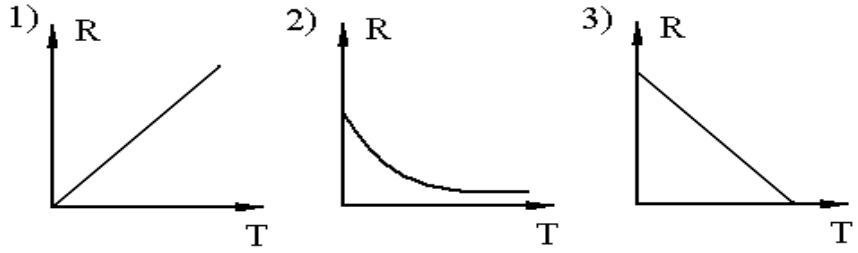
TEST: SENSORS

1) A device that converts a measured or controlled value into a signal convenient for transmission, further conversion and recording is called:
a) sensor
b) electrode
c) generator
d) amplifier.

2) The change in the output value with a unit change in the input value of the sensor is called the coefficient:
   a) transmission
   b) discrimination
   c) amplification
   d) sensitivity.

3) Sensors of medical and biological information are divided into
   a) generator and high-frequency
   b) parametric and high-frequency
   c) generator and low-frequency
   d) generator and parametric.

4) Dependence, typical for a thermistor:



   a) 1
   b) 2
   c) 3

5) The operation of the piezo sensor is based on:
   a) the phenomenon of direct piezoelectric effect
   b) inverse piezoelectric effect
   c) dependence of the electrical resistance of the sensor on deformation
   d) dependence of the deformation of the sensor on its electrical resistance.

6) The work of the load cell is based on:
   a) the phenomenon of direct piezoelectric effect
   b) inverse piezoelectric effect

c) dependence of the electrical resistance of the sensor on deformation
d) dependence of the deformation of the sensor on its electrical resistance.

7) Unit of measurement of thermistor sensitivity:
   a) Om/K
   b) mV/K
   c) Om/mm
   d) mV/mm.

8) Unit of measurement of thermoelement sensitivity:
   a) Om/K
   b) mV/K
   c) Om/mm
   d) mV/mm.

9) Unit of measurement of the piezoelectric sensor sensitivity:
   a) Om/K
   b) mV/K
   c) Om/mm
   d) mV/mm.

10) Unit of measurement of the load cell sensitivity:
   a) Om/K
   b) mV/K
   c) Om/mm
   d) mV/mm.

11) Piezoelectric sensors are used to measure:
   a) blood pressure and pressure in the digestive tract
   b) temperature and phonocardiogram
   c) blood pressure and phonocardiogram
   d) blood pressure and ballistocardiogram.

12)Rheostat sensors are used to measure:

a) blood pressure and temperature
b) temperature and pressure in the digestive tract
c) blood pressure and phonocardiogram
d) blood pressure and ballistocardiogram.

13)The formula for the sensitivity coefficient for the photoresistor:

a) $K = \Delta R/\Delta F$
b) $K = \Delta U/\Delta F$
c) $K = \Delta Z/\Delta F$
d) $K = \Delta V/\Delta F$.

14)Formula of the sensitivity coefficient for the photocell:

a) $K = \Delta R/\Delta F$
b) $K = \Delta U/\Delta F$
c) $K = \Delta Z/\Delta F$
d) $K = \Delta V/\Delta F$.

15)Induction sensors are used to measure:

a) blood pressure and temperature
b) temperature and phonocardiogram
c) removal of phonocardiogram and ballistocardiogram
d) pressure in the gastrointestinal tract and the removal of a ballistocardiogram.

16)Devices for taking out medical and biological information are:

a) electrodes, recorders, sensors
b) electrodes, pulse counters, cathode ray tube
c) electrodes, sensors
d) sensors, cathode ray tube.

17)Devices for registration of biomedical information:

a) electrodes, recorders, sensors
b) recorders, heart rate counters, cathode ray tube
c) electrodes, sensors
d) sensors, cathode ray tube.

18)Generator sensor
a) piezoelectric sensor, thermocouple, photocell
b) piezo sensor, thermistor, thermistor, photoresistor
c) strain gauge, thermistor, photocell, photoresistor
d) strain gauge, thermistor, thermistor, photoresistor.

19)Parametric sensor
a) piezoelectric sensor, thermocouple, photocell
b) piezo sensor, thermistor, thermistor, photoresistor
c) strain gauge, thermistor, photocell, photoresistor
d) strain gauge, thermistor, thermistor, photoresistor.

TEST: UHF

1) In the method of inductothermy, the patient is exposed to high-frequency
a) electric shock
b) electric field
c) magnetic field
d) electromagnetic field

2) Heating of water-containing tissues in the UHF therapy method occurs due to
a) conduction current
b) bias current
c) eddy currents.

3) The amount of heat released in 1 second in 1 m3 when exposed to tissue-conductors in the UHF-therapy method is determined by the formula:
a) $Q = k\omega E2\ \varepsilon\ tg\delta$
b) $Q = k\ E2/\rho$
c) $Q = k\ \gamma\omega^2B^2$.

4) In the method of inductothermy, the amount of heat released in 1 second in 1 m3 when exposed to conductive tissues is determined by the formula:
a) $Q = k\omega\ E^2\ \varepsilon\ tg\delta$
b) $Q = k\ E^2/\rho$
c) $Q = k\ \gamma\omega^2B^2$.

5) The amount of heat released in 1 second in 1 m3 when exposed to dielectric tissue in the UHF therapy method is determined by the formula:

a) $Q = k\omega E^2 \varepsilon \tan\delta$
b) $Q = k\ E^2/\rho$
c) $Q = k\ \gamma\omega^2 B^2$.

6) The amount of heat released in 1 second in 1 m3 when exposed to body tissues in the UHF-therapy method is determined by the formula:
a) $Q = k\omega E^2 \varepsilon \tan\delta$
b) $Q = k\ E^2/\rho$
c) $Q = k\ \gamma\omega^2 B^2$
d) $Q = k\omega E^2 \varepsilon \tan\delta + k\ E^2/\rho$.

7) In the method of therapeutic diathermy, tissues are warmed up better -
a) conductors
b) dielectrics.

8) The microwave therapy method warms up tissues better
a) conductors
b) dielectrics.

9) In the UHF field, tissues warm up better-
a) conductors
b) dielectrics.

10) With local darsonvalization, the patient is exposed to a high frequency:
a) electric shock
b) electric field
c) magnetic field
d) electromagnetic field

11) In the method of microwave therapy, the patient is exposed to high-frequency
a) electric shock
b) electric field
c) magnetic field
d) electromagnetic field

12) When exposed to HF biological tissues with electric currents and fields, the following is observed:
a) thermal effect
b) polarization effect
c) specific effect.

13) In the method of UHF - therapy, the frequency range is used:
   a) 20-400 kHz
   b) 1-2 MHz
   c) 10-15 MHz
   d) 30-300 MHz
   e) 500-2000 MHz.

14) The frequency range is used in the inductothermy method:
   a) 20-400 kHz
   b) 1-2 MHz
   c) 10-15 MHz
   d) 30-300 MHz
   e) 500-2000 MHz.

15) For local darsonvalization, the frequency range is used:
   a) 100-400 kHz
   b) 1-2 MHz
   c) 10-15 MHz
   d) 30-300 MHz
   e) 500-2000 MHz.

16) Heating of internal tissues in the method of inductothermy occurs due to
   a) conduction current
   b) bias current
   c) eddy currents.

17) The release of heat in organs and tissues is observed in methods
   a) UHF - therapy
   b) local darsonvalization
   c) inductothermy
   d) diathermy.

18) Treatment with eddy currents is possible with
   a) UHF - therapy
   b) local darsonvalization
   c) general darsonvalization
   d) inductothermy
   e) diathermy.

19) The impact of microwave fields on biological objects leads to heating:

a) bone tissue
b) muscles
c) adipose tissue
d) blood
e) skin.

20) With general darsonvalization, the patient is exposed to high-frequency
a) electric shock
b) electric field
c) magnetic field
d) electromagnetic field

TEST: ECG

1) The diagnostic method for recording the biopotentials of tissues and organs is called:
a) electrography
b) rheography
c) galvanization
d) electrophoresis.

2) A graphical recording of changes in time in the projections of the heart dipole moment in the corresponding leads is called:
a) electrocardiogram
b) vector electrocardiogram
c) rheogram.

3) The figure that represents the geometric place of the points corresponding to the end of the vector of the dipole moment of the heart during the cardiac cycle is called:
a) electrocardiogram
b) vector electrocardiogram
c) rheogram.

4) The resting potential is the potential difference between
a) inner and outer sides of the membrane
b) two points of the body
c) excited and unexcited portion of the membrane.

5) Action potential is the potential difference between
   a) the inner and outer sides of the membrane
   b) two points of the body
   c) an excited and unexcited portion of the membrane.

6) The magnitude of the dipole moment of the electric dipole is determined by the formula:
   a) p = q*L
   b) p = I*L
   c) p = I*R
   d) p = U/R.

7) The magnitude of the dipole moment of the current dipole is determined by the formula:
   a) p = q*L
   b) p = I*L
   c) p = I*R
   d) p = U/R.

8) The vector of the dipole moment of the electric dipole is directed:
   a) from negative to positive
   b) from a positive charge to a negative one.

9) In the electrocardiograph that we used in our work, the record:
   a) ink and feather
   b) inkjet
   c) thermal
   d) optical.

10) The distance between adjacent R teeth on the cardiogram is 25 mm, the speed of the chart tape is 25 mm/s, then the duration of the RR interval i
   a) 1 s
   b) 0.8 s
   c) 0.96 s
   d) 0.72 s.

