

ADMISSION SAMPLE TEST

SCHOOL OF MEDICINE
UNIVERSITY OF NAVARRA



Universidad
de Navarra

BIOLOGY EXAM

1. Which is a trace metal:

1. Na
2. K
3. Ca
4. Zn
5. Cl

2. Concerning the phenomenon of osmosis:

1. H₂O crosses a semi-permeable membrane from the side with a greater solute concentration to that with lesser concentration
2. If the two compartments have the same concentration, they are isotonic, and the phenomenon of osmosis will not occur
3. The solution in the more dilute compartment is hypertonic
4. The solution in the more concentrated compartment is hypotonic
5. In plant cells, if the medium in which they are located is hypotonic, H₂O leaves, and the cells and vacuoles contract

3. Collagen is a protein of type:

1. Reserve
2. Active
3. Structural
4. Contractile
5. Transporter

4. Regarding nucleic acids:

1. The duplication of DNA into two equal copies is denominated *replication*
2. The copying of a fragment of DNA into an RNA molecule is denominated *translation*
3. The synthesis of a protein from RNA is denominated *transcription*
4. mRNA transports amino acids to tRNA molecules
5. tRNA reproduces the genetic message of a fragment of DNA

5. All of the following are components of a prokaryotic cell, EXCEPT:

1. Plasma membrane
2. Mesosomes
3. Ribosomes
4. Cytoplasm
5. Nucleus

6. Which of the following (types of) molecules is inorganic?

1. Carbohydrates
2. Mineral salts
3. Lipids
4. Proteins
5. Nucleic acids

7. Carbohydrates are formed from:

1. Monosaccharides
2. Cholesterol
3. Amino acids
4. Vitamins
5. Water

8. Enzymes are:

1. Carbohydrates
2. Proteins
3. Lipids
4. Vitamins
5. Mineral salts

9. In which one of the following processes is energy needed?

1. Passive transport
2. Simple diffusion
3. Facilitated diffusion
4. Active transport
5. In the first three cases energy is needed

10. Which is the most abundant molecule in living matter?

1. ATP
2. Glucose
3. Cholesterol
4. Water
5. Vitamin D

11. Which one of the following groups of living beings does not have the category of Kingdom:

1. Animals
2. Plants
3. Fungi
4. Lichens
5. Monera

12. Order the taxonomic categories of a plant or animal, from lesser to greater:

1. Species, Genus, Family and Order
2. Order, Family, Genus and Species
3. Order, Genus, Family and Species
4. Genus, Family, Species, Order
5. Family, Genus, Order and Species

13. Yeasts are:

1. Moulds
2. Unicellular fungi
3. Mushrooms
4. Pluricellular fungi
5. Plants

14. At what level of organization of living beings does the material studied in histology belong?

1. Molecular
2. Cellular
3. Tissue
4. Organic
5. Taxonomic

15. The morphological and physiological building block / unit of the organism is:

1. The molecule
2. The cell
3. Tissue
4. The organ
5. The species

17. Membrane lipids are synthesized in:

1. Rough endoplasmic reticulum
2. Lysosomes
3. Smooth endoplasmic reticulum
4. Golgi body
5. Mitochondria

18. Regarding the plasma membrane:

1. It is made of a lipid mono-layer and proteins
2. The principal lipids that constitute it are: triglycerides, waxes, and cholesterol
3. The lipid layer is very permeable to ions and polar molecules
4. Proteins of the membrane are fundamentally peripheral
5. Some proteins of the membrane can act as receptor

19. In which one of the following processes is energy needed?

1. Passive transport
2. Simple diffusion
3. Facilitated diffusion
4. Active transport
5. In the first three cases energy is needed

20. The Golgi body is involved in:

1. The synthesis of phospholipids
2. The synthesis of proteins
3. Intracellular digestion
4. Processes of secretion
5. Processes of cellular respiration

21. About mitochondria:

1. The external membrane is made of a lipid monolayer
2. The inner membrane's principal components are proteins
3. The ATP synthase complex catalyzes the production of ADP from ATP
4. The principal function of mitochondria is the synthesis of carbohydrates
5. Mitochondria use proteins as their principal fuel

22. The phase of mitosis in which the mitotic spindle is complete and all the chromosomes are situated in equatorial plane is:

