I. Viscosity

1. Which is the expressions for determination the coefficient of viscosity of the liquid by Stokes method?
2. Poiseuille's law to the laminar flow of liquid through the capillary is expressed by the equation:
3. Which of the units below are not attributed to the viscosity?
4. At movement of a spherical body through a liquid the resistance force is:
5. Which of the following mathematical expressions are not written correctly?
6. At uniform movement of the ball in the liquid occurs:
7. The present forces between molecules of the fluids are:
8. The viscosity of the fluid is:
9. Internal fluid friction expressed by Newton's formula is:
10. Which of the following formulas does not refer to the viscosity phenomenon of the liquid?
11. The viscosity of a liquid has its origin in:
12. Which of the equations below represent Newton's formula for viscosity?
13. Which is the equation of Poiseuille?
14. The coefficient of viscosity of a liquid:
15. Which is the relationship for calculating the viscosity of a liquid in relation to the water, by the method of Ostwald:
16. Unit of measure in S.I. for the viscosity is:
17. The relative method for determining of the viscosity is done using:
18. The direct method for determining of the viscosity is done using:
19. The direct method of determining the viscosity can be applied for:
20. An ideal liquid would be that:
21. An real liquid would be that:
22. Absolute viscosity coefficient is numerically equal to the friction force which is exerted by a mono-molecular layer on another mono-molecular layer from inside of the liquid, when:
23. If η is independent of $\frac{\Delta v}{\Delta x}$ is said that the fluid is:
24. If η is dependent of $\frac{\Delta v}{\Delta x}$ is said that the fluid is:
25. Which of the equations below represent uniform movement (v-constant), in a liquid, a sphere-shaped particles:
26. For relatively low speed, of a spherical body which is moving in a fluid, according to Stokes's law occurs:
27. Only for spherical objects or particles that moves at a constant speed through a fluid, Stokes's law applies, which reads as follows:
28. The forces acting on the spherical body, which moves in a fluid, are:
29. Blood viscosity depends on:
30. The increase of blood viscosity occurs in:
31. The decrease of blood viscosity occurs in:
32. It describes the physiological variations of whole blood viscosity:

33. Proteins in urine lead to:
34. Cohesive forces between molecules fluids are:
35. In real liquids and gases intermolecular attractive forces can:
36. Absence of proteins in urine lead to:
37. From the formula for determining of viscosity by the relative method $\eta = \eta_0 \frac{\rho t}{\rho_0 t_0}$, ρ represents:
38. From the formula for determining of viscosity by the relative method $\eta = \eta_0 \frac{\rho t}{\rho_0 t_0}$, ρ_0 represents:
39. From the formula for determining of viscosity by the relative method $\eta = \eta_0 \frac{\rho t}{\rho_0 t_0}$, η_0 represents:
40. From the formula for determining of viscosity by the relative method $\eta = \eta_0 \frac{\rho t}{\rho_0 t_0}$, η represents:
41. In the case of liquids, is laminar flow if: (Re- Reynolds number):

II. Ultrasound

1. The ultrasound transducer represents:

2. Which are the principal components of the ultrasonic magnetostrictive transducer?

3. Which of the listed physical effects are <u>not</u> characteristic for ultrasound?

a. Optical effect
b. Thermal effect
c. Photoelectric effect
d. Electrical effect

4. Which of the listed mechanical effects are characteristic for ultrasound?

a. Cavitation
b. Diffraction
c. Elongation
d. Absorption

5. Which of the listed mechanical effects are <u>not</u> characteristic for ultrasound?

a. Cavitation
b. Elongation
c. Absorption
d. Diffusion

6. The effect that the piezoelectric transducer is using is:

7. The magnetostrictive transducer is based on:

a. Changing the size of a ferromagnetic body placed in an external magnetic field
b. Changing the size of a ferromagnetic body when applying an alternating current

c. Transforming electricity into mechanical energy
d. Transforming mechanical energy into electricity

8. Ultrasounds are:

9. Ultrasounds are:
    a. Transversal mechanical waves
    b. Longitudinal mechanical waves
    c. Transversal and longitudinal mechanical waves
    d. None of the variants mentioned above is correct

10. Sound waves are :

11. Classifications of sounds are:
    a. Infrasound with frequency less than 20Hz
    b. Acoustic sound with frequency ranging between 20Hz si 200kHz
    c. Ultrasound with frequency bigger than 200kHz
    d. All variants mentioned above are correct

12. Ultrasounds are mechanical waves that propagates in:

13. The inverse piezoelectric effect is:

14. The direct piezoelectric effect is:

15. Phenomena that occur at the ultrasound propagation are:
    a. Reflection
    b. Interference
    c. Diffraction
    d. Absorption

16. Surface treated with ultrasound should be covered with a layer of oil or grease because:

17. Cavitation, ultrasonic mechanical phenomenon, consist in:

18. The thermal effect of ultrasound consist in:

19. The electrical effect of ultrasound consist in:
    a. Generating a photocurrent at the interaction of ultrasound with biological tissue
    b. The appearance of an direct current at the interaction of ultrasound with biological tissue
    c. The appearance of an alternating current in colloidal systems
    d. Displacement of electric double layer on the surface of separation of the phases

20. Biological effects of ultrasound depend on:

21. Select the correct statements that refer to the biological effects of ultrasound:
    a. Ultrasounds are classified into two groups: low intensity and high intensity
    b. At low intensities of ultrasound, tissue morphology is not affected, only functional

c. At high intensities of ultrasound, irreversible structural changes in tissue are produced
d. All statements are correct

22. The component parts of the ultrasonic inhaler include:

23. Ultrasonic wave nebulizer is used to:

24. Doppler effect is:

25. A Doppler ultrasound is:

26. In order to determine the flow rate of the blood by the method based on the ultrasonic Doppler effect:
    a. The angle between the direction of the blood flow and the ultrasound beam direction must be between 60^0 and 90^0
    b. The angle between the direction of the blood flow and the ultrasound beam direction must be 90^0
    c. The angle between the direction of the blood flow and the ultrasound beam direction must be between 0^0 and 60^0
    d. None of the variants mentioned above is correct

27. During the investigation of blood flow through the vein based on the Doppler effect, you have positioned the transducer on the skin surface at an angle of 900. What you will notice?

28. The Doppler formula for ultrasound is:

29. Which of the following expressions are <u>not</u> correct for Doppler effect?
    a. $\Delta f = 2f\frac{v}{c}cos\theta$
    b. $f = 4\Delta f\frac{v}{c}cos\theta$
    c. $\Delta f = 2f\frac{v}{c} - cos\varphi$
    d. $\Delta f = \frac{2v\ cos\varphi}{c}f$

30. In Doppler formula $\Delta f = 2f\frac{v}{c}cos\theta$, v represents:
31. In Doppler relation $\Delta f = 2f\frac{v}{c}cos\theta$, θ represents:
32. The Doppler relation used to determine the blood flow velocity is:

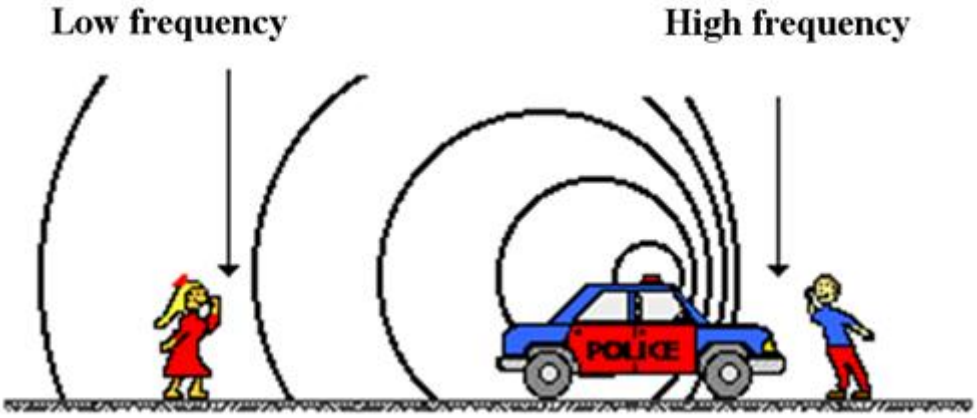
33. Which of the following expressions <u>do not</u> match the Doppler relation used to determine the blood flow velocity?
    a. $v = \frac{2cos\theta}{c}\cdot\frac{\Delta f}{f}$
    b. $v = 2cos\theta\frac{\Delta f}{f}c$
    c. $v = \frac{c}{2cos\theta}\cdot\frac{\Delta f}{f}$
    d. $v = \frac{2\ cos\varphi}{\Delta f\cdot c}f$

34. In Doppler relation used to determine the blood flow velocity, $v = \frac{c}{2cos\theta} \cdot \frac{\Delta f}{f}$, θ represents:

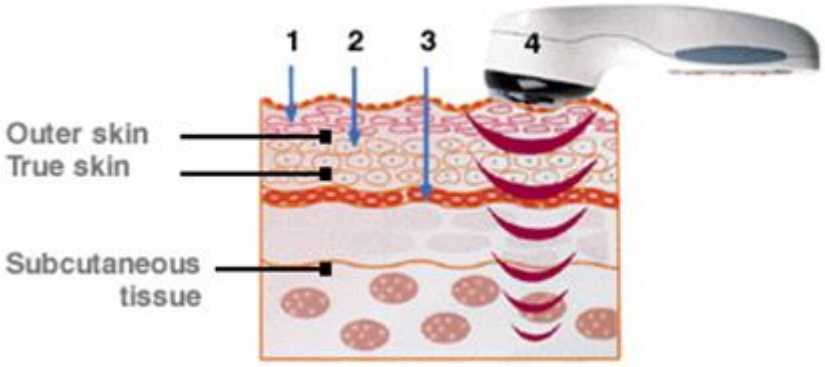
35. In Doppler relation used to determine the blood flow velocity, $v = \frac{c}{2cos\theta} \cdot \frac{\Delta f}{f}$, c represents:

36. Select the missing information from the above image:
    a. Megasound
    b. X ray
    c. Ultrasound
    d. Gama ray

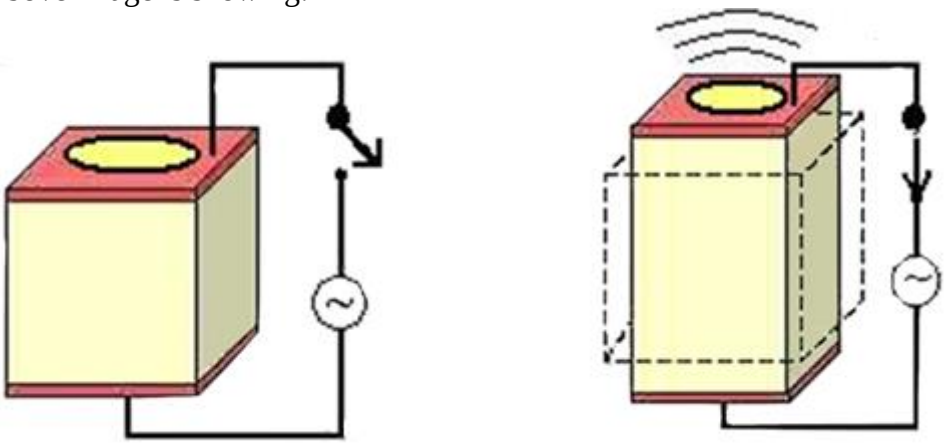
37. The above image is showing:
    a. A rectilinear and uniform motion
    b. An accelerated motion
    c. A Doppler effect
    d. Safety in traffic



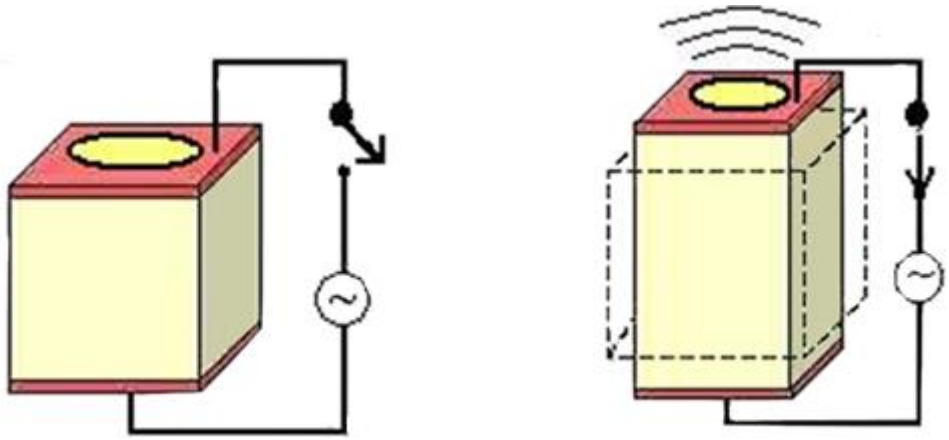
38. The above image is showing:



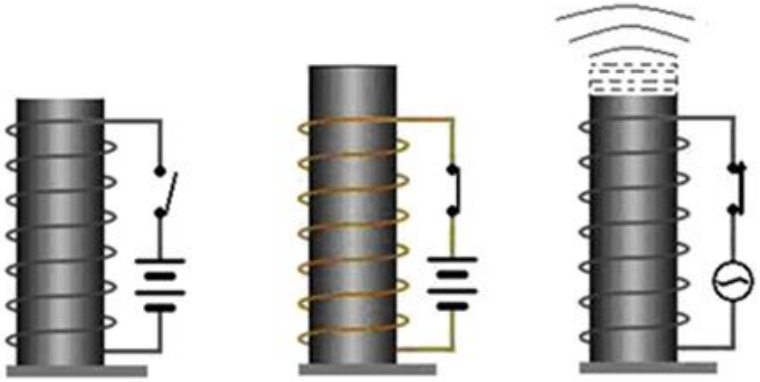
39. The above image is showing:



40. The above image is showing:

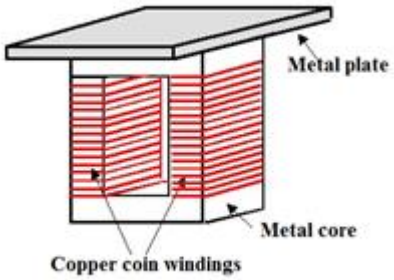


41. The above image is showing:

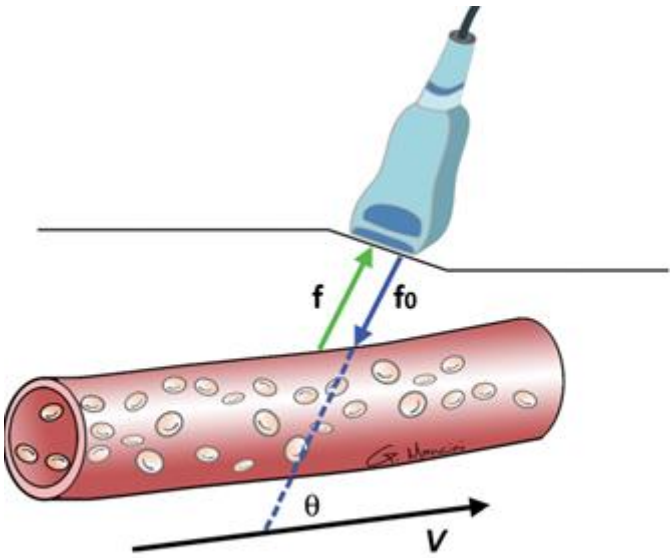
a. 