11) On the electrocardiogram, the height of the R wave is 19 mm, the height of the calibration pulse is 10 mm, then the sensitivity of the electrocardiograph is
   a) 1,9 mm
   b) 19 mm/h
   c) 15 mV

d) 10 mm/mV.

12) On the electrocardiogram, the height of the R wave is 15 mm, the height of the calibration pulse is 15 mm. Then the EMF of the R wave is equal to:
a) 1 mV
b) 1.2 mV
c) 1.13 mV
d) 0.95 mV.

13) The distance between adjacent R teeth on the cardiogram is 29 mm, the speed of the chart tape is 25 mm/s. Then the pulse rate is
a) 72 beats/min
b) 81 beats/min
c) 52 beats/min
d) 62 beats/min

14) Let the distance at which point A is from the current dipole is much greater than the arm of the dipole, then the potential created by the dipole at point A is equal to:
a) $\phi = \frac{1}{4\pi\varepsilon_r\varepsilon_0}\frac{ql}{r^2}$
b) $\phi = \frac{1}{4\pi\varepsilon_r\varepsilon_0}\frac{IL\cos\alpha}{r^2}$.

15) If the sensitivity of the cardiograph increases 2 times, then the height of the teeth of the cardiogram in this case:
a) will increase by 2 times
b) decrease by 2 times
c) Will not change
d) will increase 0.9 times.

16) If the sensitivity of the cardiograph is increased by 3 times, then the U of the teeth of the cardiogram is
a) will increase 3 times
b) will decrease by 1.5 times
c) Will not change
d) will increase by 1.5 times.

17) The duration of the ECG time intervals with an increase in the speed of the chart tape by 1.5 time
a) will increase 1.5 times
b) will decrease by 1.5 times

c) Will not change.

18) The heart in Einthoven's theory is represented a
   a) a system consisting of two stationary charges located at some distance from each other
   b) a system consisting of a current source and a current drain located at some distance from each other
   c) a current dipole with a dipole moment pc, which rotates in space, changing its value.

19) A two-pole system consisting of a current source and drain is called:
   a) dipole electric generator
   b) an electric dipole
   c) a current dipole.

20) Requirements for electrodes used to remove biopotential
   a) quickly fixed and removed
   b) be large
   c) have stable electrical parameters
   d) have high resistance
   e) do not interfere
   f) do not have an irritating effect.

TEST: MECHANICAL WAVE (SOUND, ULTRASOUND)

1. How are the velocity v, the wavelength λ, and the oscillation period T of particles in the wave related?
   a) $\lambda = vT$
   b) $\lambda = v/T$
   c) $\lambda = T/v$
   d) $\lambda = 1/vT$

2. A wave is spreading across the surface of the water. The distance between the nearest wave crests and the trough is 6 m, and the distance between the nearest wave crests is 12 m. What is the wavelength?
   a) 20 m
   b) 12 m
   c) 10 m
   d) 9 m

3. The transverse wave propagates along the stretched cord at a speed of v = 1.2 m/s at a frequency of V = 3.0 Hz. What is the phase difference $\Delta\varphi$ of vibrations of two points, standingare they separated from each other by a distance of DX = 0.20 m?
    a) 180º
    b) 90º
    c) 50º
    d) 270º

4. What type of mechanical waves can propagate in the air and the earth's crust?
    a) only longitudinal
    b) only transverse
    c) longitudinal and transverse
    d) in the air-longitudinal, in the earth's crust-transverse and longitudinal

5. Wave with a frequency of 110 Hz oscillation propagates in a medium in which the wave velocity is 330 m/s. What is the wavelength?
    a) 1 m
    b) 2 m
    c) 3 m
    d) 0.5 m

6. In which directions does the medium particles oscillate in a longitudinal wave?
    a) In all directions
    b) Only in the direction of wave propagation.
    c) Only perpendicular to the direction of wave propagation.

7. Which of these properties apply to longitudinal waves?
    a) These waves can only propagate in gases.
    b) The particles of the medium move along the direction of wave propagation during vibrations.
    c) These waves are alternating rarefactions and compressions.

8. Which of these properties apply to transverse waves?
    a) These waves are alternating compressions and rarefactions.
    b) These waves can only propagate in solids.
    c) In this wave, the oscillations are made perpendicular to the direction of propagation of the wave.

9. Transverse waves can propagate
    a) Only in solids
    b) In all environments
    c) Only in liquids.

10. A wave propagates along the surface of the lake at a speed of 4.2 m/s. What is the frequency of the buoy oscillation if the wavelength is 1.75 m?
    a) 1,4 Hz.
    b) 2,4 Hz.
    c) 3,4 Hz.

11. If the source of mechanical waves is at rest, the wavelength will be …
    a) in all directions the same
    b) in all directions different
    c) zero
    d) infinite

12. If the source of mechanical waves is moving, then the wavelength will be ...
    a) in all directions the same
    b) in all directions of different
    c) infinite
    d) zero

13. The Doppler effect is used to determine....
    a) The thickness of coatings
    b) The temperature of bodies
    c) The speed of moving objects

d) The shape of objects
e) The energy

14. Flow of the wave is determined by the formula

a) $\Phi = \frac{dE}{dt}$
b) $\omega_\rho = \frac{\rho A^2 \omega^2}{2}$
c) $\vec{I} = \omega_\rho \cdot \vec{\upsilon}$

15. The wave energy flow is measured in
a) W
b) W/m^2
c) Pa·s

16. The density of the wave energy flow is determined by the formula

a) $\Phi = \frac{dE}{dt}$
b) $\omega_\rho = \frac{\rho A^2 \omega^2}{2}$
c) $\vec{I} = \omega_\rho \cdot \vec{\upsilon}$
d) + $I = \frac{\Phi}{S}$

17. The energy flux density is measured in
a) W
b) W/m^2
c) Pa·s

18. The Umov vector is defined by the formula

a) $\Phi = \frac{dE}{dt}$

b) $\omega_\rho = \frac{\rho A^2 \omega^2}{2}$

c) $\vec{I} = \omega_\rho \cdot \vec{\upsilon}$

19. The change in the frequency of waves perceived by the observer (receiver) due to the relative motion of the wave source and the observer is called
    a) the Compton effect
    b) Hall effect
    c) Doppler effect

20. When an observer approaches a stationary wave source at the speed in, the perceived frequency of the wave emitted by the observer is determined by the formula:

a) $f = f_0 \frac{v - v_o}{v + v_s}$

b) $f = f_0 \frac{v + v_o}{v_s}$

c) $f = f_0 \frac{v}{v - v_s}$

d) $f = f_0 \frac{v + v_o}{v - v_s}$

e) $f = f_0 \frac{v - v_o}{v + v_s}$

21. When the wave source approaches a stationary observer, the frequency of vibrations of the perceived wave is determined by the formula

a) $f = f_0 \frac{v - v_o}{v + v_s}$

b) $f = f_0 \frac{v + v_o}{v_s}$

c) $f = f_0 \frac{v}{v - v_s}$

d) $f = f_0 \frac{v + v_o}{v - v_s}$

e) $f = f_0 \frac{v - v_o}{v + v_s}$

22. When the observer and the wave source simultaneously move towards each other, the perceived frequency is determined by the formula

a) $f = f_0 \frac{v - v_o}{v + v_s}$

b) $f = f_0 \frac{v + v_o}{v_s}$

c) $f = f_0 \frac{v}{v - v_s}$

d) $f = f_0 \frac{v + v_o}{v - v_s}$

e) $f = f_0 \frac{v - v_o}{v + v_s}$

23. When the observer and the wave source simultaneously move in the opposite direction from each other, the frequency perceived by the observer is determined by the formula

a) $f = f_0 \frac{v - v_o}{v + v_s}$

b) $f = f_0 \frac{v + v_o}{v_s}$

c) $f = f_0 \frac{v}{v - v_s}$

d) $f = f_0 \frac{v + v_o}{v - v_s}$

e) $f = f_0 \frac{v - v_o}{v + v_s}$

24. In medicine, the Doppler effect is used to determine
    a) Hearing acuity
    b) blood flow velocities
    c) blood viscosity

25. Mechanical disturbances that propagate in space and carry energy are called
    a) electromagnetic waves
    b) mechanical waves
    c) x-ray radiation

26. If the medium particles oscillate along the direction of wave propagation, the wave is called
    a) longitudinal
    b) transverse
    c) electromagnetic

27. If the particles of the medium oscillate perpendicular to the direction of wave propagation, the wave is called
    a) longitudinal
    b) transverse
    c) electromagnetic

28. The equation of a plane wave is described by the formula
    a) $s = A\cos[\omega(t - x/v)]$
    b) $\varphi = \omega(t - x/v)$
    c) $\lambda = Tv$

29. The set of points having the same phase are called:
    a) the wave front
    b) wavelength
    c) the frequency of the wave

30. The distance between two points of a wave, the phases at the same time differ by 2π, is
    a) phase fluctuations
    b) wave front wave
    c) length
    d) group wave

e) velocity

31. If the minimum distance between two points oscillating in the same phases is 1 m, and the wave propagation speed is 300 m/s, then the oscillation frequency is
    a) 300 Hz
    b) 150 Hz
    c) 600 Hz

32. In the formula $s = A\cos[w(t - x/v)]$ quantity x is the
    a) offset
    b) velocity
    c) distance from the source
    d) phase

33. The plane wave equation for a point with zero coordinate has the form
    a) $s = A\cos[\omega(t-x/v)]$
    b) $\varphi = \omega(t-x/v)$
    c) $\lambda = T\nu$
    d) $s = a\cos[\omega t]$

34. The smallest distance between two points that are in the same phases is called
    a) the oscillation phase
    b) of the wave front
    c) wave length
    d) and wave velocity