1. Anaphase
2. Telophase
3. Prophase
4. Prometaphase
5. Metaphase

23. The subphase of prophase of the 1st division of meiosis, in which chromosomal crossing-over occurs is denominated:

1. Leptotene
2. Zygotene
3. Pachytene
4. Diplotene
5. Diakinesis

24. Which of the following tissues covers the external surface of the organism?

1. Epithelium
2. Conjunctive tissue
3. Muscle
4. Nervous tissue
5. Bone

25. Which of the following is a type of connective tissue found in joints?

1. Loose fibrillar connective tissue
2. Adipose tissue
3. Cartilaginous tissue
4. Bone tissue
5. Mucous tissue

26. Which of the following blood cell types does NOT have a nucleus?

1. Erythrocyte
2. Lymphocyte
3. Neutrophil
4. Monocyte
5. Eosinophil

27. What is the structural unit of striated skeletal muscle?

1. Osteon
2. Sarcomere
3. Collagen
4. Platelets
5. Neuron

28. Which of the following structures does NOT form part of the neuron?

1. Glia
2. Soma
3. Dendrites
4. Axon
5. Nucleus

29. Which of the following tissues has the consistency of petrified matter?

1. Glandular tissue
2. Cardiac muscle
3. Adipose tissue
4. Bone tissue
5. Epithelial tissue

30. An individual who, for a certain trait, has the Aa genotype is referred to as being _____ with respect to that trait:

1. Recessive
2. Codominant
3. Phenotypic
4. Homozygotic
5. Heterozygotic

31. A gene is:

1. Synonymous with chromatin
2. Synonymous with chromosome
3. Any sequence of DNA
4. A sequence of nucleotides with information to synthesise a protein
5. A sequence of RNA

32. Mendel's first law is:

1. The law of uniformity
2. The law of segregation
3. The law of distribution
4. The law of evolution
5. The law of replication

33. What does Mendel's third law say?

1. Genes separate independently of each other
2. Alleles separate independently of each other
3. Traits separate independently of each other
4. Traits depend on each other to transmit themselves
5. Alleles depend on each other to transmit themselves

34. Daltonism is linked to a gene on chromosome X. What percentage of the descendants of a normal man and a normal woman, but a carrier of the gene for daltonism, will have the illness?

1. 100%
2. 75%
3. 50%
4. 25%
5. 0%

35. Bile is formed in:

1. The pancreas
2. Gall-bladder
3. The liver
4. The intestine
5. The stomach

36. Lack of Fe provokes:

1. Skeletal deformities
2. Anaemia
3. Night blindness
4. Frequent diarrhoea
5. Convulsions

37. Regarding circulation:

1. All vessels with oxygenated blood are arteries
2. All vessels that arrive at the heart are veins
3. The pulmonary arteries carry oxygenated blood from the lungs to the left auricle.
4. Circulation leaving the left ventricle - going through the aorta and returning to the right auricle through the venae cavae - is called pulmonary circulation
5. In a complete double circulatory system, oxygenated blood is mixed with non-oxygenated blood in the ventricle