42. Magnetostrictive transmitter works when:
    a. Applying an alternating current
    b. Applying a direct current
    c. Applying an alternating or direct current
    d. None of the variants mentioned above is correct

43. The image above is showing:
    a. A capacitor
    b. An ultrasound detector
    c. An example of a magnetostrictive emitter
    d. A piezoelectric element



44. The image above is showing:



45. The image above is showing:

46. Human ear can receive frequencies between:

47. To identify a sound wave it needs to have:
    a) a sound source;
    b) a medium of propagation;
    c) an ultrasound transducer;
    d) a detector of metals

48. Production of ultrasound takes place:
    a) in the presence of alternating current;
    b) only due to magnetostrictive effect;
    c) only due to inverse piezoelectric effect;
    d) due to magnetostrictive effect and due to piezoelectric inverse effect.

49. Biological effects of ultrasound depend on:

II. Surface tension

1. What is surface tension?

2. The phenomenon of surface tension occurs on the the border of:

3. Surface tension is caused by:

4. The force of surface tension acts:

5. The force of surface tension is:
6. The force of surface tension tends to:
7. In which of the figures below are represented correct surface tension forces?

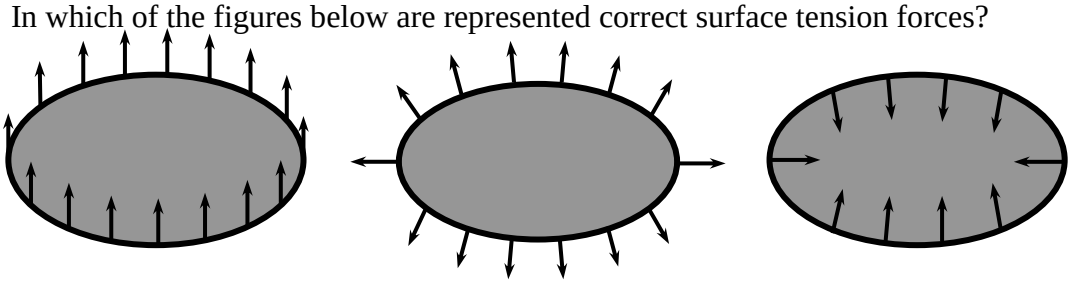


Fig. a Fig. b Fig. c

8. The force of surface tension depends of:
9. Physical size that characterizes the surface tension is:
10. The force of surface tension is:
11. The coefficient of surface tension is defined in expression: $\sigma = \frac{F}{l}$, where:
12. The coefficient of surface tension is defined in expression: $\sigma = \frac{F}{l}$, where:
13. The coefficient of surface tension is defined in expression: $\sigma = \frac{F}{l}$, where:
14. The coefficient of surface tension is defined in expression: $\sigma = \frac{F}{d}$, where:
15. The coefficient of surface tension is:
16. The coefficient of surface tension is defined by the expression: $\sigma = \frac{\Delta w}{\Delta S}$, where:
17. The coefficient of surface tension is defined by the expression: $\sigma = \frac{\Delta w}{\Delta S}$, where:
18. The coefficient of surface tension is defined by the expression: $\sigma = \frac{\Delta w}{\Delta S}$, where:
19. The coefficient of surface tension is:
20. The coefficient of surface tension is:
21. The coefficient of surface tension:
22. The coefficient of surface tension:
23. The coefficient of surface tension:

24. The coefficient of surface tension:
25. The coefficient of surface tension of a solution:
26. The coefficient of surface tension of a solution:
27. The formula definition of surface tension coefficient is:

28. The formula definition of surface tension coefficient is:

29. The unit of measurement of the coefficient of surface tension in the SI (International System) is:

30. The unit of measurement of the coefficient of surface tension in the SI (International System) is:

31. The unit of measurement of the coefficient of surface tension in the CGS (System tolerated of units):

32. The correlation between $1\frac{N}{m}$ and $1\frac{J}{m^2}$ is:

33. The correlation between N and dyn is:

34. The correlation between $\frac{N}{m}$ and $\frac{dyn}{cm}$ is:

35. An adherent liquid is if:

36. In which of the figures below is correctly represented adherent liquid?

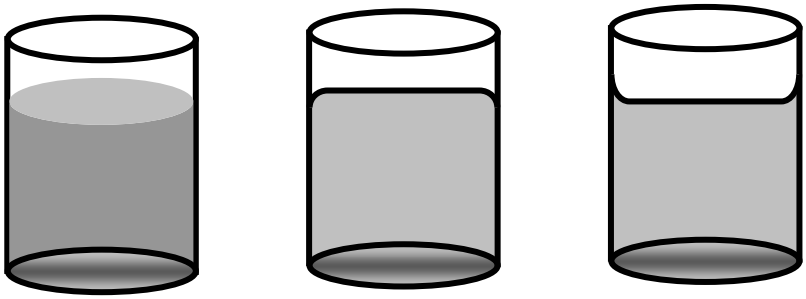


Fig.a Fig.b Fig.c

37. An nonadherent liquid is if:

38. In which of the figures below is correctly represented nonadherent liquid?

erent liq y has:

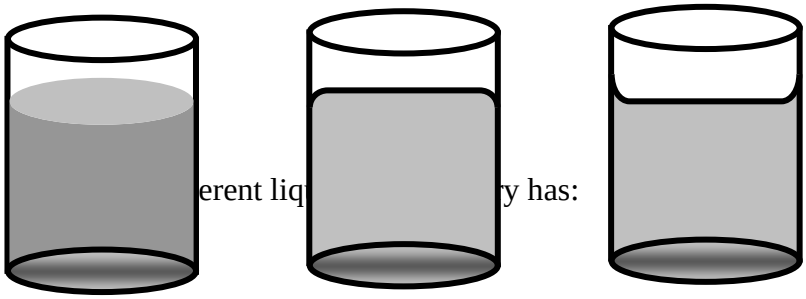


Fig.a Fig.b Fig.c

43. In a capillary free surface of a nonadherent liquid:

48. The determination of the coefficient of surface tension by the ring detachment method, the formula is:

49. The determination of the coefficient of surface tension by the relative method, the formula is:

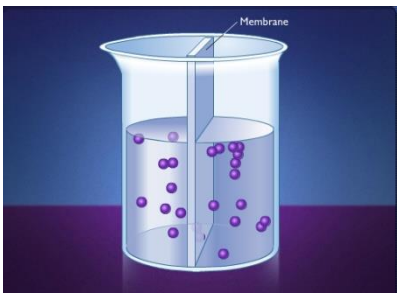
III. Osmosis

In the items below find the correct answer and mark it:

1. **Osmosis phenomenon - what is it?**
   a) The phenomenon of the solute molecules diffusion in the colloidal solutions.
   b) The phenomenon of the disolved substance transport through a permeable memrane in a solution.
   c) The phenomenon of the solvent diffusion from the solution region of low concentation to the region of high concentration through a semipermeable membrane.
   d) The phenomenon of the solute diffusion from the solution region of low concentation to the region of high concentration through a semipermeable membrane.
2. **Osmosis is:**
   a) The solvent crossing throuh a semipermeable membrane from the low concentration solution to high concentration solution.
   b) The solvent crossing throuh a semipermeable membrane from the high concentration solution to low concentration solution.
   c) The solvent motion through a membrane which separates two solutions of different concentration.
   d) The solute motion through a membrane which separates two solutions of different concentration.
3. **In the aqueous solutions the osmosis phenomenon is observed:**
   a) If the water molecules are moving from the region where the water molecules concentration is lower to the region having higher concentration of water molecules.
   b) If the water molecules are moving through a semipermeable membrane from the region where the water molecules concentration is higher to the region having lower concentration of water molecules.
   c) If the molecules of the disolved substance are moving through a membrane from the region where the water molecules concentration is lower to the region having higher concentration of water molecules.
   d) If the water molecules are not moving through the membrane separating the region where the water molecules concentration is lower to the region having higher concentration of water molecules.
4. **What are requirements to the membrane which provides the osmosis in the solutions?**
   a) The membrane should be impermeable.
   b) The membrane should be porous, the pores of which allow the crossing through it the solvent molecules but are too small to allow the solute molecules to cross it.
   c) The membrane should be semipermeable.

d) The membrane should have the large enough pores which allow the crossing through it both solvent molecules as well as solute molecules.

5. **In the solution, divided in parts by the semipermeable membrane the water molecules diffusion occurs:**



a) From left to right part.
b) From right to left part.
c) Does not occur.
d) Diffusion is in dynamic equilibrium.

6. **A red blood cell placed in a hypertonic solution will:**
a) Extend.
b) Constrain.
c) Will not change its form.
d) Transform into a white blood cell.

7. **A red blood cell placed in a hypotonic solution will:**
a) Extend.
b) Constrain.
c) Will not change its form.
d) Transform into a white blood cell.

8. **The osmotic pressure is:**
a) The pressure exercised by the solution needed for to impede the osmosis in this solution when it is separated from the solvent by a semipermeable membrane.
b) The pressure exercised by the solvent needed for to impede the osmosis in this solution when it is separated from the solvent by a semipermeable membrane.
c) The pressure exercised by the atmosphere needed for to impede the osmosis in this solution.
d) The pressure exercised by the atmosphere needed for to impede the osmosis in this solution when it is separated from the solvent by a semipermeable membrane.

9. **If F is the force acting on a semipermeable membrame having area S then its relation to the osmotic pressure is:**
a) $F = \frac{P_{osm}}{S}$
b) $P_{osm} = \frac{F}{S}$
c) $P_{osm} = Fs$
d) $P_{osm} = \frac{F}{S^2}$

10. **The osmotic pressure is defined as:**
a) The force acting on the area unit of the semipermeable membrane to stop the osmosis phenomenon.
b) The force acting on the area of the semipermeable membrane..
c) The force acting on the walls of the vessel where the solution is kept.

d) The force acting on the bottom of the vessel where the solution is kept..

11. The measurement units of the osmotic pressure are:

a) $[P_{osm}]_{SI} = \frac{N}{m^3}$

b) $[P_{osm}]_{SI} = \frac{N}{m^2}$

c) $[P_{osm}]_{SI} = N.m^2$

d) $[P_{osm}]_{SI} = N.m$

12. The osmotic pressure P_{osm} in the plant cells can reach values of:

a) $P_{osm} \approx$ 1atm

b) 5atm ≤ P_{osm} ≤20atm

c) 20atm ≤ P_{osm} ≤50atm

d) $P_{osm} \approx$ 100atm

13. The relation between osmotic pressure $P_{osm}$and the solution molar concentration C^M is given by the equation :

a) $C^M = \frac{P_{osm}}{K_T}$

b) $P_{osm} = \frac{C^M}{K_T}$

c) $P_{osm} = K_T.C^M$

d) $P_{osm} = nK_T.C^M$

14. At a constant temperature of a solution divided by a semipermeable membrane the relation between the osmotic pressure and its molar concentrtion is:

a) Directly proportional.

b) Inversly proportional.

c) Quadratic.

d) No dependence exists.

15. The temperature constant K_T which determines the osmotic pressure P_{osm} of a solution depends on:

a) The given solution temperature.

b) The solvent nature .

c) The solute nature.

d) The solution nature and concentration .

16. The temperature constant K_T which determines the osmotic pressure P_{osm} of a solution has as unit of measurement:

a) $[K_T] = \frac{Pa}{m}$

b) $[K_T] = \frac{N.m}{mol}$

c) $[K_T] = \frac{J}{mol.K}$

d) $[K_T] = \frac{J}{mol}$

17. How the osmotic pressure P_{osm} depends on the solution concentration C^M?

a) Directly proportional.

b) Inversly prportonal.

c) According to a liniar dependence.

d) Does not depend.

18. The relation between osmotic pressure P_{osm} and solution temperature T is:

a) $P_{osm} = \frac{T}{K_C}$

b) $P_{osm} = \frac{K_C}{T}$

c) $P_{osm} = K_C.T$

d) $P_{osm} = K_C.T^2$

19. is In a solution having constant concentration, divided by a semipermeable membrane the relation between osmotic pressure and temperature is:

a) Directly proporional.

b) Inversly proportional.

c) Linear.

d) No dependence exists.

20. The concentration constant K_C, which determines the osmotic pressure P_{osm}has as measuremennt unit:

a) $[K_C] = \frac{N.m}{mol}{}^{o}K$

b) $[K_C] = \frac{N}{m^{-2}}{}^{o}K$

c) $[K_C] = N.m^{-2}\,{}^{o}K$

d) $[K_C] = \frac{N.m^{-2}}{o_K}$

21. How the osmotic pressure P_{osm} depends on the solution temperature T?

a) Inversly propotional.

b) Directly proportional.

c) According to a linear dependence.

d) Do not depend on one another.

22. The Van't Hoff equation for the osmotic pressure in solution is given by the equation:

a) P_{osm}=νVRT

b) $P_{osm}V = \frac{RT}{\nu}$

c) $P_{osm}V$ = νRT

d) $P_{osm} = c^{M}RT$

23. According to the Van't Hoff law the osmotic pressure of the solution is :

a) Directly proportional to the solution temperature and its volume.

b) Directly proportional to the solution temperature and inversly proportional to its volume.

c) Directly proportional to the solution volume and inversly proportional to its temperature.

d) Directly proportional to the solution temperature and does not depend onits volume.

24. The Van't Hoff law states that the osmotic pressure of the solution:

a) Depends on the solvent nature and does not depend on the solute nature.

b) Does not depend either on the solvent nature as well as on the solute nature.

c) Depends on the solvent nature as well as on the solute nature.

d) Depends only on the number of the substance particles disolved in the solution.

25. The Dalton's law states that the osmotic pressure of a mixture of solutions:

a) Is determined by the summary osmotic pressure of each solution.

b) Is determined by the osmotic pressure of the solution having the highest concentration.

c) Is determined by the total osmotic pressure of all solutions.

d) Is determined by the osmotic pressure of the solution having the lowest concentration.