35. Propagation time of elastic waves in water is 2 s. The speed of elastic waves in water is 750 m/s. Then the depth of penetration of elastic waves is
    a) 750 m
    b) 3000m
    c) 1500m

36. The volume energy density of waves is
    a) The amount of energy carried by the wave per unit of time

    The number of vibrations per unit of time

    b) The amount of energy per unit of volume

37. In the first case, the energy of 1J was transferred by the longitudinal wave for 12 seconds. In the second case, the energy of 4J is transferred for 16s. In which case is the wave energy flow greater?
    a) in the first
    b) in the second
    c) the flow has not changed

38. An elastic wave is a
    a) radio wave
    b) light x-ray radiation
    c) gamma radiation
    d) sound

39. In the formula $s = A\cos[\omega(t - x/v)]$ quantity x/v is the
    a) phase
    b) wavelength wave propagation
    c) time
    d) distance from the source wave

40. Energy flow measured in
    a) W

        a) W/ms^2

    b) Pa·s
    c) J/s

41. The plane wave equation can be described by the expressions
    a) $s = A\cos[\omega(t-x/v)]$

b) $\varphi = \omega(t-x/v)$
c) $\lambda=T\nu$

42. The change in the frequency of waves perceived by the observer due to the relative motion of the wave source and the observer doesn't depends on the
    a) speed of the observer
    b) the speed of the source
    c) the direction of motion
    d) the density of the medium

43. The elastic wave length is defined as
    a) $\lambda=T\nu$
    b) $\lambda=c/\nu$
    c) $s = A\cos[\omega(t- x/v)]$
    d) $\varphi =\omega(t- x/v)$

TEST: MECHANICAL OSCILLATION (SPRING PENDULUM, THE SIMPLEST MATHEMATICAL PENDULUM)

1) Frequency is:
   a) The time it takes for one complete oscillation to occur
   b) the amount of energy carried by the wave per unit of time
   c) the number of oscillations per unit of time

2) The differential equation of damped harmonic oscillations has the form:
   a) $\frac{d^2X}{dt^2}+2\beta\frac{dX}{dt}+\omega_0^2X=0$
   b) $m\frac{d^2X}{dt^2}+mg\frac{X}{L}=0$
   c) $A_t=A_0\cdot e^{-\beta t}$
   d) $X=A_0e^{-\beta t}\sin(\omega t+\varphi_0)$

3) Measured in second
   a) period
   b) frequency
   c) phase
   d) amplitude

4) Measured in Hertz:
   a) number of vibrations per unit of time
   b) The time it takes for one complete oscillation to occur
   c) Maximum deviation from the equilibrium position

5) The period is
   a) The time it takes for one complete oscillation to occur
   b) Number of vibrations per unit of time
   c) Maximum deviation from the equilibrium position

6) It can be measured in centimeter
   a) Maximum deviation from the equilibrium position
   b) Number of vibrations per unit of time
   c) The time it takes for one complete oscillation to occur

7) The oscillation amplitude is:
   a) The maximum deviation from the equilibrium position
   b) the time during which one complete oscillation occurs
   c) the number of oscillations per unit of time
   d) the position of the oscillating point at any given time

8) In seconds can be measured:
   a) The time for which one complete oscillation occurs
   b) the number of oscillations per unit of time
   c) the maximum deviation from the equilibrium position
   d) the position of the oscillating point at any time

9) The oscillation frequency is measured in
   a) Hz
   b) m
   c) radians
   d) s

10) Free undamped mechanical oscillations correspond to the equation

a) $$m\frac{d^2X}{dt^2}+mg\frac{X}{L}=0$$

b) $$\frac{d^2X}{dt^2}+2\beta\frac{dX}{dt}+\omega_0^2X=0$$

c) $$A_t=A_0\cdot e^{-\beta t}$$

d) $X=A_0e^{-\beta t}\sin(\omega t+\varphi_0)$

11) The solution of the equation $m\frac{d^2X}{dt^2}+mg\frac{X}{L}=0$ is the function:

a) $X=A\cos(\omega_0 t+\varphi_0)$

b) $A_t=A_0\cdot e^{-\beta t}$

c) $X=A_0e^{-\beta t}\cos(\omega t+\varphi_0)$

d) $X=A_0e^{-\beta t}\sin(\omega t+\varphi_0)$

12) Quasi-elastic forces are called:
a) Forces of any other nature, but those that obey the law F=-kx
b) Are elastic by nature
c) Of any other nature
d) of friction

13) The phenomenon of a sharp increase in the amplitude of forced vibrations when the frequency of the driving force approaches the natural frequency of the oscillating body is called
a) resonance self oscillation
b) harmonic oscillation
c) reverberation

14) If the oscillations are performed according to the law X=9sin[π(t-0.2)], then the oscillation amplitude is equal to:
a) 9
b) 0,2
c) 0,2π
d) πt

15) If the oscillations are performed according to the law X=9sin[π(t-0.2)], then the initial phase of the oscillation is equal to
a) 0,2π
b) 9
c) 0,2
d) πt

16) If the oscillations are performed according to the law X=2sin[π(4t-0.4)], then the oscillation period is equal to
a) 2 s

b) 0,5 s
c) 0,5π s
d) 1 s

17) The phase shift of two oscillatory motions occurring along the same straight line, given by the equations $X1=A1\sin(20\pi t - 4\pi/3)$ and $x2=A2\sin(20\pi t + \pi/2)$ is equal to:
a) $2\pi/3$
b) $11\pi/6$
c) $20\pi t$
d) $40\ \pi t$

18) The phase of the oscillation is measured in
a) radians
b) degrees
c) Hertz
d) seconds

19) In the case of steady forced oscillations of a mechanical oscillation frequency of the system is determined by:
a) the frequency of the external force
b) the natural frequency
c) attenuation
d) the mass of the vibrating system

20) The amplitude of the forced vibration with increasing amplitude of the driving force 4 time
a) will increase in 4 times
b) will decrease in 4 times
c) will increase 2e time
d) will decrease in 2e times
e) will not change

21) The resonance amplitude of the forced oscillations with decreasing mass of the vibrating body 3 time
a) will increase in 3 times
b) will decrease in 3 times
c) will increase 3e time
d) will decrease in 2e times
e) will not change

22) The resonant amplitude of forced vibrations when the mass of the oscillating body and the amplitude of the driving force decreases by 2,5 time
a) Will not change

b) Will increase by 5 times
c) Will decrease by 5 times
d) Will increase by 2,5e times
e) Will decrease by 5e times

23) The frequency of the external force is 3 (1/s), the natural frequency of the system is 4 (1/s), and the attenuation coefficient is 0.5(1/s). The resonant frequency in SI units is
a) 3,9
b) 2,4
c) 1,3
d) 2,7

24) The natural frequency of the system is 3 (1/s), the resonant frequency is 2 (1/s), the attenuation coefficient is
a) 2,24 (1/s)
b) 1,08 (1/s)
c) 1,96 (1/s)
d) 0,27 (1/s)

25) When the driving force amplitude increases and all other parameters are preserved, the value of the resonant frequency:
a) Does not change
b) increases
c) decreases

26) The phenomenon of reaching the maximum amplitude when the frequency of the driving force reaches a certain value is called:
a) resonance
b) amplitude of damped vibrations speed
c) amplitude
d) q-factor of the oscillatory system

27) The natural frequency of vibrations is 30 (1/s). If we consider the attenuation coefficient to be zero, the resonant frequency in SI units is
a) 50
b) 30
c) 75
d) 100

TEST: SPRING PENDULUM

1) If the oscillations are performed according to the law $X=7\sin[3\pi(t-0.1)]$, then the oscillation amplitude is equal to:
   a) 7
   b) 0,3
   c) 0,3π
   d) 3πt

2) If the oscillations are performed according to the law $X=7\sin[3\pi(t-0.1)]$, then the initial phase of the oscillation is equal to
   a) -0,3π
   b) 0,3π
   c) 0,3
   d) 3πt

3) If the oscillations are performed according to the law $X=7\sin[3\pi(t-0.1)]$, then the oscillation period is equal to
   a) 2 s
   b) 2/3 s
   c) 0.5π s
   d) 1 s

4) The phase of the oscillation is measured in
   a) radians
   b) degrees
   c) Hz
   d) Seconds

5) Spring stiffness k_1= 5 kN/m and k_2=10 kN/m. The stiffness coefficient k of the system of two springs with their serial connection is equal to
   a) 1,5
   b) 9
   c) 3.3
   d) 6

6) Spring stiffness k_1= 1 kN/m and k_2=5 kN/m. The stiffness coefficient k of the system of two springs with their parallel connection is equal to
   a) 1,5

b) 8
c) 4
d) 6

7) The period of oscillation of a spring pendulum if its mass is 100 g and the coefficient of elasticity k=10 N/m is equal to
   a) 6.28 s
   b) 62,8 s
   c) 198.6 s
   d) 0 s

8) The coefficient of elasticity of a spring pendulum, if its mass is 200 g, and the displacement from the equilibrium position (the pendulum does not move? Assume g as 10m/s^2) without a load is 4 cm is equal to
   a) 20 N/m
   b) 0.05 N/m
   c) 2 N/m
   d) 50 N/m

TEST: RESONANCE IN ELECTRICITY CIRCUIT

1) Periodic changes in charge, current strength, voltage are called
   a) mechanical vibrations
   b) electromagnetic vibrations
   c) free vibrations
   d) forced vibrations

2) Resonance in the oscillatory circuit occurs if
   a) the amplitude of the external voltage coincides with the natural frequency
   b) the phase of the external voltage coincides with the natural frequency
   c) the oscillation period of the external voltage coincides with the natural frequency
   d) external voltage frequency coincides with natural frequency

3) What does the resonance current matter?
   a) 1.maximum;
   b) 2.minimal;
   c) is equal to zero;

4) What electric current periodically changes its direction and continuously changes in magnitude?
   a) Alternating current
   b) Direct current

c) Capacitive current
d) Magnetoelectric current
e) Voltage current

5) What device is used to measure the strength of the electric current?
a) A. Ammeter
b) V. Voltmeter
c) S. Wattmeter
d) Phase meter
e) E. Kenetron

6) A 500 μF capacitor is connected to the AC mains. Determine the capacitance of the capacitor at 50 Hz.
a) 254 Ohm
b) 25.4 ohm
c) 25.4 F
d) 254 Gn

7) What is the period of natural oscillations in the oscillatory circuit if the inductance of the coil is 3 mH and the capacitance of the capacitor is 0.3 μF?
a) 0.248 ms
b) 0.248 s
c) 0.248 minutes
d) 0.248 μs

8) The electric oscillatory circuit contains a flat capacitor, between the plates of which there is a substance with a relative dielectric constant ε = 16. How will the resonant frequency of the circuit change if the dielectric is removed?
a) Will increase 4 times.
b) Will decrease by 4 times.
c) Will not change.