38. The hypophysis (pituitary gland) is found in:

1. The cerebellum
2. The spinal cord
3. The encephalon
4. The medulla (oblongata)
5. The peripheral nervous system

39. Receptors sensitive to touch are:

1. Chemoreceptors
2. Thermoreceptors
3. Photoreceptors
4. Visceroreceptors
5. Mechanoreceptors

40. The secretion of hydrochloric acid occurs in the:

1. Mouth
2. Oesophagus
3. Stomach
4. Intestine
5. Appendix

41. Gaseous interchange occurs in:

1. The pulmonary alveoli
2. The bronchioles
3. The bronchi
4. The trachea
5. The nasal fossae

42. The functional unit of the kidney is:

1. The renal pelvis
2. The renal medulla
3. The renal cortex
4. The nephron
5. The ureters

43. Indicate which of the following concepts has no connection at all with reproduction:

1. Ovulation
2. External fecundation
3. Segmentation
4. Viviparity
5. Metamorphosis

44. Which of the following hormones diminishes the concentration of glucose in blood?

1. Insulin
2. Glucagon
3. Estrogens
4. Testosterone
5. Progesterone

45. The component of the eye that can change its aperture to adapt to light is the:

1. Lens
2. Conjunctiva
3. Cornea
4. Pupil
5. Retina

46. The contacts between neurons are called:

1. Axons
2. Dendrites
3. Synapses
4. Astrocytes
5. Schwann cells

47. Lysogeny can be defined as:

1. Cytopathic lysis
2. Lysis mediated by complement
3. Integrated latency
4. Partial lysis
5. Total lysis

48. What is the metabolic activity responsible for obtaining yogurt?

1. Fermentation
2. Aerobic respiration
3. Anaerobic respiration
4. Lithotrophy
5. Photosynthesis

49. The process by which particles are coated with antibody and complement in order to facilitate phagocytosis is called:

1. Chemotaxis
2. Opsonization
3. Margination
4. Neutralization
5. Compaction

50. The process of destruction of all forms of life is called:

1. Sterilization
2. Disinfection
3. Germination
4. Antisepsis
5. Autophagia

CHEMISTRY EXAM

1. What is the number of atoms present in a mol de ^{32}S ?
 1. 12
 2. 12.000
 3. 6.023×10^{23}
 4. 6.023
 5. 14
2. It is known that a sample of mineral sulphur contains 10 moles of S. How many atoms of S are there in that sample?
 1. 6.023
 2. 1.42×10^{24}
 3. 6.023×10^{24}
 4. 32
 5. 10
3. 0.1 moles de Ruthenium weigh 10.1 grams. The atomic weight of Ru is:
 1. 101g
 2. 10.1g
 3. 1.01g
 4. 0.1g
 5. 100g
4. The two natural isotopes of lithium, ^6Li and ^7Li , have atomic masses of 6.015 and 7.016 u respectively. Which of them has greater abundance in nature? (The atomic mass of Li is 6.94)
 1. ^6Li
 2. ^7Li
 3. Both are in the same proportions
 4. Depends on the height at which the sample is taken
 5. It is not possible to answer this question
5. With respect to an atom with the following parameters: $Z=1$, $N=2$, $A=3$, we can say that:
 1. It is an isotope of hydrogen
 2. Its atomic number is 2
 3. Its mass number is 2
 4. It is helium
 5. Both 2 and 4 are true

6. Which is the correct symbol for a species that contains 29 protons, 34 neutrons and 31 electrons?

1. ${}^{63}_{29}\text{A}^{-2}$
2. ${}^{34}_{29}\text{A}^{27}$
3. ${}^{29}_{63}\text{A}$
4. ${}^{63}_{29}\text{A}^{+2}$
5. ${}^{27}_{29}\text{A}^{+2}$

7. Which of the following species has the same number of protons and electrons?

1. ${}^{47}_{24}\text{Cr}$
2. ${}^{60}_{27}\text{Co}^{+3}$
3. ${}^{24}_{12}\text{Mg}^{+2}$
4. ${}^{120}_{38}\text{Sn}^{+2}$
5. ${}^{35}_{17}\text{Cl}^{-}$

8. Which is true with regard to atomic magnitudes?

1. The atomic number (Z) indicates the number of electrons of an atom
2. The mass number (A) indicates the total number of protons and electrons of an atom
3. The number of neutrons of an atom is given by $A-Z$
4. An atomic mass unit is defined as the mass of an atom of carbon-12
5. The mass of an electron is 2000 times greater than that of a proton

9. Which of the following belongs to the alkali metal elements of the periodic table?

1. Fe
2. Li
3. Ca
4. C
5. Br

10. Which of the chemical formulae does NOT correspond with the name given?

1. HCl hydrogen chloride
2. Ba_2O barium oxide
3. CaF_2 calcium fluoride
4. Na_2S sodium sulphide
5. Cu_2O copper oxide

11. Identify the atomic number of the element that has the following electron configuration: $1s^2 2s^2 2p^6$:

1. 17
2. 8
3. 18
4. 15
5. 10

12. Calculate the number of molecules contained in 34.2 g of saccharose ($C_{12}H_{22}O_{11}$) (molecular weight = 342 g/mol):