26. The solution is named isotonic if:

a) The concentrations of two solutions separted by a semipermeable membrane are the same.

b) The osmotic pressure of two solutions separted by a semipermeable membrane are different..

c) The osmotic pressure of two solutions separted by a semipermeable membrane are the same.

d) The concentrationsof two solutions separted by a semipermeable membrane are different.

27. The Raoult law for osmotic pressure is given by the equation:

a) $P_{osm} = \frac{RT}{\Delta t.K_f}$

b) $P_{osm} = \frac{RT.K_C}{\Delta t}$

c) $P_{osm} = \frac{RT.\Delta t}{K_f}$

d) $P_{osm} = \frac{RK_f}{T}\Delta t$

28. The solution is hypotonic if :

a) The solution contains less solute than solvent.

b) The solution contains the same amount of solute as of solvent.

c) The solution contains more water than solute.

d) The solution contains less solvent than solute.

29. The solution is hypertonic if:

a) The solution contains less solute than solvent.

b) The solution contains the same amount of solute as of solvent.

e) ! The solution contains less water than solute.

c) ! The solution contains less solvent than solute.

30. In the Dutrochet osmometer the osmotic pressure is indicated by:

a) The level of diluted solution.

b) The level of concentrated solution.

c) The height of the diluted solution.

d) Hydrostatic pressure of a concentrated solution.

31. What is the type of solution in which the plant cell indicated in the Figure below is placed ?

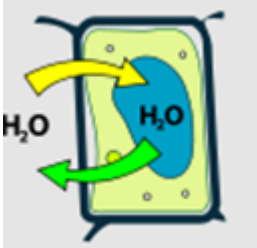
a) Hypotonic.

b) Hypertonic.

c) Isotonic.

d) High concentration solution.

32. What is the type of solution in which the plant cell indicated in the Figure below is placed ?



a) Hypotonic.

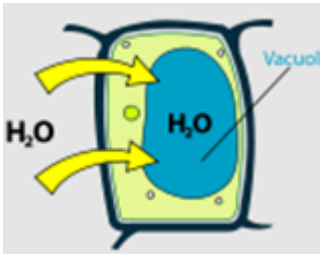
b) Hypertonic.

c) Isotonic.

d) High concentration solution.

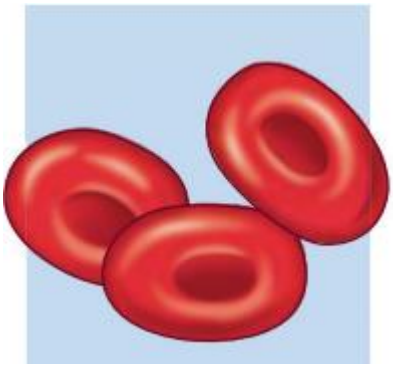
33. What is the type of solution in which the plant cell indicated in Figure below is placed?

a) Hypotonic.



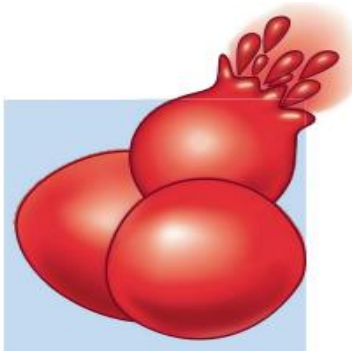
b) Hypertonic.
c) Isotonic.
d) Low concentration solution.

34. What is the type of solution in which the red blood cell indicated in Figure below is placed?



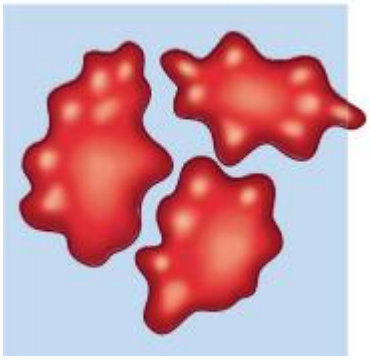
a) Hypotonic.
b) Hypertonic.
c) Isotonic.
d) High concentration solution.

35. What is the type of solution in which the red blood cell indicated in Figure below is placed?



a) Hypotonic.
b) Hypertonic.
c) Isotonic.
d) High concentration solution.

36. What is the type of solution in which the red blood cell indicated in Figure below is placed?



a) Hypotonic.
b) Hypertonic.
c) Isotonic.
d) High concentration solution.

e) What happens with a red blood cell placed in a hypotonic solution?

a) Its volume increases up to eruption.
b) Its volume decreases.
c) Its volume remains unchanged.
d) Its volume increases depending on the solution concentration.

f) What happens with a red blood cell placed in a hypertonic solution?

a) Its volume increases.
b) Its volume decreases.
c) Its volume remains unchanged.
d) In it the plasmolysis phenomenon is observed.

g) Osmoregulation is:

a) The process of leveling of the osmotic pressure between two solutions.
b) The process of the water and of mineral salts concentration adjusting in the blood.
c) Active adjustment of the osmotic pressure of the liquid in order to maintain homeostasis of the body water content.
d) The diffusion of water from animal cells.

40. Dialysis is:

a) The passage through the semipermeable membraneof the solvent molecules in the multicomponent system.
b) Passing through the semipermeable membrane of colloidal molecules in multicomponent system.
c) The passage through the semipermeable membrane into the multi-component system of the molecules of the solvent.
d) The passage through the semipermeable membrane into the multi-component system of the molecules of the solvent and small solute molecules.

41. **Dialysis could be used for:**

a) The separation of water molecules from the colloidal molecules.
b) Separation of proteins from small ions.

c) To restore electrolitic balance.
d) Platelet separation from erythrocytes.

42. Haemodialysis is carrying out following functions:

a) Adjust the blood temperature .
b) Eliminates toxins, salts and excess water to prevent their accumulation in the body.
c) Keep some chemical substances (potassium, sodium bicarbonate) at an appropriate level.
d) Raises blood pressure.

43. The artificial kidney functions based on the phenomenon of:

a) Plasmolysis.
b) Haemodialysis.
c) Solutions diffusion.
d) Suspension in solutions.

44. **In Vant Hoff's law $P_{osm}V = vRT$ the symbol V is for physical value of:**

a) Solvent volume.
b) Solute volume .
c) Solution volume.
d) Volume of the vessel in which the solution is kept.

45. In Raoult's law $P_{osm}=\frac{RT}{K_f}\Delta t$ the symbol Δt is a for physical value of:

a) Depression constant of freezing point.
b) Temperature difference of solvent and solute after it is dissolved.
c) Difference between solvent and solution solidification temperature.
d) The solution temperature variation.

46. In the Figure below the workers are spreading salt on the road ice. What is the effect of it ?

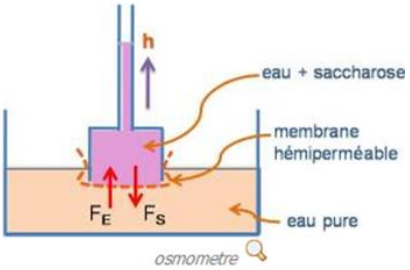
a) Salt increases the friction betweenwheels and the road.
b) The salt raises the temperature of solidification of water.
c) The salt decresees the temperature of ice melting.
d) Salt increases the friction between wheels and the ice.

47. In the formula which defines osmotic pressure $P_{osm}=\frac{F}{S}$ the physical value F is the symbol for:

a) Force which should be applied on solution for to stimulate the solute dissolving .
b) Force which should be applied on solution for to stop the solute diffusion.
c) Force which should be applied on solution for to stop the solvent diffusion through membrane.
d) Force which should be applied on solution for to stop osmosis.

48. In the Figure below is given Dutrochet osmometer. What the value of h determines?

a) Height to which the solutionis rising relative to the vessel bottom.



b) Hydrostatic pressure of the solution.

c) Osmotic pressure.

d) Osmometr's heght.

49. As a semipermeable membrane In the tube for hemodialysis are used:

a) A gauze membrane.
b) A sheet of pressed paper.
c) A set of tubes made from polimers (copolimers).
d) A set of teflon tubes.

50. In medical practice the determination of freezing point is used for:

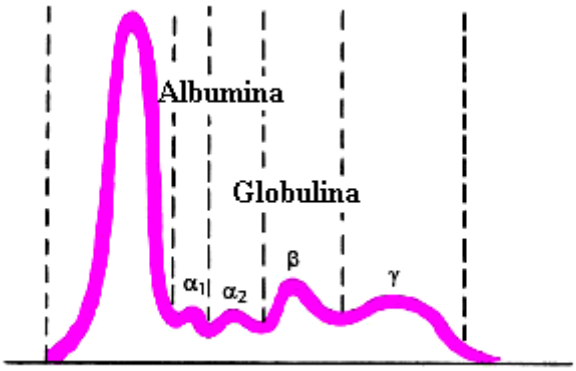
a) Determination of the solvent nature.
b) Gaining the information on the nature of the solute in the solution.
c) Getting information on blood serum or other body fluids.
d) Determination of the quantity of the solidified solution.

IV. Mobility of ions

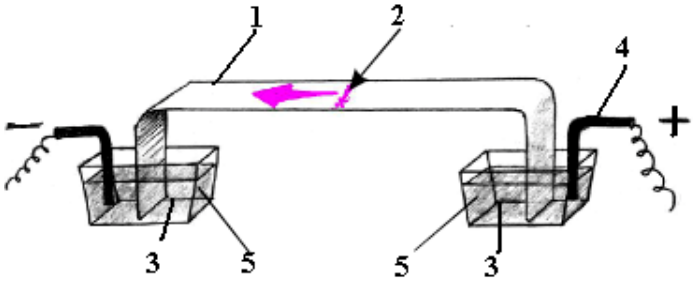
1. On a spherical particles electrically charged during migration in an environment, under the influence of an external electric field, acting simultaneously two forces compensate each other a short time.These forces are:
   a) Electric force $F_e = Z \cdot e \cdot E$ and friction force;
   b) Stokes force $F_s = 6 \cdot \pi \cdot \eta \cdot r$ and electric force;
   c) Electric force $F = Z \cdot e$ and Stokes force;
   d) Electric force $F = q \cdot E$, where $q = Z \cdot e_x$ and Stokes force $F = 6 \cdot \pi \cdot r \cdot v$;
   e) All answers are incorrect.
2. From the formula for the mobility of a particle $M = \frac{e \cdot Z}{6 \cdot \pi \cdot \eta \cdot r}$, can see that the mobility of the particle depends on:
   a) electric charge of the particle, viscosity of the environment in which the particle moves and environment temperature;
   b) particle nature, the nature of the environment in which the particle moves and the external electric field strength;
   c) nature of the environment in which the particle is moving, the nature of the particle, the temperature and the electric force acting on the particle;
   d) only the electric charge of the particle;
   e) All answers are incorrect.
3. The mobility of the charged particles during migration in an environment under the action of an external electric field is expressed by the formula $M = \frac{e \cdot Z}{6 \cdot \pi \cdot \eta \cdot r \cdot v}$, where:
   a) *Z*- the number of charged particles, *η*- electric charge particle, ***v***- particle velocity;

b) $Z \cdot e$- electric charge particle, η- viscosity coefficient of the environment;
c) η- viscosity coefficient of the environment, *e*- electric charge of the particle, Z-atomic number;
d) *r*- particle radius, *e* - electron charge, Z-atomic number;
e) all answers are incorrect.

4. It's called electrophoresis, electrokinetic phenomena, in which the movement is oriented (and uniform) in a given environment:
   a) electrically charged particles, independent of their origin under the action of an external electric field;
   b) ions, colloidal particles and other particles and gas bubbles in suspension subjected to a variable electric field;
   c) electrically charged particles, independent of their origin, under the action of an electromagnetic field;
   d) colloidal particles, ions, and other particles and gas bubbles in the suspension, subjected to a constant magnetic field;
   e) all answers are incorrect.
5. Depending on the nature of the environment, in which the migration of charged particles under the influence of an electric field constant and uniform, can differ:
   a) electrophoresis in liquid column and electrophoresis in ionizing gases;
   b) gel electrophoresis and electrophoresis in crystalline bodies;
   c) electrophoresis on the filter paper and gas electrophoresis;
   d) porous bodies electrophoresis and electrophoresis in the liquid column;
   e) none of the statements is correct;
6. As a result of blood serum electrophoresis and the coloring of celluloid film with special dye is obtained the picture shown below. How is called this picture?