9) A coil with an inductance of 0.2 H is included in the AC circuit with a frequency of 300 Hz. What capacitance must be included in this circuit for resonance to occur?
a) 3.0 μF
b) 1.6 μF
c) 1.4 μF

TEST: MECANICAL RESONANCE

1) With steady forced oscillations, the fluctuating value changes with time according to the law:
a) $x = A\sin(\omega_0 t + \varphi)$
b) $x = A\exp(-\beta t - \varphi)$
c) $x = Ae^{-\beta t}\cos(\omega t + \varphi)$

d) $x = A_0 e^{-\beta t} \sin(\omega t + \varphi_0) + A\cos(\Omega t + \varphi)$

2) With steady-state forced mechanical vibrations, the vibration frequency of the system is determined by:
   a) natural frequency
   b) external force frequency
   c) attenuation coefficient
   d) the mass of the oscillating system

3) The amplitude of the forced vibrations, with an increase in the amplitude of the driving force by 3 time
   a) increase by 3 times
   b) will decrease by 3 times
   c) increase by $3\sqrt{2}$ times
   d) will decrease by $\sqrt{3}$ times
   e) Will not change

4) Resonant amplitude of forced oscillations when the mass of the oscillating body decreases by 5 time
   a) will increase by 5 times
   b) will decrease by 2.5 times
   c) will increase by $5\sqrt{2}$ times
   d) decrease by $\sqrt{5}$ times
   e) will not change

5) Resonant amplitude of forced oscillations with a decrease in the mass of the oscillating body and the amplitude of the driving force by 2.5 time
   a) will increase by 2.5 times
   b) will decrease by 2.5 times
   c) will increase by $\sqrt{3}$ times
   d) decrease by $\sqrt{2}$ times
   e) will not change

6) The frequency of the external force is 3 (s^{-1}), the natural frequency of the system is 4(s^{-1}), and the attenuation coefficient is 0.5(s^{-1}). The resonant frequency is
   a) 3,9 s^{-1}

b) 2,8 s^{-1}
c) 1,7 s^{-1}
d) 2,6 s^{-1}

7) The natural oscillation frequency of the system is $3s^{-1}$, the resonant frequency is $2s^{-1}$, the damping coefficient is
   a) 2.24 s^{-1}
   b) 1,98 s^{-1}
   c) 1,50 s^{-1}
   d) 0,90 s^{-1}

8) With an increase in the amplitude of the driving force and keeping all other parameters, the value of the resonance frequency:
   a) increases
   b) decreases
   c) does not change

9) Establish a correspondence between the type of oscillation and the differential equation of this oscillation

1) Free undamped oscillations	A) $\frac{d^2x}{dt^2} + 2\beta\frac{dx}{dt} + \omega_0^2 x = f_0 \cos\omega t$
2) Free damped oscillations	B) $\frac{d^2x}{dt^2} + 2\beta\frac{dx}{dt} + \omega_0^2 x = 0$
3) Forced oscillations	C) $\frac{d^2x}{dt^2} + \omega_0^2 x = 0$

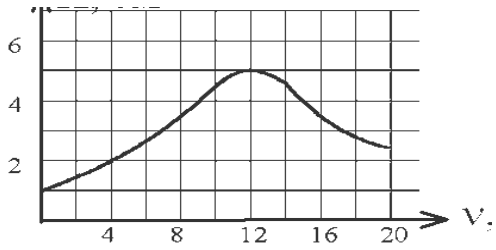
10) The value of the resonant frequency is determined by:
   a) the frequency of natural vibrations
   b) the amplitude of the driving force
   c) attenuation

11) The phenomenon of reaching the maximum amplitude when the frequency of the driving force reaches a certain value is called:
   a) amplitude of damped vibrations
   b) speed amplitude
   c) resonance
   d) q-factor of the oscillatory system

12) The natural frequency of vibrations is 75 s^-1. If the attenuation coefficient is assumed to be zero, the resonant frequency in system SI i
   a) 30

b) 50
c) 75
d) 100

13) Figure shows the dependence of the oscillation amplitude on the frequency of the driving force.



Then the resonant frequency is:

a) 4 Hz
b) 8 Hz
c) 12 Hz
d) 20 Hz

14) If the system performing mechanical vibrations is moved to a medium with a higher coefficient of resistance, the resonant amplitude:
a) increases
b) decreases
c) does not change

TEST: POLARIZATION

1) Which of the vectors of the light wave has a photochemical effect?

a) vector E

b) vector H.

2) The substances are called optically active if they have the property

a) rotation of the plane of polarization when plane polarized light passes through this substance

b) absorption of plane polarized light when passing through this substance

c) scattering of plane polarized light when passing through this substance.

3) The polarimeter is based on the law

a) $I = \frac{a}{\lambda^2}$

b) $tg\ i = n$

c) $I = I_o\ Cos^2\varphi$.

4) Polarimeters are used in medicine to determine

a) concentration of optically active substances

b) optical activity dispersion

c) structures of transparent anisotropic biological objects.

5) A mixture is called racemic if it consists of

a) dextrorotatory molecules

b) levorotatory molecules of matter

c) equal number of left and dextrorotatory molecules of the substance.

6) The extraordinary beam is polarized

a) in the main optical plane

b) in the plane perpendicular to the main optical plane.

7) With an increase in the concentration of the test substance, the angle of rotation of the plane of polarization

a) will not change

b) will increase

c) will decrease.

8) How will the intensity of the light wave I_o change if the angle between the planes of the polarizer and the analyzer is $\varphi = 90°$?

a) $I = I_o$

b) $I = I_o/2$

c) $I = 2I_o$

d) $I = 0$.

9) How will the intensity of the light wave Io change if the angle between the planes of the polarizer and the analyzer is $\varphi = 0º$?

a) $I = I_o$

b) $I = \frac{1}{2} I_o$

c) $I = 2I_o$

d) $I = 0$.

10) Does the angle of rotation of the plane of polarization depend on the length of the light wave?

a) yes

b) no.

11) What is the angle between the main planes of the polarizer and the analyzer, if the intensity of natural light transmitted through these prisms has decreased by 8 times? Absorption is neglected.

a) $\varphi = 0°$

b) $\varphi = 30°$

c) $\varphi = 45°$

d) $\varphi = 60°$

e) $\varphi = 90°$.

12) The main planes of two Nicol prisms placed in the path of the beam form an angle $\varphi_1 = 60°$ between them. If the angle between Nicol prisms becomes $\varphi_2 = 45°$, the intensity of natural light passing through these prisms is

a) will increase 2 times

b) will increase 3 times

c) will decrease by 2 times

d) will decrease by 3 times.

13) Two Nicol prisms are located so that the angle between their main planes is 30^0. The intensity of natural light when it passes through one Nicol prism will decrease

a) 2 times

b) 4 times

c) 6 times

d) 8 times.

14) Two Nicol prisms are located so that the angle between their main planes is 45^0. How many times will the intensity of natural light decrease when it passes through both Nicol prisms?

a) 2 times

b) 4 times

c) 6 times

d) 8 times.

15) The light vector is called the vector of tension

a) electric field

b) magnetic field

16) When reflected light is fully polarized the law is satisfied

a) Malus

b) Bio

c) Brewster.

Insert the answer numbers in a logical sequence

17) In birefringence for an ordinary ray _1__ laws of refraction and its refractive index __2_ from the direction of propagation of light in the crystal.

a) depends

b) does not depend

c) are carried out

d) are not performe

18) The plane passing through the incident beam and the optical axis of the crystal is called the ___ of crystal.

a) polarization plane

b) vibration plane

c) the main plane.

19) Both rays emerging from the crystal _1_ in mutually __2_ planes.

a) completely polarized

b) partially polarized

c) not polarized

d) parallel

e) perpendicular.

20) The ability of crystals to absorb ordinary and extraordinary rays in different ways is called

a) optical activity

b) dichroism

c) double refraction.

21) The angle of rotation of the plane of polarization depends on

a) distance traveled by light in matter

b) concentration of optically active substance

c) wavelength

d) solvent properties.

22) Spectropolarimeters are used in medicine to determine

a) in a solution of levorotatory and dextrorotatory molecules

b) concentration of optically active substances

c) the presence of a racemic mixture of substances.

Match between

23) The name of the law and its formula

1) Malus's law	a) $I = \frac{a}{\lambda^2}$
2) Bio's law	b) $tg\ i = n$
3) Brewster's law	c) $I = I_o \cos^2\varphi$

TEST: X-RAY AND RADIOACTIVITY

1) The nature of X-rays is
   a) flow a-particles
   b) the flow of electromagnetic waves
   c) the flow of electrons.

2) The X-ray source in the X-ray tube is
   a) cathode
   b) anode.

3) The X-ray bremsstrahlung spectrum has the form
   a) solid
   b) ruled
   c) stripe

4) The spectrum of characteristic X-ray radiation has the form
   a) solid
   b) ruled
   c) stripe

5) The minimum wavelength in the bremsstrahlung spectrum is calculated by the formula
   a) $\lambda = \frac{B}{T}$
   b) $\lambda_{min} = \frac{hc}{eU}$
   c) $\lambda = \frac{h}{\sqrt{2\varepsilon\mu Y}}$

6) Braking X-rays are generated by:
   a) knocking out electrons from the inner layers of the atom, as a result of which electrons from the outer levels of the atom pass to the inner levels
   b) the capture of one or more electrons by the nucleus, as a result of which electrons from the outer levels of the atom pass to the inner levels
   c) deceleration of electrons by the electrostatic field of the nucleus and atomic electrons.

7) X-ray flux is calculated by the formula
   a) $\phi = BS\cos\alpha$
   b) $\Phi = \frac{dE}{dt}$
   c) $\Phi = \kappa I U^2$

8) As the atomic number of the anode substance increases, the spectrum of characteristic X-ray radiation shifts
a) towards lower frequencies
b) towards higher frequencies
c) does not move.

9) Moseley's law has the form
a) v= eU/h
b) $\nu = R\left(\frac{1}{n_i^2 - n_k^2}\right)$
c) $\sqrt{\nu} = A(z - B)$

10) The Compton effect can be described by the equation
a) $h\nu = \varepsilon Y$
b) $h\nu = A + \frac{mv^2}{2}$
c) $h\nu = h\nu' + A + \frac{mv^2}{2}$.

11) The photoeffect can be described by the equation
a) $h\nu = \varepsilon Y$
b) $h\nu = A + \frac{mv^2}{2}$
c) $h\nu = h\nu' + A + \frac{mv^2}{2}$

12) Coherent scattering occurs if
a) hv<Au
b) hv~ Au
c) hv>> Au.

13) Incoherent scattering occurs under the condition
a) hv<Au
b) hv~ Au
c) hv>> Au.

14) The X-ray diagnostic method is based on the phenomenon
a) refraction
b) absorption
c) diffraction
d) reflections.

15) If the voltage between the cathode and anode in the X-ray tube is increased by 4 times, then the X-ray flux
a) will not change
b) will increase 4 times
c) will increase 16 times
d) will increase by 2 times.

16) If we increase the voltage between the anode and cathode in the X-ray tube, then the cutoff wavelength in the spectrum
a) will shift towards longer wavelengths
b) will remain in the same place
c) will shift towards short wavelengths.

17) The hardness of X-rays depends on
a) wavelength
b) flux density
c) intensity.

18) The voltage on the X-ray tube was double Cutoff wavelength
a) has shifted to the region of long waves
b) has shifted to the region of short wavelengths
c) remained in the same place.

19) The method by which you can investigate the structure of crystals is called
a) X-ray structural analysis
b) photocolorimetry
c) spectropolarimetry.

20) Spontaneous decay of unstable nuclei with the emission of other nuclei and elementary particles is called
a) X-rays
b) the phenomenon of diffraction
c) radioactivity
d) the phenomenon of interference.

21) Spontaneous transformation of an atomic nucleus with the emission of positively charged α-particles called
a) beta decay
b) alpha decay
c) electronic capture

d) radiolysis of water.

22) Scheme of alpha decay

a) ${}^{A}_{Z}X \rightarrow {}^{A-4}_{Z-2}Y + {}^{4}_{2}\mathrm{He}$

b) ${}^{A}_{Z}X \rightarrow {}^{A}_{Z-1}Y + {}^{0}_{+1}e + \nu$

c) ${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{0}_{-1}e + \nu$

23) Gamma radiation is a flux

a) positively charged particles

b) negatively charged particles

c) electromagnetic waves

d) particles neutral in sign.

24) Formula expressing the law of radioactive decay

a) $A(t) = \pm A_0 e^{-\beta t}$

b) $N(t) = N_0 e^{-\lambda t}$

c) $I = I_0 e^{-\mathrm{kd}}$

d) $A(t) = A_0 e^{-\beta t}\cos(\omega t + \phi)$

25) Half-life is the time during which it decays

a) 1/e radioactive nuclei

b) an arbitrary number of radioactive nuclei

c) half of radioactive nuclei

d) 1/3 of radioactive nuclei.

26) If 200 nuclei of a substance disintegrate within 0.1 second, then the activity of the drug in Bq is

a) 30

b) 200

c) 2000

d) 10000.

27) The rays with the highest linear ionization density are

a) beta rays

b) gamma rays

c) alpha rays

d) x-rays.

28) The amount of energy absorbed by a unit mass of the irradiated substance is called
a) exposure dose
b) equivalent dose
c) dose of radiation
d) dose rate.

29) The magnitude of the dose related to time is called
a) exposure dose
b) equivalent dose
c) dose of radiation
d) dose rate.

30) Activity of the radioactive drug over time
a) does not change
b) increases
c) decreases.

31) The activity of radioactive decay is the number of particles or gamma-photons
a) falling on matter per second
b) absorbed by the substance per second
c) escaping from the substance per secon

32) The gamma topograph is used in medicine for
a) irradiation of individual organs with gamma rays
b) determination of the radioactive background of the environment
c) determining the location and activity of radionuclides in the body
d) obtaining characteristic X-ray radiation

33) Radioactive isotopes are used in medicine for
a) determining visual acuity
b) diagnosing diseases of individual organs
c) obtaining characteristic X-ray radiation
d) determining the location and activity of radionuclides in the body

34) Radiolysis of a substance is a chemical transformation of a substance caused by the action of quanta
a) visible light
b) ultraviolet radiation

c) ionizing radiation
d) infrared radiation

35) The equivalent dose of radioactive radiation is the product
a) absorbed dose on the quality factor of radioactive radiation
b) exposure dose per conversion factor
c) the absorbed dose rate for the time during which the absorption occurre

36) The device used to measure doses of ionizing radiation is called
a) tomograph
b) radiometer
c) computer tomograph.

37) The radiometer measures
a) exposure dose to radioactive radiation
b) X-ray power
c) radioactive isotope activity
d) equivalent dose of radioactive radiation.

38) Ionizing radiation, the quality factor of which is of greatest importance is
a) gamma radiation
b) X-rays
c) alpha radiation
d) beta radiation.

39) The disintegration constant of the drug is 50 s-1, then the average lifetime of this drug in seconds is
a) one hundred
b) ten
c) 0.2
d) 0.02.

40) The unit of measurement of the natural background radiation is
a) rem/year
b) μR/h
c) Gy/s
d) Cl/kg.

41) The average lifetime of a radioactive nucleus is the time during which the number of radioactive nuclei
a) decreases by half

b) decreases e times
c) increases by e times
d) doubles.

42) The absorbed dose of radiation in Gy for a body weighing 100 kg and the received energy of ionizing radiation of 5 J will be

a) 0.05
b) 50
c) one hundred
d) 150.

43) Quality factor for alpha radiation K = 20. The absorbed dose from this radiation is 0.2 rad, then the equivalent dose in rem is

a) 0.1
b) 4
c) 40
d) 100.

44) Second product of a nuclear reaction ${}^{14}_{7}\mathrm{N}+{}^{4}_{2}He\rightarrow{}^{17}_{5}O+X$

a) represents
b) proton
c) alpha particle
d) neutron
e) electron.

45) The half-life of the nuclei of atoms of some substance is 15 s. It means that

a) in 15 s the atomic number of each atom is halved
b) one atom decays in 15 s
c) half of the initially available atoms decays in 15 s
d) all atoms decay in 30 s.

46) Ionizing radiation is

a) ultrasound
b) radio waves
c) gamma radiation
d) infrared radiation.

TEST: REFRACTION

1) The absolute refractive index of a substance shows how many times the speed of light in a vacuum
   a) more than in the environment
   b) less than in the environment.

2) When passing from an optically denser medium to an optically less dense medium, the light beam is deflected
   a) to the perpendicular restored to the point of incidence of the beam
   b) from the perpendicular restored to the point of incidence of the beam
   c) does not deviate.

3) A ray of light does not experience refraction at the interface between two media if the angle of incidence is
   a) 90°
   b) 45°
   c) 0°.

4) Fiber optics is based on the phenomenon
   a) polarization of light
   b) light diffraction
   c) total internal reflection of light
   d) light scattering.

5) What is the refractive index of a medium in which light travels at a speed of 100,000 km/s?
   a) 1.5
   b) 2
   c) 0.67.

6) At what speed do electromagnetic waves propagate in cedar oil if its refractive index is 2.5?
   a) $2 \cdot 10^8$ m/s
   b) $3 \cdot 10^8$ m/s
   c) $1.2 \cdot 10^8$ m/s

7) The wavelength of violet light in a vacuum is 420 nm. Determine the wavelength of this light in topaz, which has a refractive index of 1.63.
   a) 652 nm
   b) 258 nm
   c) 345 nm.

8) The water is illuminated with red light. What kind of light does a person see when they open their eyes underwater?
   a) red
   b) white
   c) sees nothing.

9) The phenomenon of a change in the direction and speed of propagation of a light wave in an inhomogeneous medium is called
   a) light absorption
   b) refraction of light
   c) dispersion of light.

10) The principle of operation of medical refractometers is based on measurement
   a) the energy of a light wave when it propagates in matter
   b) wavelength of light transmitted through matter
   c) limiting angle of light refraction
   d) the limiting angle of total light reflection.