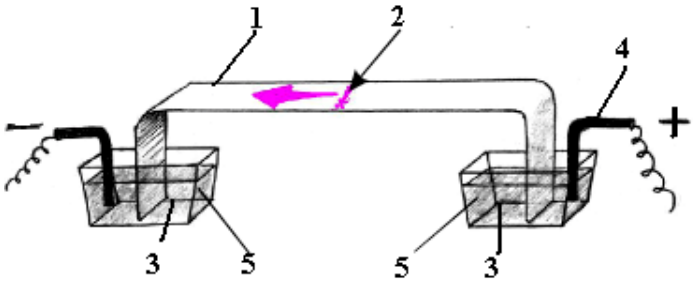


   a) the electrogram of blood protein;
   b) the electrogram ofblood serum;
   c) the blood proteinogram;
   d) the electrophoregramof the blood protein;
   e) none of the statements is correct;
7. Following a simplified scheme of the room electrophoretic please indicate the correct statement:



a) 2 - the buffer solution; 5 - metal electrodes;
b) 1 -the filter paper strip moistened into the solution under investigation; 5 - cuvettes;
c) 3 - the buffer solution; 1 - the filter paper strip moistened in the buffer solution; 5 - cuvettes;
d) 5 - cuvettes; 4 - the buffer solution; 2 - the drop of researched solution; 3 - strip of filter paper;

8. In the figure below is presented the simplified scheme of electrophoresis chamber.



In the figure:

a) 1 - the filter paper stripmoistened in the mixture of investigated solutions;
b) 3 - the buffer solution - concentrated hydrochloric acid;
c) 2 - a drop of dilute hydrochloric acid;
d) none of the statements is correct;

9. As a result of electrophoresis on paper was obtained the average mobility of copper equal to $1.25 \cdot 10^{-5}$ cm/$V^{-1} \cdot s^{-1}$. That expresses this quantity?
   a) the speed of uniform motion of the copper ion under the influence of an electric field with the intensity E equal to $1.25 \cdot 10^{-5}$ cm/$V^{-1} \cdot s^{-1}$;
   b) the distance passed by the copper ion in uniform the movement during one second under the influence of an electric field with the intensity equal to 1 V/m;
   c) copper ion movement speed under the influence of an unit electric field;
   d) distance traveled by the copper ion under the influence of an unit electric field;
   e) none of the statements is correct;
10. By the method of electrophoresis on paper was determined that the mobility of the ions of iron is on average equal to $0,61 \cdot 10^{-8}$ cm/$V^{-1} \cdot s^{-1}$. That is the physical meaning of this quantity?
    a) it is numerically equal to the speed of ions under the influence of an electric field with the intensity of 1 V/m;
    b) it is the distance traveled by ion in one second under the influence of an electric field;
    c) it is numerically equal to the speed of uniform motion of ions under the influence of an electric field, whose intensity is 1 V/m;
    d) It is numerically equal to the speed of uniform motion of ions under the influence of an homogeneous electric field;

e) none of the statements is correct;

11. The revelation of filter papers and getting the electropherograms to determine the mobility of iron and copper ions is done using:
    a) the buffer solution;
    b) the iron chloride solution of 10% in water;
    c) the copper chloride solution of 10% in water;
    d) dilute hydrochloric acid;
    e) the 5% solution of potassium ferrocyanidein water;
12. In determining the mobility of iron and copperions by the paper electrophoresis method, filter paper strips are wetted in:
    a) ferric chloride solution of 10% in water;
    b) the 5% solution of potassium ferrocyanidein water;
    c) the mixture of ferric chloride solution of 10% and copper chloride solution of 10% in water;
    d) the copper chloride solution of 10% in water;
    e) it is not indicated the moistening solution of the filter paper strips;
13. The mobility$M$ of ions in the electrophoresis process is determined by formula $M = \frac{l \cdot d}{U \cdot t}$, where U is:
    a) the intensity ofexternal electric field;
    b) the potential difference between the electrodes of electrophoresis chamber per one unit of the distance between them;
    c) a physical quantity measured in amperes;
    d) the potential difference between the electrodes of the electrophoresis chamber;
    e) none of the statements is correct;
14. The mobility$M$of ions in the electrophoresis process is determined by formula $M = \frac{l \cdot d}{U \cdot t}$, where d - is the distance from the buffer solution level into one of cuvettes to the buffer solution level from other cuvette, U - the voltage applied to the electrodes, t - the time during which the electric field acted on ions, and l is the:
    a) the distance between the electrophoresis chamber cuvettes;
    b) the length of the electrodes in cuvettes of electrophoresis chamber;
    c) the average distance passed by ions during electrophoresis;
    d) the length of filter paper strips moistened;
    e) none of the statements is correct;
15. The mobility $M$of ions in the paper electrophoresis process is determined by formula $M = \frac{l \cdot d}{U \cdot t}$, where l is the average distance passed by ions in the time t, U - the voltage applied to the electrodes, and d is:
    a) the distance between the electrolyte level in a cuvette to the liquid level in the other;
    b) the length of filter paper strips;
    c) the difference between the distances traveled by ions during the action of the electric field;
    d) the distance between the cuvettes of electrophoresis chamber;
    e) none of the statements is correct;
16. On paper electrophoresis the mobility $M$of charged particles is determined by one of the formulas below: (In formulas:v - the uniform movement speed of the particle, E - electric field

strength, U - the voltage applied to electrodes, d - the distance between electrodes, l - the average distance passed by the particles during electrophoresis, t - the time interval in which the electric field acted on the particles.)

a) $M = \frac{v}{E}$;

b) $M = \frac{U \cdot d}{l \cdot t}$;

c) $M = \frac{U \cdot t}{l \cdot d}$;

d) $M = v \cdot E$;

e) none of the formulas is correct;

17. The mobility$M$ of the charged particles during electrophoresis is expressed by the formula below: (In formulas:v - the uniform movement speed of the particle,E - electric field strength, U - the voltage applied to electrodes)

a) $M = v \cdot E$;

b) $M = \frac{v}{U}$;

c) $M = v \cdot U$;

d) $M = \frac{v}{E}$;

e) none of the formulas is correct;

18. At the electrophoresis the uniform motion speed $v$of a charged particle can be expressed by the formula below: (In formulas:M - the particle mobility, E - electric field strength)

a) $v = \frac{M}{E}$;

b) $v = \frac{E}{M}$;

c) $v = ME$;

d) $v = M \cdot E$;

e) none of the formulas is correct;

19. In electrophoresis, thevalue ofinternal friction force F is determined by the Stokes' law, expressed by the formula:

a) $F_s = 9\pi\eta r$;

b) $F_s = \pi\eta r v$;

c) $F_s = 6\pi r v$;

d) $F_s = 6\pi\eta r v$;

e) none of the formulas is correct;

20. Internal friction force exercised by the environment on the particle in motion during electrophoresis, given by the Stokes' law is: $F_s = 6\pi\eta r v$, where:

a) r - is the distance between the electrodes;

b) π - the Stokes constant;

c) η - the mobility of the particle;

d) v - the electric field strength variation speed;

e) none of the statements is correct;

21. Over a electric charge being in uniform moving in a homogeneous environment under the influence of an external homogeneous electric field, act theforces:
    a) $F_e = ZE$ and F_s;
    b) $F_e = qE$ and F_s;
    c) $F_s = 6\pi\eta v$ and $F_e = qU$;
    d) $F_e = \frac{E}{q}$ and F_s;
    e) none of the statements is correct;
22. Of which factor does not depend the speed of uniform motion of the charged particles under the influence of an external electric field in an electrolyte (medium)?
    a) the environment'stemperature in which the particle moves;
    b) the sign of the electric charge of the particle;
    c) the particle radius;
    d) the viscosity of the medium (electrolyte) in which the particle is moving;
    e) none of the statements is correct;
23. The electric field strength between the electrodes of electrophoresis system can be measured in:
    a) $\frac{m}{V}$;
    b) $\frac{J}{C}$;
    c) $\frac{C}{N}$;
    d) $\frac{N}{C}$;
    e) not correct units for measuring the electric field strength;
24. The electric field strength between the electrodes of electrophoresis systemis determined by one of the formulas below. Specify the correct formula:
    a) $E = \frac{d}{U}$;
    b) $E = \frac{U}{d}$;
    c) $E = \frac{F}{d}$;
    d) $E = \frac{q_1 q_2}{r^2}$;
    e) none of the formulas is correct;
25. The electrophoresis occurs due to the electric fieldsinteraction of charged particles.Two charged particles located within a certain distance between them:
    a) repeleach other if they have different signsof electrical charge;
    b) attract each otherif both electrical charge are positive;
    c) moves towards one another if they are freeand have different electrical charge;
    d) none of the statements is correct;
26. The mobility of an ion depends on its nature. What is called ion?

a) the atom that has lost electrons;
b) any particle that has electric charge;
c) the atom that has acquired electrons;
d) a neutral atom which can be ionized;
e) none of the statements is correct;

27. The movement speed of ions in electrophoresis depends on electric field strength E=U/d. The terms in the formula are:
    a) U- the electric field strength between the electrodes;
    b) d - the distance between the electrodes;
    c) U - the difference of potential between the electrodes;
    d) d - the distance passed by ions during the electrophoresis;
    e) none of the statements is correct;

V. Laserul

1. Population inversion in an active medium means:

2. In Ruby Laser the excitation of active medium is made by:

3. In He-Ne laser, the emission of photons takes place because of :
    a) He-atoms de-excitation
    b) Ne-atoms de-excitation
    c) both He and Ne atoms de-excitations
    d) 50% from Helium and 50% from Neon de-excitation

4. Which of the following leads to coherent light?
    a) absorption
    b) spontaneous emission
    c) stimulated emission
    d) none of these

5. The pumping method used in He-Ne laser is:

6. The life time of the metastable state is about:

7. The transition of an atom between two energy levels in which two coherent photons are emitted is called:
    a) absorption
    b) spontaneous emission
    c) stimulated emission
    d) population inversion

8. Brewster's windows (optical cavity) are used in He-Ne laser to obtain:
    a) coherent light
    b) monochromatic light
    c) powerful light
    d) polarized light

9. Which of the following will increase the energy of a photon?
    a) the increase of the frequency of the photon
    b) the decrease of the frequency of the photon
    c) the increase of the intensity of light
    d) the decrease of the intensity of light

10. The frequency of the laser radiation is determined from the relationship:

11. The gain medium for the He-Ne laser is a mixture of helium and neon gases in a ratio of:
    a. 20:3
    b. 10:1
    c. 30:2
    d. 1:0,5

12. The energy of the emitted laser light is determined from:

13. In a stable form, atoms can:
    a. Absorb energy
    b. Emit energy
    c. Be instable
    d. Jump to a higher energy level

14. The formula for the diffraction is:

15. The wavelength for the laser radiation can be determined with the relation:

16. The formula for the diffraction grating is $m\lambda = d\ sin\alpha$. What λ means here?

17. The laser radiation represents:
    a. Particles
    b. Ultrasounds
    c. Photons
    d. Electromagnetic waves

18. The active substance in the ruby laser is:

19. The active substance in the He-Ne is:

20. Which of the following statements are valid for the laser radiation?
    a) It is a flux of electrons
    b) It is polarized
    c) It is monochromatic
    d) It is directional

21. Which of the following statements are **not** valid for the laser radiation?
   a. It is a flux of electrons
   b. It is polarized
   c. It is monochromatic
   d. It is directional

22. "LASER" notion means:

23. The component parts of the He-Ne laser include:
   a. Active medium
   b. Passive medium
   c. Optical cavity
   d. Energy source

24. The component parts of the He-Ne laser **doesn't** include:
   a. Active medium
   b. Passive medium
   c. Optical cavity
   d. Energy source

25. Bohr's atomic model specify that:
   a. Electrons can gain energy by jumping from one lower energy level to an upper one, absorbing electro radiation
   b. Electrons can lose energy by jumping from one upper energy level to a lower one, emitting electro radiation
   c. Electrons can gain energy by jumping from one upper energy level to a lower one, absorbing electro radiation
   d. Electrons can lose energy by jumping from one upper energy level to a lower one, absorbing electro radiation

26. Bohr's atomic model **doesn't** imply the following:
   a. Electrons can gain energy by jumping from one lower energy level to an upper one, absorbing electro radiation
   b. Electrons can lose energy by jumping from one upper energy level to a lower one, emitting electro radiation
   c. Electrons can gain energy by jumping from one upper energy level to a lower one, absorbing electro radiation
   d. Electrons can lose energy by jumping from one upper energy level to a lower one, absorbing electro radiation

27. The emitted or absorbed energy by an atom is given by:

   a. The stimulated emission is the process of a photon generation, when the electron jumps from:
   b. A superior energy level to an inferior one when interacting with a photon
   c. An inferior energy level to an superior one
   d. One orbit to another
   e. All variants are correct

28. The absorption of light is the process in which the electron jumps from:
    a. A superior energy level to an inferior one
    b. An inferior energy level to an superior one
    c. One orbit to another
    d. All variants are correct

29. The stimulated emission can occur when there is:
a. A hit of the electron with a photon
b. An action on the system from the exterior
c. A transition of the electron to an inferior energy state
d. All answers are correct

30. The metastable state is an excited energy state in which the electron:
a. Stays a longer period of time than 10^{-8}s
b. Stays a shorter period of time than 10^{-8}s
c. Emits infrared radiation
d. Emits ultraviolet radiation

31. In a metastable state the electron will never:
a. Stay a longer period of time than 10^{-8}s
b. Stay a shorter period of time than 10^{-8}s
c. Emit infrared radiation
d. Emit ultraviolet radiation

32. The population inversion is the process in which:

33. Which of the following types **doesn't** involve the lasers?
    a) Gas laser
    b) Solid state laser
    c) Plasm laser
    d) Semiconductor laser

34. The laser types are:

35. Diffraction of the light is :

36. Which of the following statements **doesn't** apply to the light diffraction:
a. The bending of light around the corners of an obstacle
b. A complex phenomenon that consists of composing coherent radiation from multiple sources from spa
c. The change in the angle of refraction of different colors of light
d. The change in direction of propagation of a wave due to a change in its transmission medium.

37. The component parts of a laser include:

38. Which of the following applications in medicine **doesn't** involve the laser?
a. Reattach of the retina
b. Destruction of the urinary stones
c. Bladder obstruction
d. Investigation of hard tissue

39. Which of the following applications in medicine involve the laser?
a. Reattach of the retina

b. Destruction of the urinary stones
c. Bladder obstruction
d. Investigation of hard tissue

40. In oncology, the laser is used for:

41. In oncology, the laser **can't** be used for:
a. Cancer cells destruction
b. Illumination of the cancer tissue
c. Endoscopic procedures
d. Changing position of the cancer cells

42. Which of the following procedures produces coherent light?
a. Absorption
b. Stimulated emission
c. Spontaneous emission
d. All variants are correct

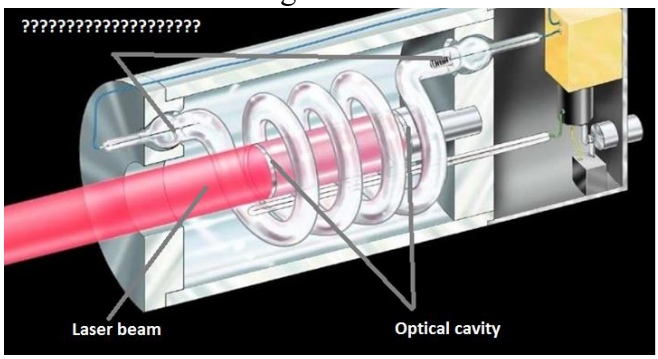
43. Which of the following laser parts produces powered and polarized light?
a. The quartz tube
b. The optical cavity
c. The fluorescent lamp
d. The pumping source

44. The visible spectrum of electromagnetic radiation has wavelength limits between:

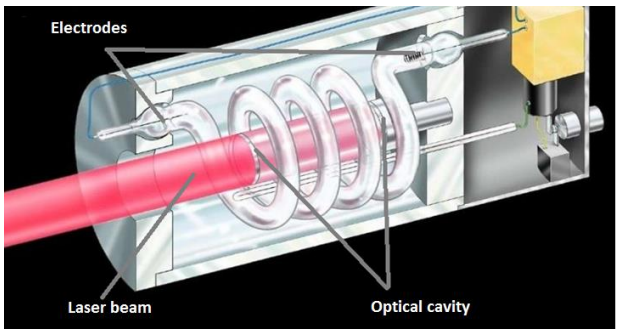
45. The relaxation time of the electrons in the excites state is about:

46. The relaxation time of the electrons in the metastable state is about:

47. What's the missing information on the image:

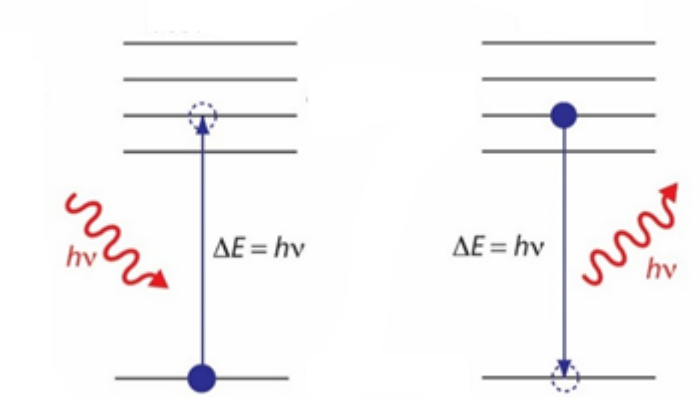
48. 