11) Flexible light guides in medical devices are used to
   a) warming up internal organs
   b) transmission of light fluxes for illumination of internal organs
   c) transmission of images of internal organs.

12) What parameters of a light wave change when it passes from one medium to another?
   a) wavelength
   b) frequency
   c) speed of light

TEST: ABSOPTION OF LIGHT & PEC (Photo Electrical Colorimeter)

1) Light absorption is called

   a) the phenomenon of a change in the direction of propagation of a light wave in an inhomogeneous medium
   b) the phenomenon of energy loss by a light beam passing through a substance, due to its transformation into various forms of internal energy

c) the phenomenon of the dependence of the phase speed of light on frequency.

2) The transmittance of a substance can be determined by the formula

a) $D = \log(1/\tau)$

b) $\tau = \frac{I_d}{I_o}$

c) $\tau = RC$

d) $D = \chi CL$.

3) The optical density of the solution is 3. Then the transmittance is

a) 1

b) 0.1

c) 0.01

d) 0.001.

4) When light passes through the solution layer, 2/3 of the initial light energy is absorbed. Determine the transmittance of the solution.

a) 1/3

b) 2/3

c) 1

d) 3/2.

5) If the concentration of the solution is increased by 3 times, then its optical density

a) will increase 3 times

b) will decrease by 3 times

c) Will not change.

6) The transmittance of the solution is 0.1. Then the optical density of the solution is

a) 1

b) 2

c) 3.

7) In medicine, concentration colorimetry is used to determine the concentration

a) substances in clear solutions

b) substances in colored solutions

c) optically active substances.

8) The ratio of the intensity of the incident light to the intensity of the transmitted light $I_o/I_d = e$, then the absorption coefficient is

a) the thickness of the layer of matter through which the light passed

b) the reciprocal of the thickness of the layer through which the light passed

9) Light scattering is called

a)the phenomenon of changing the direction of propagation of a light wave in an inhomogeneous medium

b) the phenomenon of energy loss by a light beam passing through a substance, due to its transformation into various forms of internal energy

c)the phenomenon of the dependence of the phase speed of light on frequency.

10) Nephelometers are used in medicine

a) to obtain information on the parameters characterizing the intermolecular interaction in the investigated solutions

b) for determining the size of macromolecules

c) for determining the transparency of solutions

d) to determine the concentration of optically active substances.

11) Photocolorimetric analysis is used to determine

a) the concentration of erythrocytes and hemoglobin in the blood

b) the concentration of proteins in biological materials

c) the degree of polarization of the transmitted light.

12) The Bouguer-Lambert-Beer law is expressed by the formulas

a) $I = Io \cdot e^{-\chi_c d}$

b) $I = Io \cdot 10^{-\chi_c d}$

c) $I \sim 1/\lambda^2$

d) $D = \log (1/\tau)$.

13) The optical density of the solution is determined by the formulas

a) D = log (1/τ)

b) $\tau = \frac{I_d}{I_o}$

c) τ = RC

d) D = χCL.

14) The intensity of the scattered light is determined by the law _1____, and the intensity of the absorbed light by law ___2___.

a) Rayleigh

b) Stokes

c) Bouguer.

15) Scattering in turbid media is described by _1_, and molecular scattering by _2_.

a) Bouguer's law

b) Rayleigh's law

c) Tyndall's law

d) Malus's law.

16) The absorption of light in solids is described by the law ___1_, and in solutions by the law ___2__.

a) Rayleigh

b) Stokes

c) Bouguer -Lambert-Beer

d) Bouguer.

17) If the light transmittance is zero, then the intensity of the transmitted light through the substances is _____.

a) incident light intensity

b) zero.

18) The physical characteristics of the solution and the value

Optical density of solution varies within _____1

The clarity of the solution will change with in _____2

a) from 0 to ∞

b) from 0 to 1

TEST: ULTRASOUND

1) Ultrasound is mechanical waves with a frequency
a) below 16 Hz
b) 16 to 20,000 Hz
C) over 20,000 Hz

2) Infrasound is mechanical waves with a frequency
a) below 16 Hz
b) from 16 to 20,000 Hz
c) over 20,000 Hz.

3) The direct piezoeffect is
a) change in the linear dimensions of a piezoelectric under the action of an alternating electric field
b) lengthening or shortening of a ferromagnetic core by a magnetic field
c) the formation of a potential difference during deformation of a piezoelectric.

4) The reverse piezoelectric effect is
a) change in the linear dimensions of a piezoelectric under the action of an alternating electric field
b) lengthening or shortening of a ferromagnetic core by a magnetic field
C) the formation of a potential difference during deformation of a piezoelectric.

5) Magnetostriction is
a) change in the linear dimensions of the piezoelectric under the action of an alternating electric field
b) lengthening or shortening of a ferromagnetic core under the influence of a magnetic field
c) the formation of a potential difference during deformation of the piezoelectric.

6) Low frequency ultrasound can be obtained by

a) magnetostriction
b) reverse piezoelectric effect
c) direct piezoelectric effect.

7) High frequency ultrasound can be obtained using
a) magnetostriction
b) reverse piezoelectric effect
c) direct piezoelectric effect.

8) The speed of propagation of ultrasound in the medium depends on
a) layer thickness
b) medium density
c) propagation time.

9) Ultrasound absorption occurs according to the law
a) $I = k\lg\frac{I_x}{I_0}$
b) $I = \frac{p^2}{2\rho\upsilon}$
c) $I_d = I_0 e^{-\mu d}$

10) Characteristic impedance is determined by the formula
a) $\omega = \rho v$
b) $X = 8\eta l\pi r^4$
c) $\omega_p = 1\sqrt{LC}$
d) $R = UI$

11) The echolocation method is based on
a) ultrasound absorption
b) reflection of ultrasonic waves at the interface between media with different acoustic density.

12) With an echoencephaloscope, you can
a) to measure the size of the heart in dynamics
b) determine the size of the eye media
c) identify tumors and swelling of the brain.

13) Welding damaged or transplanted tissue using ultrasound is called
a) ultrasound osteosynthesis
b) ultrasonic echolocation
c) ultrasonic flow measurement.

14) Ultrasound propagation speed in water 1500 m/s, the distance between the input and the reflected pulse on the echogram L_0 = 30 mm, sample thickness L = 40 mm. Then the speed of ultrasound in the substance is
a) 1300 m/s
b) 2000 m/s
c) 3000 m/s
d) 3750 m/s.

15) The speed of propagation of ultrasound in water is 1500 m/s, the distance between the input and reflected impulses on the echogram L_0 = 10 mm, sample thickness L = 30 mm. Then the speed of ultrasound in the substance is
a) 1300 m/s
b) 2100 m/s
c) 4500 m/s
D) 3750 m/s.

16) Ultrasound propagation speed in water 1500 m/s, the distance between the input and reflected impulses on the echogram L_0 = 15 mm, sample thickness L = 60 mm. Then the speed of ultrasound in the substance is
a) 1300 m/s
b) 2100 m/s
c) 6000 m/s
D) 3750 m/s.

17) Ultrasound propagation speed in water 1500 m/s, the distance between the input and reflected impulses on the echogram L_0 = 20 mm, sample thickness L = 32 mm. Then the speed of ultrasound in the substance is
a) 1000 m/s
b) 1200 m/s
c) 2400 m/s
d) 3000 m/s

18) Ultrasound propagation speed in water 1500 m/s, the distance between the input and reflected impulses on the echogram L_0 = 25 mm, sample thickness L = 30 mm. Then the speed of ultrasound in the substance is
a) 1200 m/s
b) 2100 m/s
c) 1800 m/s
d) 3000 m/s

19) When ultrasound passed through the substance, its intensity decreased by a factor of "e" ($\mu = 0.1$ мм$^{-1}$), then the thickness of the substance layer
a) 20 mm
b) 50 mm
c) 10 mm
d) 200 mm.

20) When ultrasound passed through a substance, its intensity decreased by "E" times ($\mu = 0.5$ мм$^{-1}$), then the thickness of the substance layer
a) 10 mm
b) 2 mm
c) 50 mm
d) 100 mm.

21) When ultrasound passed through a substance, its intensity decreased by "E" times ($\mu = 0.8 mm^{-1}$), then the thickness of the substance layer
a) 10 mm
b) 20 mm
c) 1,25 mm
d) 25 mm

22) When ultrasound passed through a substance, its intensity decreased by "E" times ($\mu = 0.04\ mm^{-1}$), then the thickness of the substance layer
a) 10 mm
b) 25 mm
c) 50 mm
d) 100 mm

23) When ultrasound passed through a substance, its intensity decreased by "E" times ($\mu = 0.002\ mm^{-1}$), then the thickness of the substance layer
a) 100 mm
b) 250 mm
c) 500 mm
d) 200 mm.

24) The speed of propagation of ultrasound in the medium depends on
a) layer thickness
b) medium density
c) environmental properties
d) propagation time.

25) Ultrasound can be obtained by
a) magnetostriction
b) reverse piezoelectric effect
c) direct piezoelectric effect.

26) Ultrasound diagnostic methods allow to determine
a) hearing acuity
b) blood flow velocity
c) the depth and size of tumors
d) concentration of colored solutions
e) refraction of rays

27) Ultrasonic methods are used in
a) physiotherapy
b) diagnostics
c) fluoroscopy
d) tomography

TEST: ELECTOPHORESIS

1) Electrophoresis is a directed movement of charged particles under the influence of an external

a) magnetic field

b) electric field

c) gravitational fiel

2) The introduction of medicinal substances into the body through the skin and mucous membranes is carried out by the method:

a) microwave therapy

b) percussion

c) diathermotomy

d) therapeutic electrophoresis

3) In medical electrophoresis, in contrast to galvanization, they use:

a) oxygen

b) medicinal substances

c) saline.