49. The presented image is describing:
a. He-Ne laser
b. Au laser
c. Ruby laser
d. Semiconductor laser

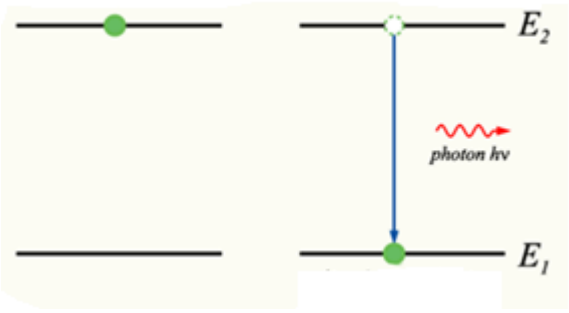
50. 

51. The presented image is describing a:

a. Light absorption
b. Spontaneous emission
c. Stimulated emission
d. Spontaneous and stimulated emission

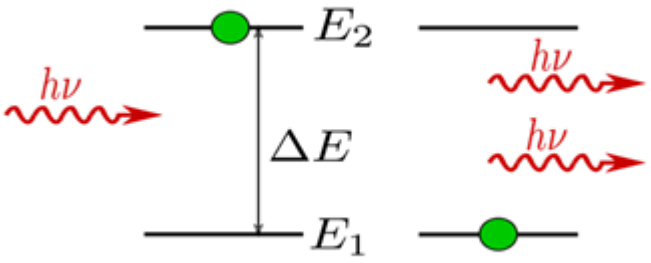


52. The presented image is describing:



a)

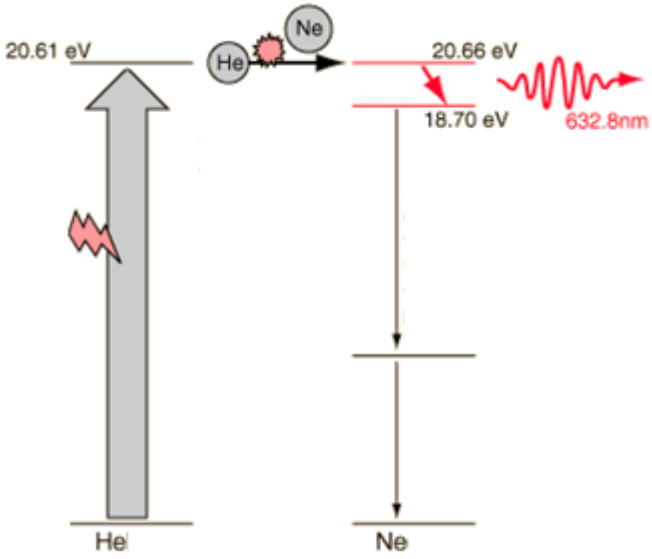
53. The presented image is describing:



a)

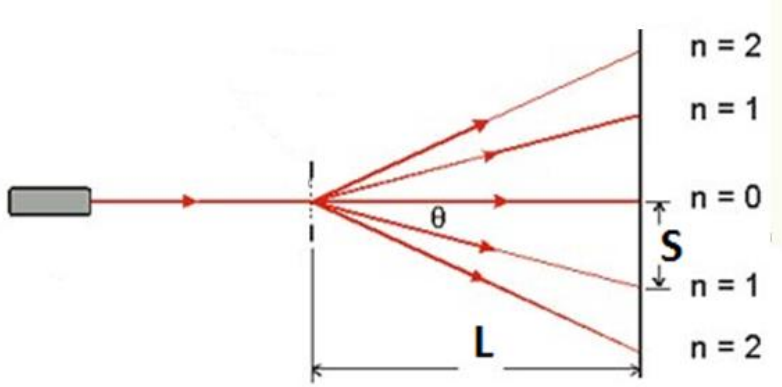
54. The presented image is describing:

a. The working principle of He-Ne laser
b. Absorption of the light and stimulated emission
c. Absorption of the light
d. Absorption of the light and spontaneous emission



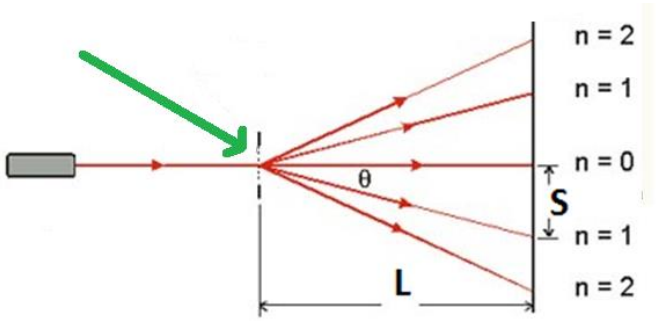
a)

55. The presented image is describing:



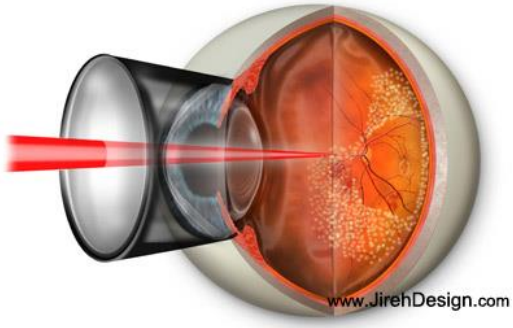
56.

57. In the presented image, which describes the light diffraction, the green arrow is showing:

a) 

58. Which of the following laser application in medicine it is represented in the attached image?

a. Destruction of the urinary stones
b. Bladder obstruction
c. Retina photocoagulation
d. Investigation of hard tissue

59. 

60. Which of the following laser application in medicine it is represented in the attached image?

a. Retina photocoagulation
b. Cavities drilling
c. Bladder obstruction
d. Treatment of periodontitis through resection

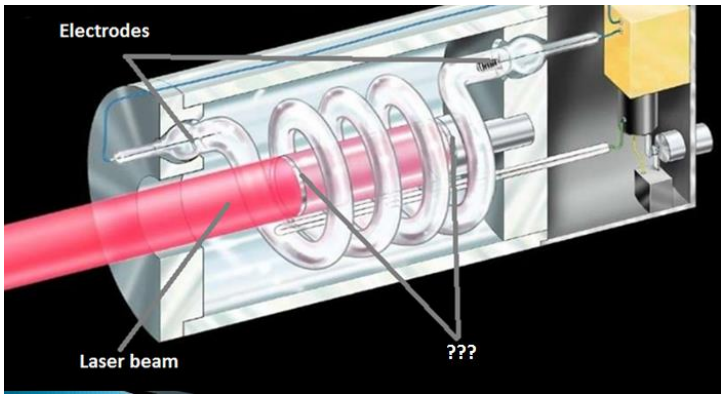
61. 

62. Which of the following laser application in medicine is represented on the image?

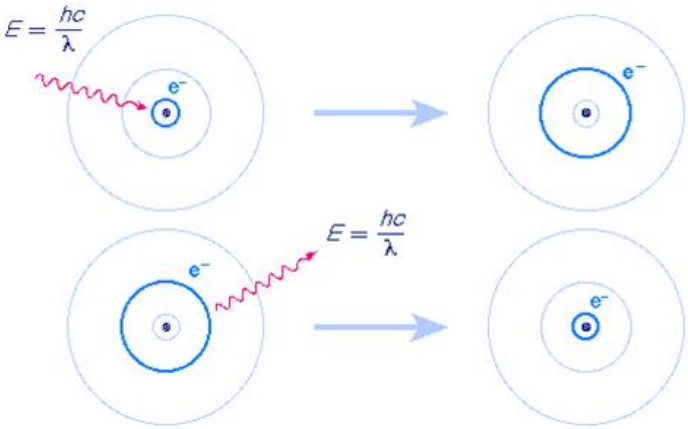
a. Retina photocoagulation
b. Surgical excision
c. Bladder obstruction
d. Treatment of periodontitis through regeneration.

i. 

63. What's the missing information in the image:

a) 

64. The presented image is describing:



VI. POlarimetria

Items(2)

1. What is the light?

a) A mechanical wave.

b) An electromagnetic wave .

c) An electromagnetic field oscillation which is propagating in the space.

d) An accoustical wave.

2. The visible light wavelength covers the wavelengths interval:

a) (0,01 ÷ 0,10) μm.

b) (0,38 ÷ 0,75) μm.

c) (2,00 ÷ 5,00)μm.

d) (380 ÷ 750)nm.

3.In an electromagnetic wave of light the vectors of electric field $\vec{E}$ and magnetic field$\vec{B}$ are oriented:

a) Parallel to one another.
b) At an angle to one another .
c) Perpendicular to one another.
d) Along to the same line in oposite direction .

4. The light is considered unpolarized (natural) if toward its direction of propagation:

a) The planes in which luminous vector $\vec{E}$ of different waves oscillates, make different angles.
b) The planes in which luminous vector $\vec{E}$of different waves oscillates are parallel to each other.
c) The planes in which luminous vector $\vec{E}$of different waves oscillates have a chaotic orientation.
d) The planes in which luminous vector $\vec{E}$of different waves oscillates make an angle of 0^o.

5.The light is polarized if:

a) The planes, in which the luminous vector $\vec{E}$ of different waves oscillates, are forming an angle of 45^o.

b) The planes in which the luminous vector $\vec{E}$of different waves oscillates are parallel to each other .

c) The planes in which the luminous vector $\vec{E}$ oscillates have a chaotical orientation.

d) !The planes in which the luminous vector $\vec{E}$of different waves oscillates, are making an angle of 0^o.

6. The natural light coud be transformed into polarized one in the processes of:

a) Transmission.

b) Amplifying.

c) Reflection.

d) Absorbtion.

7. The phenomena leading to the light polarization are:

a) Reflection.

b) Refraction.

c) Transmission.

d) Birefringence.

8. At the optical transmission the polarizing filter is capable to polarize the light depending on:

a) Chemical composition of the filter material.

b) Filter transparency to the light.

c) Filter position toward the light ray direction.

d) High value of the lght intensity.

9. Through the polarizing filter can pass only the light waves the luminous vector of which is:

a) Perpendicular to the axis of polarization.

b) Parallel to the axis of polarization.

c) Is forming a positiv anghe with the axis of polarization.

d) Is forming a negativ anghe with the axis of polarization.

10. Tne Intensity of light beam after the consecutive passing through the polarizer and analyzer:

a) Does not change.

b) Is maximum when their polarization planes coincide.

c) It is minimal when their planes of polarization are crossed (make an angle of 90^o).

d) It changes very weakly at the change of their mutual position.

11. The polarized light wave differs from the natural light by the fact that the light vector $\vec{E}$ has:

a) A predominant oscillation plan.

b) The oscillation plane is parallel to the light beam direction.

c) The oscillation plane is perpendicular to the light beam direction.

d) The oscillation plane is oriented at a sharp angle to the light beam direction.

12. Natural light may be subject to polarization by reflection from the surface of the following substances:

a) Gaseous.

b) Metallic.

c) Dielectric.

d) Liquids.

13. At the light polarization by refraction the direction of the incident natural light beam:

a) Does not change.

b) Deviates from the original direction when passing from one medium to another.

c) It changes his direction to reverse.

d) It changes by 90^o.

14. At the light polarization by refraction the polarization planes of the reflected ray and refracted ray are oriented:

a) Refracted beam in the plane of incidence, the reflected beam perpendicular to it.

b) The reflected beam in the plane of incidence, refracted beam perpendicular to it.

c) Refracted and reflected ray beam are perpendicular to the plane of incidence plan.

d) Refracted and reflected ray beam are parallel to the plane of incidence plan.

15. In the Brewster's law (*tg*i =n) the physical value i is:

a) Refraction angle.

b) The incidence angle at which the reflected light is totally polarized.

c) The incidence angle at which refracted light is totally polarized.

d) The incidence angle at which reflected light is not polarized.

16. If *i* is the angle of incidence at which the reflected light is totally polarized, then in the Brewster's law (*tg*i =n) the physical value n is:

a) Solution concentration.

b) Number of atoms.

c) Refraction index of the reflecting substance.

d) Quantity of substance.

17. When the reflected beam is totally polarized, then the angle between the refracted and the reflected beam is:

a) Equal to 45^o.

b) Equal to 90^o.

c) Equal to 120^o.

d) Equal to 180^o.

18. The birefringence phenomenon consists in dividing the incident light beam in:

a) Two reflected rays.

b) Two refracted rays.

c) A reflected and a refracted ray.

d) A refracted and two reflected rays.

19. The rays which are obtained by the phenomenon of birefringence are polarized in the direction:

a) Ordinary ray- perpendicular, extraordinary ray- parallel to the incidence plane .

b) Ordinary ray- parallel, extraordinary ray- perpendicular to the incidence plane.

c) Ordinary rayn and extraordinary ray- parallel to the incidence plane.

d) Ordinary ray extraordinary ray- perpendicular to the incidence plane.

20. Ordinary and extraordinary rays are polarized in the directions:

a) Parallel to one another.

b) Reciprocal perpendicular .

c) Along to the same line in oposite directions.

d) At an angle of 90^{o}.

21.The birefringence phenomenon is observed when light passes through:

a) Glass.

b) Iceland spar.

c) Water.

d) Quartz.

22. What substances are called optically active substances?

a) Substances that strongly absorb light.

b) Substances that strongly absorb polarized light.

c) Substances that rotate the plane of polarization of light.

d) Substances that do not absorb polarized light.

23. **As optically active substances can serve:**

a) Glass.

b) Quartz single crystals.

c) The aqueous solution of sugar.

d) Tartaric acid.

24. Polarimeter is a device designated for:

a) Getting polarized light.

b) Studying polarized light.

c) Studying of optically active substances.

d) Determination of optically active solutions concentration.

25. The specific rotation of a compound reflects:

a) The relative ability of a compound to attenuate light.

b) The ability of a compound to alter the degree of polarization of the light.

c) The ability of a compound to rotate the plane of polarization of the polarized light.

d) The ability of a compound to reflect polarized light.

26. The angle to which the optically active substance rotates the plane of polarization of the light depends on the:

a) Light wavelength.

b) Path length traveled by the light in the optically active substance.

c) Optically active compound concentration.

d) The specific rotation of optically active compound.

27.The concentration of optically active compound in solution can be determined by using:

a) Polarizer.

b) Analyzer.

c) Polarimeter.

c) Lens.

28. The polarimeter uses the light sources having wavelength:

a) Higher than 0,8μm.

b) Higher than 1μm.

c) Lower than 0,1μm.

d) From 0,38μm up to 0,75μm.

29. By using a polarimeter one could analyze:

a) Solutions concentration.

b) Solutions purity.

c) Solutions composition.

d) Solution aggregate state .

30. The relation between the optically active solution concentration C and the polarization plane rotation angle φ is:

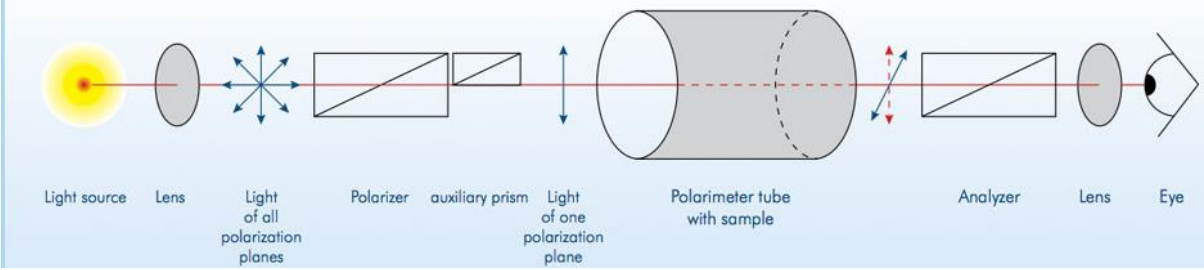
a) Quadratic.

b) Directly proportional.

c) Inversly proportional.

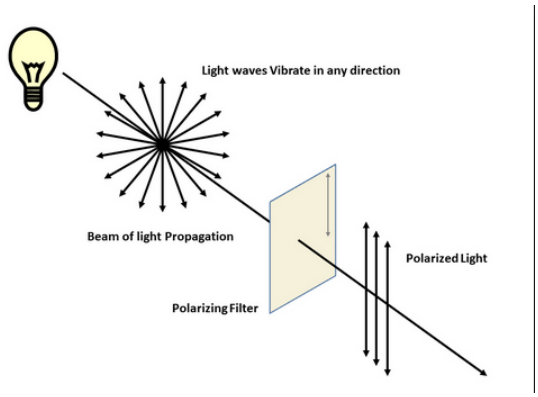
d) Of power.

31. In the diagram in Figure below the light passing through the analyzer is polarized in a plane:



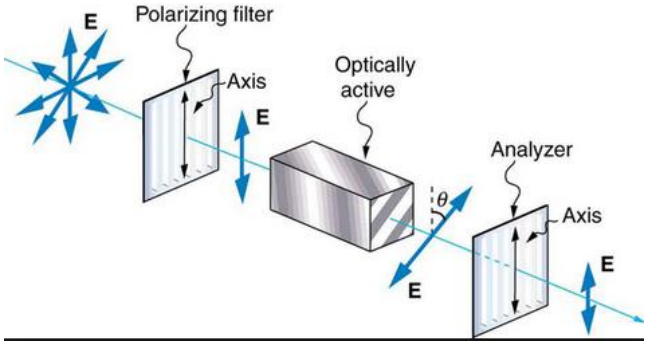
a) Parallel to the polarizer plane.
b) Perpendicular to the polarizer plane.
c) Plane which forms an angle φ to the plane of the polarizer.
d) Plane rotated at an angle relative to the same, incident in the studied sample .

32. Which of the natural light waves are passing through the polarizing filter in the Figure below :



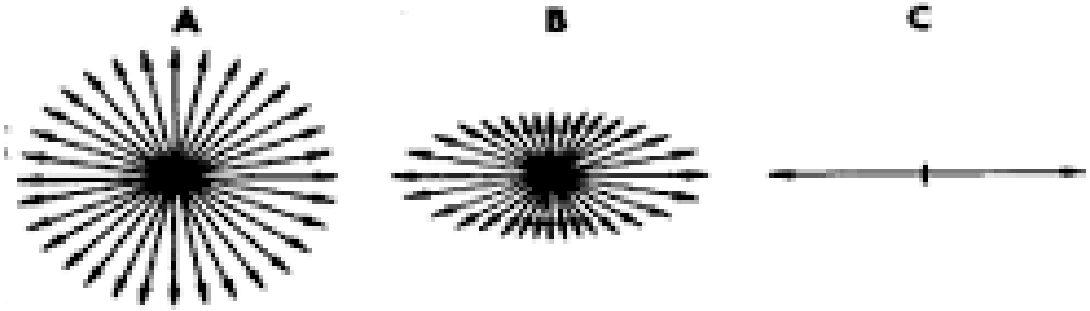
a) Through the filter only the waves of a certain wavelength are passing.
b) Through the filter only the waves of a certain intensity are passing.
c) Through the filter only the waves of a certain orientation of luminous vector are passing.
d) Through the filter only the waves of a certain frquency are passing.

33. After passage of the natural light through optically active substance in the figure below:



a) Light changes its direction of propagation.
b) Light changes its colour.
c) Light changes its polarization plane orientation.
d) Light changes its intensity.

34. The figure below illustrates the planes of oscillation of electromagnetic wave luminous vector. Statements A, B, C correspond to the light:



a) A- Natural, B- Partially polarized,C-totaly polarized.
b) B- Natural, C- Partially polarized, A-totaly polarized.
c) A- parțial polarizată, B -total polarizată, C- naturală.
d) A- Natural, B-natural,C-totaly polarized.

35.When using the polarimetric method for determining the optically active solution concentration, is required to be measured:

a) The rotation angle $\varphi_x$of the polarization plane of the light in the studied solution.

b) The rotation angle φ_0 of the polarization plane of the light in the known (reference)solution.

c) The intensity of polarized light passing through the known solution.

d) The intensity of polarized light passing through the studied solution.

36. When using polarimetric method of determining the optically active solution concentration, the relationship between the concentration of of the studied solution Cx and the reference solution C is:

a) $C_x = C\varphi\varphi_x$

b) $C_x = C\frac{\varphi_x}{[\alpha]l}.100\%$

c) $C_x = C\frac{\varphi}{\varphi_x}.100\%$

d) $C_x = C\frac{\varphi_x}{\varphi}$

37. The polarized light can be used in medicine for:

a) Highlighting sectors of the malignant skin tumors.

b) To identify gout crystals.

c) To identify of Amyloid tissue.

d) To identify the malaria pigments.

38. What is the linearly polarized light?

a) The light which after the double refraction contains only $\overrightarrow{E}$ vector.

b) The light in which $\vec{E}$ vector has a single direction of oscillation.

c) The light in which $\vec{E}$ vector has many directions of oscillation but one of it is preferential .

d) The light extraordinary ray that emerges from the Nicol prism.

39. The optically active substances could be:

a) Dextrorotatory type that rotate the light polarization plane to the right, when looking to the falling ray .

b) The type who does not rotate the light polarization plane.

c) Levorotatory type that rotate the plane of polarization of light to the left, when looking to the falling ray .

d) Unorganic type.

40. Which of the rays obtained by birefringence in Iceland spar (calcite) is polarized?

a) Only ordinary ray.

b) Only extraordinary ray.

c) The reflected ray.

d) Both ordinary and extraordinary rays.

41. What determines the angle of rotation of oscillation plane of polarized light?

a) Concentration of optically active solution.

b) Incidence angle of light beal on polarizer.

c) Only on incident light wavelength.

d) Only on the length of the layer passed by the light.

42. In the natural light:

a) The vector of electric field strenth $\vec{E}$ oscillates in a single direction.

b) The vector of electric field strength $\vec{E}$ oscillates in all directions in the plane perpendicular to the direction of propagation of the light wave.

c) The vector of electric field strength $\vec{E}$ oscillates in all directions in the plane parallel to the direction of propagation of the light wave.

d) The vector of electric field strength $\vec{E}$ oscillates along of a single direction.

43. Polarized light microscopy is used for distinguishing and identifying of dental structures such as :

a) Structure comparison between permanent teeth and falling ones.

b) The effect of teeth whitening.

c) Analysis of collagen papilla of dental germs.

d) Study of dental enamel.

44.Phototherapy consists of :

a) Exposure to daylight.

b) Exposure to polychromatic polarized light.

c) Exposure to the laser light.

d) Exposure to the light of LED.

45. What is the number of electromagnetic waves In a light beam ?

a) A single one.

b) Two.

c) Close to 10^{20}.

d) Close to 10^{3}.

46. Light beam propagates in a direction:

a) Parallel to the direction of oscillation of the electric field strenth vector $\vec{E}$.

b) Parallel to the direction of oscillation of the magnetic field induction vector $\vec{B}$.

c) Perpendicular to the direction of oscillation of the electric field intensity vector $\vec{E}$.

d) Perpendicular to the direction of oscillation of the electric field intensity vector $\vec{E}$ and to the direction of oscillation of the magnetic field induction vector $\vec{B}$.

47. Light waves are electromagnetic waves with a frequency in the range of:

a) $10^{14} \div 10^{15}$ Hz.

b) $10^{22} \div 10^{24}$ Hz.

c) $10^{8} \div 10^{10}$ Hz.

d) $10^{4} \div 10^{6}$ Hz.

48. The electromagnetic waves having the wavelenths in the range of 380nm÷750nm are:

a) Radiowaves.

b) Microwaves.

c) Visible light waves.

d) X -rays.

49. The polarizing filter is capable to polarize light due to:

a) Its dimensions.

b) Specific forms.

c) Its chemical composition.

d) Temperature at which it is maintained.

50. Polarimeter is a device used for measurements of :

a) Light absorption.

b) Light transmission.

c) Angle of the light polarization plane rotation.

d) Light intensity.

VII. Spectral analysis

1. The light scattering represent:
   a) return radius in environment from which came;
   b) deviations from the law of reflection;
   c) composing of light radiation;
   d) the phenomenon of variation of the refractive index depending on the wavelength.
2. When a monochromatic light beam passing through from glass to the air remains constant:
   a) wavelength;
   b) Frequency;
   c) the speed of propagation;
   d) direction of propagation.
3. The deviation angle D of a prism is determined according to the relation (where: A - angle prism; n - refraction index of the prism):

a) $D = (n^2 - 1) \cdot A$;
b) $D = (n + 2) \cdot A$;
c) $D = (n - 1) \cdot A$;
d) $D = (n + 1) \cdot A$.

4. The atom represents the elementary particle composed of:
   a) nucleus with positive electric charge;
   b) electrons with a negative charge;
   c) neutrons with neutral electrical charge;
   d) all answers are correct.
5. The nucleus of the atom is composed of:
   a) nucleons with positive electric charge;
   b) positively charged protons;
   c) neutrons with neutral electrical charge;
   d) all answers are incorrect.
6. The number of electrons rotating around the nucleus coincides with:
   a) the number of protons in the nucleus;
   b) the number of neutrons in the nucleus;
   c) order number on the periodic table;
   d) all answers are incorrect.
7. Bohr's first postulate consists of:
8. Bohr's second postulate consists of:
9. Atom excitation is accompanied by:
   a) Its transition to a higher energy level;
   b) Its transition to a lower energy level;
   c) rotation around its axis;
   d) no changes.
10. Atom deexcitation is accompanied by:
    a) Its transition to a higher energy level;
    b) Its transition to a lower energy level;
    c) rotation around its axis;
    d) no changes.
11. Physical method for analysis used to determine the chemical composition of various substances by using the spectra is named:
    a) Spectroscopy;
    b) quantitative spectral analysis;
    c) qualitative spectral analysis;
    d) analysis based on emitted spectrum.
12. Physical method for analysis used to determine the amount of chemical elements, by means of spectra is named:
    a) Spectroscopy;
    b) quantitative spectral analysis;
    c) qualitative spectral analysis;
    d) analysis based on emitted spectrum.
13. The emission spectrum represents:
    a) radiation of different wavelengths that atom is able to emit them;
    b) all radiation of different wavelengths on an atom is able to absorb;
    c) some radiation of different wavelengths on an atom is able to absorb or emit;
    d) all answers are incorrect.
14. The absorption spectrum represents:

a) radiation of different wavelengths that atom is able to emit them;
b) all radiation of different wavelengths on an atom is able to absorb;
c) some radiation of different wavelengths on an atom is able to absorb or emit;
d) all answers are incorrect.

15. Spectrul de absorbție este caracterizat prin:
a) the presence of dark lines or bands;
b) They may be in the form of lines, bands or continuous;
c) a continuous background;
d) the presence of dark lines or bands placed against a background of continuous spectrum.

16. Kirchhoff's law expressing the connection between the spectrum of emission and absorption of a substance says:
a) The substance can not absorb electromagnetic radiation;
b) The substance absorbs radiation only if a power source emits many wavelengths;
c) The substance absorbs radiation only when an energy source emits a single wavelength;
d) The substance absorbs radiation at those wavelengths that is able to issue them.

17. Visible spectrum is represented by electromagnetic radiation with wavelengths between about:
a) 760 μm şi 400 μm;
b) 760 nm şi 400 nm;
c) 760 nm şi 400 m;
d) 1260 nm şi 400 nm.

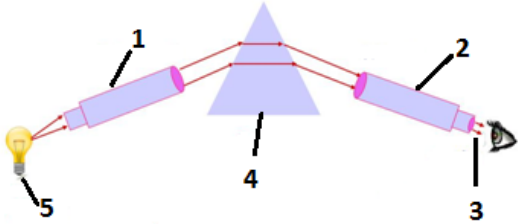
18. 
In the image above is represented:
a) an emission spectrum;
b) absorption spectrum;
c) a continuous spectrum;
d) light scattering.

19. 
In the image above is represented:
a) an emission spectrum;
b) absorption spectrum;
c) a continuous spectrum;
d) light scattering.

20. 
In the image above is represented:
a) an emission spectrum;
b) absorption spectrum;
c) a continuous spectrum;

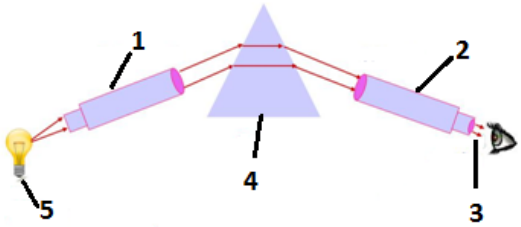
d) light scattering.