4) Cations of medicinal substances in therapeutic electrophoresis are introduced from:

a) cathode

b) cathode and anode

c) anode.

5) Mobility of ions with an increase in solution viscosity by 2 time

6) does not change

a) decreases by 2 times

b) increases by 2 times

c) decreases 4 times

d) increases 8 times.

7) The mobility of ions with increasing temperature of the buffer solution in the electrophoretic bath:

a) increases

b) does not change

c) decreases.

8) The mobility of ions with a decrease in the voltage on the electrodes of the electrophoretic bath by 5 time

a) decreases 10 times

b) increases 10 times

c) decreases by 5 times?

d) increases by 5 times

e) does not change.

9) Mobility of ions with an increase in the duration of the electrophoretic process by 3 time

a) does not change

b) increases 3 times

c) increases by 9 times.

10) The composition of blood proteins can be determined by

a) electrocardiogram

b) electrophoregram

c) electroencephalogram

d) electromyogram.

11) Ions move during electrophoresi

a) in arbitrary directions

b) along the lines of force of the electric field

c) around the equilibrium position.

12) Electrophoresis is used in medicine for:

a) galvanizing "collar area"

b) treatment of the central nervous system

c) determining the composition of proteins

d) treatment of the peripheral nervous system.

13) Fraction is a group of molecules or ions that have the same:

a) weight

b) charge

c) size

14) During electrophoresis of blood serum, ___1___ is released first, then __2__, 3___, and finally _____4____.

a) albumin

b) α -globulin

c) β -globulin

d) γ -globulin.

15) The name of the physical quantity and its formula

1) mobility	a) $b = \frac{X * L}{t * U}$
2) ion speed	b) $v = \frac{X}{t}$
3) electric field strength	a) $E = \frac{U}{L}$

TEST: MATHEMATICS

1) The differential of the product of two functions d(u·v) is equal to:
   a) vdu + udv
   b) du + dv
   c) du·dv
   d) udu + vdv

2) The product of the derivative of the function on the differential of the argument is called:
   a) differential of the function
   b) the integral of a function
   c) derivative of the function
   d) the integral sum

3) The increment Δy of the function y= - x^2 when changing the argument from x1=1 to x2=3 is
   a) -8
   b) 8
   c) -13

d) -15

4) The law of motion of a material point has the form: $x(t)=7+5t^2$. Then the acceleration of the point at t=3 is equal to:

a) 3
b) 18
c) 30
d) 27

5) The limit of the ratio of the function increment to the argument increment, when the latter tends to zero, is called:

a) derivative of the function
b) the function differential
c) the integral of a function
d) the limit of integral sums

6) The second derivative of $y=2x^3+1x$ i

a) 12x
b) $3x^4+2$
c) $9x^2$
d) 12

7) The independent variable x is called

a) Argument
b) function
c) definition area
d) indefinite integral
e) value area

8) The dependent variable y is called

a) function
b) Argument
c) definition area
d) value area

9) Main period of the function y = ctgx

a) π
b) 3π
c) 4π
d) 2π

10) Function is called ... if for any x1 and x2 from the condition x2 > x1 follows f(x2)< f (x1)

a) decreasing
b) increasing

c) monotonous bounded

11) Choose the correct answer: Function definition area y=2a/x

a) $(-\infty; 0) \cap (0; +\infty)$
b) $(-\infty; +\infty)$
c) $[0; +\infty)$
d) $(-\infty; 0]$

12) The Function is called .... if for any two values of the argument x1 and x2, the condition x2 > x1 follows f (x2) > f (x1)

a) increasing
b) decreasing
c) monotonous bounded

13) The set of antiderivatives F(x) + C for a given function f (x) is called:

a) Indefinite integral
b) Definite integral
c) Derivative of the function
d) The set of derivatives of the function

14) The geometric meaning of the derivative is that the derivative is

a) Tangent of the angle
b) The rate of change of the function
c) area of a curved trapezoid
d) triangular matrix

15) A function is called complex if:

a) its argument is a dependent variable
b) it depends on several variables
c) its argument is an independent variable
d) it consists of the sum of several functions

16) The partial derivative of the function $z=2u^2+3v^3$ with respect to the argument u is

a) 4u
b) $4u+9v^2$
c) $9v^2$
d) $4u+3v^3$

17) The partial derivative of the function $z=u^2+5v^3$ with respect to the argument v is

a) $15v^2$
b) $2u+15v^2$
c) 2u
d) $2u+15v^3$

18) The function F(x) is called the integral of the function f(x) if:

a) $F'(x) = f(x)$
b) $f'(x) = F(x)$
c) $f'(x)dx = F(x)$
d) $f(x) = F(x)$

19) The second-order derivative y=cos2x is

a) 4cos4x
b) 4sinx
c) 4cos4x
d) -4sin4x

20) The derivative of the function y = a + x is equal to

a) a
b) X+a
c) $Ax^2/2$
d) a/x

21) The derivative of the function $y = a^{2x}$ is

a) $a^{2x}\ln a^2$
b) $2a^x a^{-1}$
c) 2/x
d) 2x+a

22) The derivative of the function y = ln (x-1) is

a) 1/(x-1)
b) $a^x a^{-1}$
c) $a^x \ln a$
d) x+1

23) The derivative of the function y=sin (2x+1) is

a) 2cos (2x+1)
b) –2sin 2x
c) –sin 2x
d) sin 2x

24) The Set of antiderivatives F (x) + C for a given function f(x) is called:

a) The indefinite integral
b) The derivative
c) the differential
d) the definite integral

25) The approximate value of the function at a given point $f(x_0+\Delta x)$ can be calculated by the formula:

a) $f(x_0)+ y'\Delta x$

b) $\Delta y+dx$
c) $y'(x_0)\Delta y$
d) $y'(x_0)\Delta x$

26) The increment Δy of the function $y= 2x^2$ when changing the argument from x1=-2 to x2=3 is
a) -5
b) 5
c) 10
d) -25

27) Using a Definite integral, it is impossible to calculate:
a) The current velocity
b) the area of a curved trapezoid
c) the work of a variable force
d) the average value of the function on the interval

28) The total differential dz of the function $z=u^2+2v^3$ i
a) $2udu +6v^2 dv$
b) $2u\times9v^2 du dv$
c) $u^2\times du +3v^3 dv$

29) A definite integral is
a) The limit of the integral sum
b) A family of antiderivatives that differ by a constant value
c) The rate of change of function

30) The area of the figure enclosed between the curve $y = x^2$, the axis Ox and the straight lines x = 1 and x = 0 i
a) 1/3
b) 4
c) 8
d) 4/3

31) The area of the figure enclosed between the curve $y = X^3$, the axis Ox and the straight lines x = -1 and x = 1 is equal to:
a) 1/4
b) 1/2
c) 0
d) 2

32) An independent variable x is called an
a) argument
b) function definition
c) area value area

33) On the interval of positivity of the derivative the function
   a) increases
   b) decreases
   c) increases and decreases both does not change the sign

34) On the negative interval of the derivative the function
   a) decreases
   b) increases
   c) and increases and decreases
   d) without changing the sign

35) The law of motion of a material point has the form: $x(t)=9+3t^2$. Then the velocity of the point at t=1 is equal to
   a) 10
   b) 6
   c) 12
   d) 17

36) The integral $\int 2xdx$ is equal to:
   a) x^2+C
   b) 2
   c) $1/2x^2$
   d) 1/2x+C

37) If the limits of integration in a certain integral coincide, then the integral is equal to:
   a) 0
   b) 1
   c) integrand function
   d) infinity

38) The differential of the function $y = a^{x+1}$ is equal to:
   a) $a^{x+1}\ln a \cdot dx$
   b) $a^{x-1}a^{-1}dx$
   c) $(1/x)dx$
   d) $\cos x \cdot dx$

39) The differential of the function y = 3ln x i
   a) (3/x)dx
   b) $nx^{n-1}dx$
   c) $a^x \ln a \cdot dx$
   d) $\cos x \cdot dx$

40) The differential of the product of two functions d(uv) i
   a) vdu + udv

b) du + dv
c) udu + vdv
d) du·dv

41) The differential of the sum of two functions d(u + v) i
a) du + dv
b) vdu + udv
c) udu + vdv
d) du·dv

42) The second derivative of $y=2x^4+1x^2$ is
a) 4x
b) $24x^2+2$
c) 40x+1
d) $24x^2+1$

43) An equation that relates an independent variable, function, and its derivatives or differentials is called:
a) differential
b) analytical
c) algebraic
d) linear

44) A differential equation contain
a) An Argument, a function, and derivatives of various orders
b) Only the function and the argument
c) Only the derivative and argument
d) Only the antiderivative

45) The order of a differential equation is determined by the order of…
a) the highest derivative
b) the argument function
c) of the lowest derivative

46) The General solution of a differential equation is the function:
a) y=F(x)+C
b) y=F'(x)
c) y=F'(x)+C

47) At the critical point that separates the increasing interval from the decreasing interval, the function has
a) Maximum
b) Minimum
c) Inflection
d) Extremum

48) At the critical point divides the interval of decrease and the interval of increase, the function has
   a) Minimum
   b) Maximum
   c) Inflection
   d) Extremum

49) An equation of the form $\frac{dy}{dx}=g(x)h(y)$ is called a differential equation:
   a) with separable variables
   b) with unseparated variables
   c) homogeneous
   d) of the second order

50) The solution of a differential equation is a function whose substitution in the original equation:
   a) it turns into an identity
   b) the right part is zero
   c) the left part is zero

51) The particular solution of a differential equation i
   a) one function
   b) set of functions that differ by a constant
   c) derivative of the function
   d) differential of the function

52) The indefinite integral of a function is.
   a) set of all antiderivatives
   b) one antiderivative function
   c) set of all derivatives of the function
   d) set of all differentials of the function
   e) area of a curved trapezoid bounded by the graph of the function, the abscissa axis and two lines

53) Note the incorrect statement:
   a) $\int dF(x)=F(x)+C$, C – const
   b) $(\int f(x)\,dx)' = \int f(x)dx$
   c) $\int (f1(x)+f2(x))dx = \int f1(x)dx+\int f2(x)dx$

54) The derivative of the product $(x+3)e^x$ is equal to
   a) $e^x(x+4)$
   b) e^x
   c) $-e^x(x+1)$
   d) $ex^{-1}(e+2x+x^2)$

55) Note the correct statement:

a) The function $F(x)=x^3/3+6.5$ is antiderivative for $f(x)=x^2$

b) The function $F(x)= x^2$ is antiderivative for $f(x)= x^3/3$

c) The function $F(x)=2x$ is antiderivative for $f(x)=x^2$

56) The function F(x) is called an antiderivative function for the function f(x) on the interval...

a) if at each point x of this interval F '(x) = f(x)

b) at least one point x in this interval F '(x) = f(x)

c) at least one point x in this interval f '(x) = F(x)

d) if at each point x of this interval f'(x) = F(x)

57) The integral sum is...

a) the sum of the products of the lengths of the segments of integration on the function values at the points of these segments

b) the limit of the sum of the products of the lengths of the segments of integration on the function values at the points of these segments

c) the Newton-Leibniz's formula

d) indefinite integral

e) definite integral

58) Note the correct statement:

a) A constant multiplier can be taken as the sign of a certain integral

b) all the properties of a certain integral are similar to the properties of an indefinite integral

c) an indefinite integral is a definite number

59) Note the incorrect statement:

a) if F(x) is some antiderivative for f(x), then all functions of the form C*F(x)- are antiderivatives for f(x) too

b) if F(x) is some antiderivative for f(x), then all functions of the form F(x) + C, where C is a constant, are antiderivatives for f(x)

c) the integral of the algebraic sum of two functions is equal to the sum of the integrals of these functions

60) Find the derivative of the function $y = \sqrt[3]{x} \cdot \ln x$:

a) $y' = \frac{1}{3\sqrt[3]{x^2}} \cdot \ln x + \sqrt[3]{x^2}$

b) $y' = \frac{\sqrt[3]{x^2}}{3} \cdot \ln x + \frac{1}{\sqrt[3]{x^2}}$

c) $y' = \frac{1}{3\sqrt[3]{x^2}} \cdot \frac{1}{x}$

d) $y' = \frac{1}{3\sqrt[3]{x^2}} \cdot \ln x + \frac{1}{\sqrt[3]{x^2}}$ г)

e) $y' = -\frac{xSinx + 6Cosx}{x^2}$

61) Calculate the indefinite integral $\int \frac{10x^5 + 3x^3 + 1}{x} dx$:

a) $2x^5 + x^3 + \ln x + C$

b) $2x^5 + x^3 + \ln x$

c) $\frac{50x^4 + 9x^2 + x}{x}$

d) no solution

62) Find the derivative of a function $y = 2 \cdot Cosx + 4 \cdot \ln x + \frac{x^2}{4} - 3e^x$:

a) $y' = -2Sinx + \frac{4}{x} + \frac{x}{2} - 3e^x$

b) $y' = 2Sinx + \frac{4}{x} + \frac{x}{2} + 3e^x$

c) $y' = -2Sinx + \frac{4}{x} + \frac{x^3}{12} - 3e^x$

d) $y' = -2Sinx - \frac{4}{x} + \frac{x}{2} - 3e^x + C$

63) Calculate the indefinite integral $\int \left(\frac{1}{Cos^2 x} + 3e^x + \frac{2}{x} \right) dx$:

a) $tgx + 3e^x + 2\ln x + C$

b) нет решения

c) $-tgx + 3e^x + 2\ln x + C$

d) $Ctgx + 3e^x + 2\ln x + C$

64) Calculate the definite integral $\int_1^e \frac{5}{x} dx$:

a) $5 \cdot (\ln e - 1)$

b) 5

c) $\frac{5}{e} - 5$

d) $\frac{5(e-1)}{e}$

65) A first-order differential equation is an equation of the form

a) $F(x,y,y')=0$

b) $F(x,y',y'')=0$

c) $ax+b=0$

66) Separating the variables in the differential equation $e^x \ln y \cdot dx + xy \cdot dy = 0$ will result in the form

a) $\frac{e^x dx}{x} = -\frac{ydy}{\ln y}$

b) $\frac{e^x dx}{x} = -\frac{\ln y dy}{y}$

c) $\frac{e^x dx}{x} = \frac{ydy}{\ln y}$

d) $\frac{e^x \ln y dx}{xy} = -dy$

67) The solution of the differential equation y"+ 81y = 0 is the function…

a) $y = \cos 9x$

b) $y = x^9$

c) $y = 9x$

68) Example of a 2nd-order differential equation:

a) $y'' - 3y = 0$

b) $dy = 3dx$

c) $y' = 4x$

d) $y^2 = 2x$

ANSWERS

TEST: AUDIOMETRY

1	b
2	b
3	d
4	a
5	a
6	c
7	a
8	c
9	d
10	b
11	b
12	abd
13	ace
14	bcd
15	ab
16	c
17	b
18	c

TEST: VISCOSITY

1	d
2	a
3	c
4	b
5	a
6	a
7	c
8	b
9	b
10	b
11	b
12	a

13	b
14	b
15	ab
16	abcd
17	bc
18	abcd
19	abcd
20	a
21	a
22	b
23	a
24	c

TEST: SENSORS

1	a
2	d
3	c
4	b
5	a
6	a
7	c
8	b
9	b
10	b
11	b
12	a
13	b
14	b
15	c
16	c
17	b
18	a
19	d

TEST: UHF

1	d
2	b
3	b
4	c
5	a
6	d
7	b
8	a
9	b
10	a
11	d
12	a
13	d
14	c
15	a
16	c
17	a
18	cd
19	cde
20	ab

TEST: ECG

1	a
2	a
3	b
4	a
5	c
6	a
7	b
8	a
9	c
10	a

11	d
12	a
13	c
14	a
15	a
16	c
17	c
18	bc
19	ac
20	aceg

TEST: MECHANICAL WAVE

1	a
2	b
3	a
4	d
5	c
6	b
7	bc
8	bc
9	a
10	b
11	a
12	b
13	c
14	a
15	a
16	d
17	b
18	c
19	c
20	b
21	c
22	d
23	c

24	b
25	b
26	a
27	b
28	a
29	a
30	c
31	a
32	c
33	d
34	c
35	c
36	c
37	b
38	d
39	c
40	d
41	a
42	d
43	b

TEST: MECHANICAL OSCILLATION

1	a
2	a
3	a
4	a
5	a
6	a
7	a
8	a
9	a
10	a
11	a
12	a
13	a
14	a

15	a
16	b
17	b
18	a
19	a
20	a
21	a
22	a
23	a
24	a
25	a
26	a
27	b

TEST: SPRING PENDULUM

1	a
2	a
3	b
4	a
5	c
6	d
7	b
8	d

TEST: RESONANCE IN ELECTRICAL CIRCUIT

1	b
2	d
3	a
4	a
5	a
6	b
7	a
8	b

9	c

TEST: MECHANICAL RESONANCE

1	d
2	b
3	a
4	a
5	e
6	a
7	a
8	c
9	1c2b3a
10	a
11	c
12	c
13	b

TEST: POLARIZATION

1	a
2	a
3	c
4	a
5	c
6	a
7	b
8	d
9	b
10	a
11	d
12	a
13	a
14	b
15	a

16	c
17	1c2b
18	c
19	1a2e
20	b
21	abc
22	ac
23	1c2a3b

TEST: X-RAY AND RADIOACTIVITY

1	b
2	b
3	a
4	c
5	b
6	b
7	c
8	b
9	c
10	c
11	b
12	a
13	c
14	b
15	c
16	c
17	a
18	b
19	a
20	c
21	b
22	a
23	c
24	b
25	a
26	c

27	c
28	c
29	d
30	c
31	c
32	c
33	b
34	c
35	a
36	b
37	c
38	c
39	d
40	b
41	b
42	a
43	b
44	b
45	c
46	c

TEST: REFRACTION

1	a
2	b
3	c
4	c
5	b
6	c
7	b
8	a
9	b
10	cd
11	cd
12	ac

TESC: PEC

1	b
2	b
3	d
4	a
5	a
6	a
7	b
8	a
9	a
10	abc
11	ab
12	ab
13	ad
14	1a2c
15	1c2b
16	1d2c
17	a
18	1a2b

TEST: ULTRASOUND

1	c
2	a
3	c
4	a
5	a
6	a
7	b
8	b
9	c
10	a
11	b
12	c

13	a
14	b
15	c
16	c
17	c
18	c
19	c
20	b
21	c
22	b
23	c
24	ab
25	ab
26	bc
27	ab

TEST: MATHEMATICS

1	a
2	a
3	b
4	c
5	a
6	a
7	a
8	a
9	a
10	a
11	a
12	a
13	a
14	a
15	a
16	a
17	a
18	a
19	a
20	a

21	a
22	a
23	a
24	a
25	a
26	c
27	a
28	a
29	a
30	a
31	c
32	a
33	a
34	a
35	b
36	a
37	a
38	a
39	a
40	a
41	a
42	b
43	a
44	a
45	a
46	a
47	a
48	a
49	a
50	a
51	a
52	a
53	a
54	a
55	a
56	a
57	b

58	a
59	a
60	d
61	a
62	a
63	a
64	b
65	a
66	a
67	a
68	a