21. The light scattering occurs when:
    a) the beam of light is monochromatic;
    b) the beam of light passes through a diffraction grating;
    c) the beam of light passes through a prism of any material;
    d) all answers are incorrect.
22. When the light pass through an optical prism occurs:
    a) light diffraction;
    b) changes direction;
    c) light scattering;
    d) avoids the prism.
23. Newton has shown that the refractive index of the glass depends on the (when the light passes trough the optical prism):
    a) light wave frequency;
    b) Wavelength;
    c) the velocity of light;
    d) thickness of the prism.
24. The laser is a source of energy (in terms of λ):
    a) Ordinary;
    b) with a high energy;
    c) monochromatic;
    d) Polychromatic.
25. 

    In the picture adjacent is represented:
    a) a polarimeter;
    b) a spectrograph;
    c) a spectroscope;
    d) a refractometer.
26. The refractive index of a substance, under the same conditions depends on the:
    a) the intensity of light;
    b) light frequency;
    c) direction of the light;
    d) absorption coefficient.
27. 

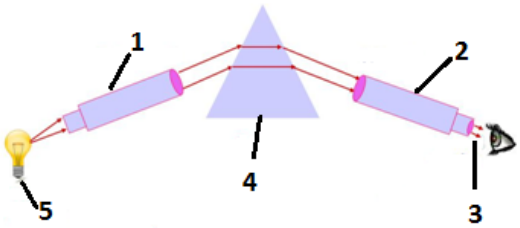
In the nearby picture element number 1 shows:

a) light source;
b) Telescope;
c) collimator;
d) Objective;
e) The prism.

28. 

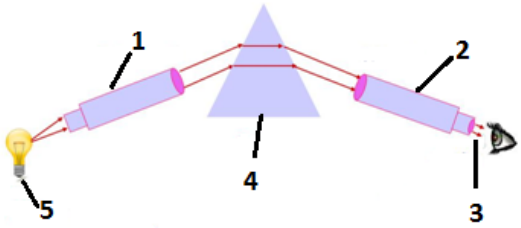
In the nearby picture element number 2 shows:

a) light source;
b) Telescope;
c) collimator;
d) Objective;
e) The prism.

29. 

In the nearby picture element number 3 shows:

a) light source;
b) Telescope;
c) collimator;
d) Objective;
e) all answers are incorrect.

30. 

In the nearby picture element number 5 shows:

a) light source;
b) Telescope;
c) collimator;
d) Objective;
e) spectral source.

31. If in the path of rays scattered by the optical prism, will put a screen, it will get:

a) a color image which is called spectrograph;
b) a color image which is called absorption spectrum;
c) a color image which is called spectrum;

d) a color image which is called emission spectrum.

32. The spectral lines emitted by an atom are caused by:
    a) the spectral lines absorbed by the atom;
    b) the phenomenon can not be explained by Kirchhoff's Law;
    c) electronic configuration of the atom whose they are;
    d) All answers are correct.
33. The spectral lines absorbed by an atom are caused by:
a) the spectral lines absorbed by the atom;
b) the phenomenon can not be explained by Kirchhoff's Law;
c) electronic configuration of the atom whose they are;
d) All answers are incorrect.
34. Stationary states of the atom can be called:
    a) energy state of the atom;
    b) circular and elliptical orbits of the electrons rotate around the nucleus without emitting or absorbing radiant energy;
    c) the passing electron energy levels if it is disrupted from the outside;
    d) all answers are correct.
35. Knowing the refraction angle of the prism and the deviation angle of the emerging beam, can be determined:
    a) intensity of incident light beam;
    b) only the incident angle;
    c) linear dimensions of the prism;
    d) the refractive index of the prism in relation to the environment.
36. When an atom absorbs energy from the outside it takes place:
    a) his transition to a higher energy level;
    b) his transition to a lower energy level;
    c) rotation around its axis;
    d) excitation of the atom.
37. When the atom emits a photon occurs:
a) his transition to a higher energy level;
b) his transition to a lower energy level;
c) rotation around its axis;
d) excitation of the atom.
38. When a monochromatic beam of light passing through the glass in air, <u>does not</u> remain constant:
    a) wavelength;
    b) Frequency;
    c) the speed of propagation;
    d) direction of propagation.
39. The light scattering <u>is not</u> represent by the:
    a) return radius in environment from which came;
    b) deviations from the <u>law of reflection</u>;
    c) composing of light radiation;
    d) the phenomenon of variation of the refractive index depending on the wavelength.
40. The nucleus of the atom <u>is not</u> composed of:
a) nucleons with positive electric charge;

b) positively charged protons;
c) neutrons with neutral electrical charge;
d) all answers are incorrect.

41. The number of electrons rotating around the nucleus doesn't coincide with:
a) the number of protons in the nucleus;
b) the number of neutrons in the nucleus;
c) order number on the periodic table;
d) all answers are incorrect.

42. There is two types of spectral analysis:
a) quantitative and numerical,
b) analytic and quantitative,
c) quantitative and qualitative,
d) none of those.

43. There is two types of spectra:
a) the emission and the absorption spectra,
b) the linear and the continuous spectra,
c) the emission and the continuous spectra,
d) the linear and the emission spectra.

44. The spectral analysis is:
a) a method of analyzing the properties of matter from their electromagnetic interactions,
b) the study of human activity in the past, primarily through the recovery and analysis of the material culture and environmental data that has been left behind by past human populations,
c) a method of physical analysis used for chemical composition determination of different substances,
d) the study of celestial objects, the physics, chemistry, and evolution of such objects, and phenomena that originate outside the atmosphere of Earth.

45. The emission spectrum
a) is the pattern of dark lines and colors made when electromagnetic energy, such as light, passes through a substance and excites its atoms,
b) is the pattern of dark lines and colors made when light passes through an absorbing medium, such as a gas or liquid,
c) can be used to determine the substance's chemical composition,
d) can be used to identify the composition of different substances, such as the gaseous outer layers of stars.

46. The third Kirchhoff's law of spectroscopy says:
a) a hot solid object produces light with a continuous spectrum,
b) a hot solid object surrounded by a cool tenuous gas (cooler than the hot object) produces light with an almost continuous spectrum which has gaps at discrete wavelengths depending on the energy levels of the atoms in the gas,
c) a hot tenuous gas produces light with spectral lines at discrete wavelengths (specific colors) which depend on the energy levels of the atoms in the gas,
d) none of those.

47. The continuous spectrum is:
    a) energy at all wavelengths,
    b) energy at only certain wavelengths,
    c) bright lines,
    d) dark lines.

48. The phenomena that causes light of different colors to be refracted differently and to leave the prism at different angles, creating an effect similar to a rainbow is called:
    a) diffraction,
    b) dispersion,
    c) reflection,
    d) refraction.

49. The visible light spectrum is the very narrow band of wavelengths located/ coresponding to:
    a) the right of the ultraviolet region and to the left of the infrared region,
    b) the right of the infrared region and to the left of the ultraviolet region,
    c) a wavelength range of 400 -700 nanometers (nm),
    d) a wavelength range of 400 -700 milimeters (mm).

50. The Prism Spectroscope doesn't include as a part of it
    a) the slit and collimator,
    b) the mirror,
    c) the telescope,
    d) the scale.

VIII. Radioactivity

1. The atom consists of:

2. Radiation is:

3. Non-ionising radiation is a type of radiation:

4. Ionising radiation is a type of radiation:

5. Select the right type of radiation, that involves the following: It is composed of two protons and two neutrons, it is a nucleus of the element helium, these particles are also very dense which, with their strong positive charge, precludes them from penetrating more than an inch of air or a sheet of paper:

6. Select the right type of radiation that involves the following: It consists of **negatively charged** particles emitted from an atom in the process of decay. These particles are relatively light and can penetrate only through a few millimeters of aluminum at best.

7. Select the right type of radiation, that involves the following: It represents one extreme of the electromagnetic spectrum, particularly that radiation with the highest frequency and shortest wavelength and can pass through virtually anything, but stopped by materials of high atomic weight such as lead

8. In a stable, neutral atom:

9. The radioactivity is:

10. The radioactive disintegration is:

11. The nucleus of an atom has the general symbol ${}_{Z}^{A}X$, where:

12. The alfa radiation represents:

13. The beta radiation represents:

14. The beta radiation represents:

15. The alfa radiation represents:

16. The correct form of the alfa decay formula is:

17. In the result of the radioactive decay, the following radiations can be emitted:

18. In the result of the radioactive decay, the following subatomic particles can be emitted:

19. In the result of the radioactive decay, the following subatomic particles can be emitted:

20. In the result of the radioactive decay, the following electromagnetic waves can be emitted:

21. In the result of the alfa radioactive decay, the resulted nucleus will:

22. As a result of an alpha decay, the nucleus of the obtained atom, in the periodic system:

23. Beta decay is:

24. Beta decay is:

25. The correct form of the beta decay formula is:

26. As a result of an beta decay, the nucleus of the obtained atom, in the periodic system:

27. A beta plus β^+ radiation is:

28. A beta plus (β^+) radiation is:

29. The fastest radioactive radiation is:

30. The radiation with the highest penetration capacity is:

31. The radiation with the highest ionization capacity is:

32. The law of radioactive decay is:

33. The expression for the half-life time of radioactivity is:

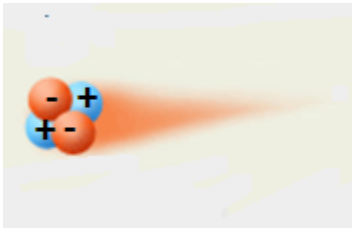
34. The unit of measurement for the activity of the absorbed dose of radiation is:

35. The unit of measurement for the activity of the radioactive source is:

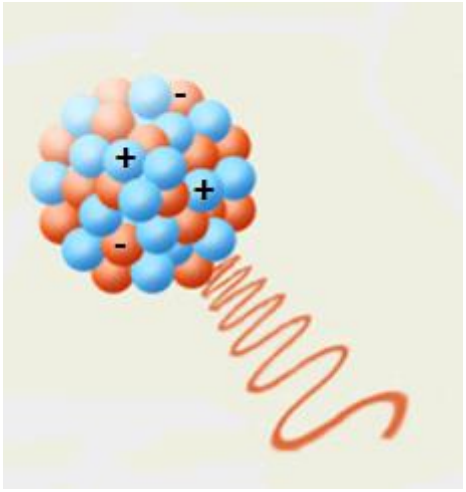
36. The unit of measurement for the effects of ionizing radiation on living material is:

37. The roentgenologic system for measuring the absorbed dose of radiation may be applied:

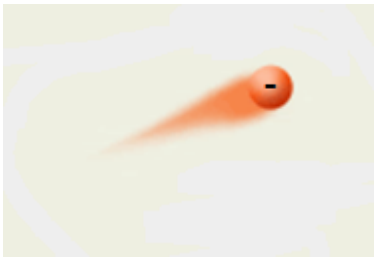
38. The presented image illustrates:



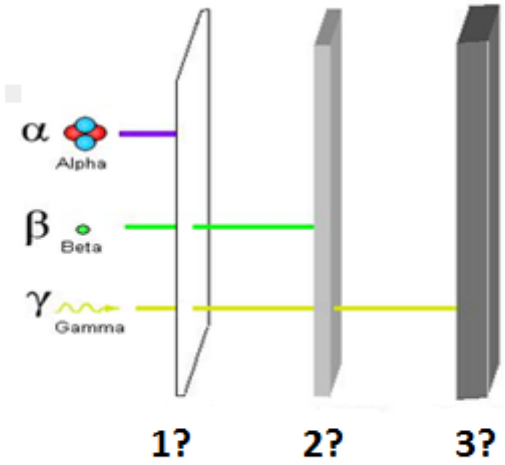
39. The presented image illustrates:



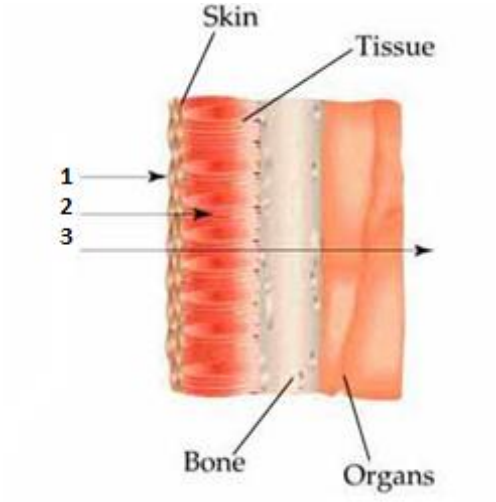
40. The presented image illustrates:



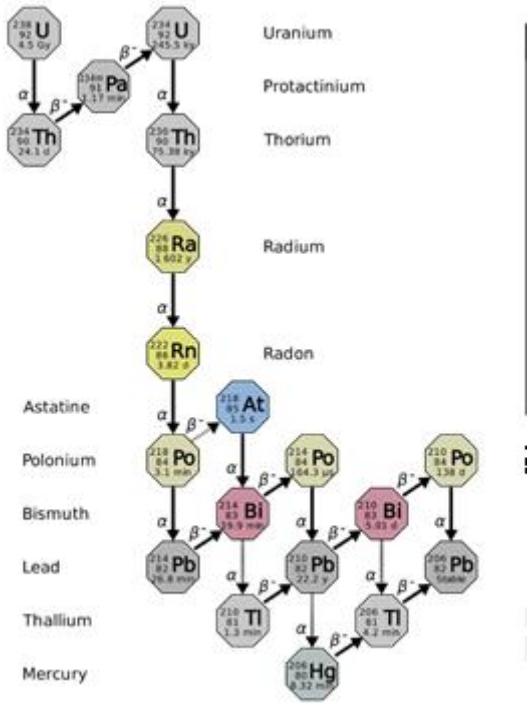
41. In the following picture, put in order the types of materials, according to the capacity of penetration of the radiations:



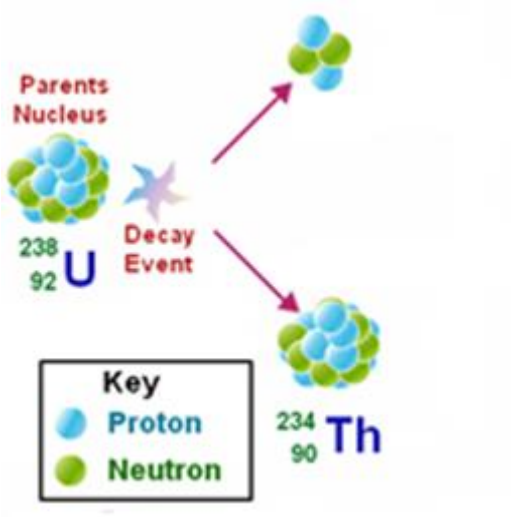
42. In the following picture, put in order the types of radiations, according to the capacity of penetration of the radiations:



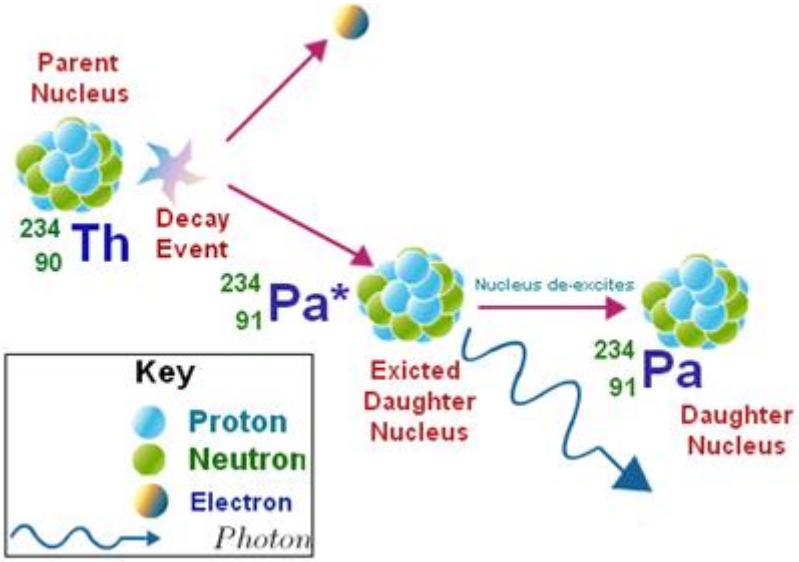
43. The presented image illustrates:



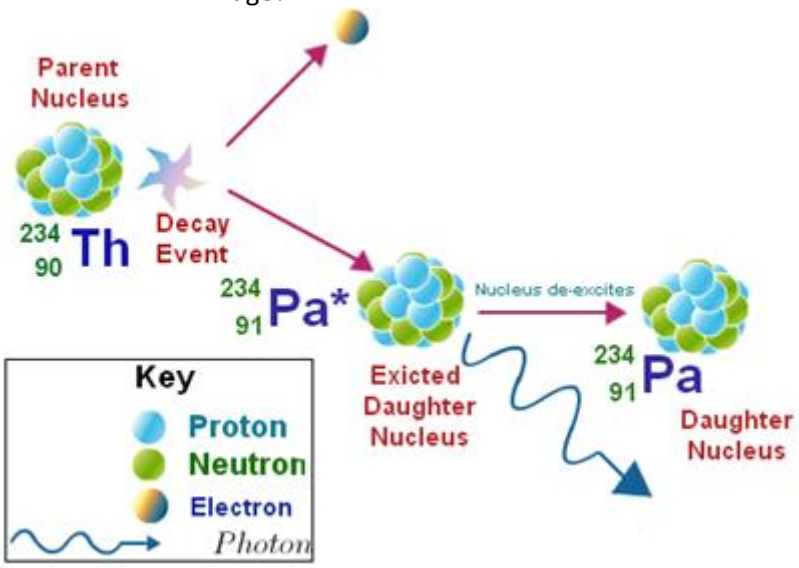
44. The presented image illustrates:



45. The presented image illustrates:



46. What are the emitted types of radiation during the radioactive decays illustrated in the image?



47. The Half-life constant, in radioactivity, describes:

48. The time required for one half the atoms of a given amount of a radioactive substance to disintegrate is called:

49. When a cell absorbs radiation, the possible effects on the cell are:

50. When a cell absorbs radiation, the possible effects on the cell are:

51. Nuclear radiation detectors serve to:

52. The Geiger–Müller counter, also called a Geiger counter, is an instrument used for:

IX. Fotocolorimetry

1. A light wave is:
a. An electromagnetic wave that travels through the vacuum of outer space
b. A mechanical wave that travels through all types of matter
c. An electromagnetic radiation within a certain portion of the electromagnetic spectrum
d. A mechanical wave which frequency range between 20 Hz and 20000Hz

2. An electromagnetic wave is a:
a. Transverse wave that has both an electric and a magnetic component
b. Transverse wave that has only an electric component
c. Longitudinal wave that has both an electric and a magnetic component
d. Longitudinal wave that has only a magnetic component

3. Electromagnetic radiation can be described in terms of
a. An oscillation of matter that transfers energy through a medium
b. A stream of photons which are massless particles each travelling with wavelike properties at the speed of light
c. An energy traveling in the form of particles or waves in bundles of energy called photons
d. All answers are correct

4. The light is characterized by multiple sizes as:
a. the flow of light
b. light intensity
c. transparency
d. reflection

5. The amount of energy carried by electromagnetic wave through a certain surface per unit of time is called:
a. the flow of light
b. light intensity
c. absorption of the light
d. transmittance of the light

6. The amount of energy carried by the wave of light in a unit time through a unit surface, perpendicular to the direction of propagation of the wave is called:
a. the flow of light
b. light intensity
c. absorption of the light
d. transmittance of the light

7. The phenomenon in which the light intensity attenuation when passing through any substance as a result of the transformation of light energy into other forms of energy, is called:

a. reflection of light
b. refraction of the light
c. absorption of the light
d. transmittance of the light

8. Absorption of light can cause:
a. warming substances
b. ionization
c. excitation of atoms or molecules
d. chemical processes

9. Visible and infrared radiation, which is absorbed by the skin, it causes:
a. cavitation in the cells
b. dehydration of the body
c. warming of the body
d. changes at the DNA level in the cells

10. Ultraviolet radiation, which is absorbed by the skin, it:
a. causes photochemical reactions, absorbed in the upper layer of the skin, as a result the skin tans areas
b. it forms the pigment color dark Tan
c. dehydration of the body
d. changes at the DNA level in the cells

11. The visible spectrum of electromagnetic radiation has limits between:
a. 400-900nm
b. 400-700nm
c. 400-700mm
d. 400-900mm

12. Absorption law of a parallel beam of monochromatic light, in a homogeneous medium was discovered by:
a. Bouguer and developed by Lambert
b. Newton and developed by Einstein
c. Beer and developed by Lambert
d. Einstein and developed by Bouguer

13. Bouguer-Lambert law establishes that:
a. the monochromatic absorption coefficient of colored solutions is inverse proportional with its concentration
b. the monochromatic absorption coefficient of colored solutions is direct proportional with its concentration
c. the intensity of the light (or the flow of light) decrease with increasing thickness d of the layer, when passing through it, by an exponential law
d. the intensity of the light (or the flow of light) increase with increasing thickness d of the layer, when passing through it, by an exponential law

14. Lambert Beer's law establishes that:

a. the monochromatic absorption coefficient of colored solutions is inverse proportional with its concentration
b. the monochromatic absorption coefficient of colored solutions is direct proportional with its concentration
c. absorption of the monochromatic light in colorful solutions takes place according to law Bouguer-Lambert;
d. absorption of the polychromatic light in solutions takes place according to law Bouguer-Lambert;

15. Bouguer- Lambert law is described by the formula (where I_0- the incident light intensity, I_d- intensity of light that has passed through a layer of the thickness of the substance d, e – base of natural logarithms ($e = 2{,}72$) and k – coefficient of absorption of natural substance):

a. $I_d = I_o e^{kd}$
b. $I_d = I_o e^{-kd}$
c. $I_d = I_0 e^{-k_\lambda d}$
d. $I_d = I_0 e^{k_\lambda d}$

16. Bouguer- Lambert Beer's law is described by the formula:

a. $I_d = I_0 e^{-\chi_\lambda C d}$
b. $I_d = I_0 e^{\chi_\lambda C d}$
c. $k_\lambda = \chi_\lambda C$
d. $k_\lambda = -\chi_\lambda C$

17. Lambert Beer's law is described by the formula:

a. $I_d = I_0 e^{-\chi_\lambda C d}$
b. $I_d = I_0 e^{\chi_\lambda C d}$
c. $k_\lambda = \chi_\lambda C$
d. $k_\lambda = -\chi_\lambda C$

18. The monochromatic absorption coefficient of colored solutions is:

a. direct proportional with its concentration
b. inverse proportional with its concentration
c. given by the expression $k_\lambda = \chi_\lambda C$
d. given by the expression $k_\lambda = \boldsymbol{e}^{-\chi_\lambda C}$

19. Radiation can be considered as:

a. Energy traveling in the form of particles or waves in bundles of energy called photons
b. Electromagnetic waves
c. An oscillation of matter that transfers energy through a medium
d. Mechanical wave

20. Bouguer- Lambert law is described by the formula (whereΦ_0- the flow of incident light, Φ_d- the flow of light that has passed through a layer of d thick substance, e – base of natural logarithms ($e = 2{,}72$) and k – coefficient of absorption of natural substance):

a. $\Phi_d = \Phi_0 e^{kd}$
b. $\Phi_d = \Phi_0 e^{-k_\lambda d}$
c. $\Phi_d = \Phi_0 e^{-kd}$
d. $\Phi_d = \Phi_0 e^{k_\lambda d}$

21. The optical transmission (transparency) of the substance is:

a. the ratio of the intensity of the incident light intensity I_0 and the light that passed through the substance I_d
b. the ratio of the intensity of the light that passed through the substance I_d and incident light intensity I_0
c. determining which part of the light is absorbed by the substance(the solution)
d. determining which part of the light passes through the substance (the solution)

22. The optical extinction coefficient (optical density) of the substance is:

a. the ratio of the intensity of the incident light intensity I_0 and the light that passed through the substance I_d
b. the ratio of the intensity of the light that passed through the substance I_d and incident light intensity I_0
c. determining which part of the light is absorbed by the substance(the solution)
d. determining which part of the light passes through the substance (the solution)

23. The optical extinction coefficient (optical density) of the substance is:

a. the natural logarithm from the inverse value of the transmittance of the substance
b. the natural logarithm from the value of the transmittance of the substance
c. determining which part of the light is absorbed by the substance(the solution)
d. determining which part of the light passes through the substance (the solution)

24. The optical transmission (transparency) of the substance is:

a. the natural logarithm from the inverse value of the transmittance of the substance
b. the natural logarithm from the value of the transmittance of the substance
c. determining which part of the light is absorbed by the substance(the solution)
d. determining which part of the light passes through the substance (the solution)

25. In terms of light flows, the optical transmission coefficient can be expressed as:

a. $\tau = \frac{\Phi_d}{\Phi_0}$
b. $\tau = \frac{I_d}{I_0}$
c. $\tau = \frac{\Phi_0}{\Phi_d}$
d. $\tau = \frac{I_0}{I_d}$

26. In terms of intensity of light, the optical transmission coefficient can be expressed as:

a. $\tau = \frac{\Phi_d}{\Phi_0}$

b. $\tau = \frac{I_d}{I_0}$

c. $\tau = \frac{\Phi_0}{\Phi_d}$

d. $\tau = \frac{I_0}{I_d}$

27. The optical transmission coefficient(transparency) of the substanceis expressed as:

a. $\tau = \frac{\Phi_d}{\Phi_0}$

b. $\tau = \frac{I_d}{I_0}$

c. $\tau = \frac{\Phi_0}{\Phi_d}$

d. $\tau = \frac{I_0}{I_d}$

28. The optical extinction coefficient (optical density) of the substanceis expressed as:

a. $D = ln\left(\frac{1}{\frac{I_0}{I_d}}\right)$

b. $D = ln\left(\frac{1}{\tau}\right)$

c. $D = ln\left(\frac{1}{\frac{\Phi_0}{\Phi_d}}\right)$

d. $D = ln\left(\frac{1}{\frac{I_d}{I_0}}\right)$

29. The photovoltaic calorimeter is a device used to:

a. determine the concentration of oxygen in blood
b. determine the concentration of biochemical components in the painted solutions
c. measure the optical rotation of a substance
d. analyze the concentration, content and purity of the substances.

30. A photovoltaic calorimeter is a device that doesn't :

a. determine the concentration of oxygen in blood
b. determine the concentration of biochemical components in the painted solutions
c. measure the optical rotation of a substance
d. analyze the concentration, content and purity of the substances.

31. Pulse oximetry is a medical method:

a. for determining the blood oxygen saturation
b. for studying the variation of the absorption spectrum of blood depending on his oxygen saturation
c. for determining the concentration of glucose in blood
d. that measures the changing absorbance at each of the wavelengths, allowing it to determine the absorbance due to the pulsing arterial blood

32. Absorption spectra analysis applies in medicine to determine:
a. the blood oxygen saturation
b. the concentration of glucose in blood
c. the amount of many substances in blood, urine, saliva
d. speed of the blood flow through the blood vessel

33. A photo-colorimeter can't determine:
a. the blood oxygen saturation
b. the concentration of glucose in blood
c. the amount of many substances in blood, urine, saliva
d. speed of the blood flow through the blood vessel

34. In biology, a colorimeter can be used to:
a. increase the photosynthesis of unicellular plants
b. change the morphology of a bacterial or yeast culture
c. monitor the growth of a bacterial or yeast culture
d. measure the density of algae using absorbance colorimetry

35. As component parts of a photoelectric colorimeter may be:
a. a source of light
b. lens
c. photovoltaic cell
d. polarimeter

36. Choose the right relation for the transmission of a substance. (I_0 –incident light intensity, I_d - emerging beam intensity, *d*- the thickness of substance's layer, *k*-the coefficient of absorption).
a. $\tau = \frac{I_d}{I_0}$
b. $\tau = \frac{I_0}{I_d}$
c. $\tau = \exp(-kd)$
d. $\tau = I_0 \exp(-kd)$

37. Pick the right answer for the transmission of a substance:
a. it characterizes the decrease of the light intensity when it crosses through a layer of substance
b. it is a dimensionless physical size
c. it define the ratio between the incident beam intensity (I_0) and the emerging beam intensity(I)
d. it is always less than one ($\tau < 1$)

38. Pulse Oximetry:
a. is an invasive technique to diagnose the cardiac failure

b. it can be used to determine the heart rate thanks to the periodic variation of the layer's thickness of the investigated tissue;
c. it is a method of determination of the oxygenated hemoglobin concentration and reduced by the absorption's measurement of a piece of tissue at two wavelengths
d. is based on the measurement of the auto-fluorescence of the living tissue;