1. 1.2×10^{24}
2. 1.1×10^{26}
3. 6.023×10^{22}
4. 6.7×10^{16}
5. 4×10^{25}

13. How many grams of NaCl (MW = 58.5) are required to prepare 100 ml of 1 M aqueous solution?

1. 0.012 g
2. 12.83 g
3. 5.85 g
4. 01.28 g
5. 43830 g

14. Hydrochloric acid 37% (weight-weight percentage) has a density of 1.19 g/ml. What quantity of water will it be necessary to add to 10 ml of this acid to obtain a 2 M solution? (MW of HCl = 36.5):

1. 50 ml
2. 14 ml
3. 28 ml
4. 3 ml
5. 10 ml

15. What is the geometry of the electrons around a C atom in ethylene:

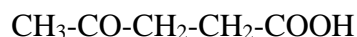
1. Octahedral
2. Tetrahedral
3. Triangular
4. Hexahedral
5. Pentahedral

16. Which is the correct name (IUPAC) for the hydrocarbon:



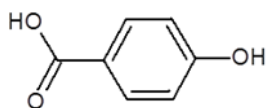
1. Octane
2. 2,4,4-trimethylpentane
3. 2-methyl-4-ethyl-propane
4. 2,2,4-trimethylpentane
5. 4,2,2-trimethylpentane

17. What are the functional groups present in the compound:



1. Ester and amine
2. Amine and alcohol
3. Ether and carboxyl group
4. Aldehyde and amide
5. Ketone and carboxyl group

18. Identify the functional groups in the following compound:



1. Aldehyde, hydroxyl and aromatic ring
2. Carboxyl, aromatic ring and hydroxyl
3. Amide and aldehyde
4. Ester and alcohol
5. Ketone and alcohol

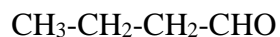
19. The functional groups present in natural amino acids are:

1. Carboxyl
2. Amino
3. Amide
4. Hydroxyl
5. All of the above

20. The bonds that can be found in the glycerophospholipids present in the plasma membrane are:

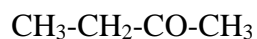
1. Phosphoester
2. Acetal
3. Amide
4. Glycosidic
5. All of the above

21. Identify the functional group possessed by the organic molecule:



1. Alcohol
2. Aldehyde
3. Ketone
4. Ether
5. Ester

22. Identify the functional group possessed by the organic molecule:

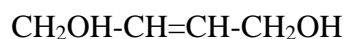


1. Ether
2. Ketone
3. Aldehyde
4. Alcohol
5. Ester

23. What type of bond is it necessary to break in order to melt ice?

1. Covalent bonds
2. Ionic bonds
3. Hydrogen bonds
4. Van der Waals forces
5. Metallic bonds

24. Name the following compound:



1. 1,2 butanediol
2. 1,2 butanediona
3. 1,2 butenal
4. 2,6-buten-1,4diol
5. 2-butyne-1,4diol

25. Calculate the number of molecules contained in 2 moles of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) (atomic masses: C= 12 u; H: 1 u; O=16 u):

1. 2×10^{22}
2. 1.1×10^{15}
3. 1.8×10^{28}
4. 6.7×10^{21}
5. 1.2×10^{24}

26. Lavoisier's Law is also known as:

1. The law of multiple proportions
2. The law of conservation of matter or mass
3. The law of chemical equilibrium
4. The law of ideal gases
5. The law of defined proportions

27. How many grams of glucose are required to prepare 500 ml of 0.2 M aqueous solution?

1. 360 g
2. 18 g
3. 1.8 g
4. 5.55 g
5. 0.9 g

28. How many ml of sulphuric acid 90% are required to prepare 360 ml of sulphuric acid 20%?

1. 16.2 ml
2. 44 ml
3. 5.14 ml
4. 4 ml
5. 80 ml

29. Hydrochloric acid 36.5% by weight has a density of 1.25 g/ml. Calculate its molarity (MW of HCl = 36.5):

1. 12.5 M
2. 1 M
3. 1.25 M
4. 17.1 M
5. 3.6 M

30. The process of distillation for separation of substances is based on differences in:

1. Weight
2. Net charge
3. Density
4. Size
5. Boiling point

31. The process that consists of a change of state from solid to gas without passing through the liquid state is known as:

1. Sublimation
2. Vaporization
3. Combustion
4. Fusion
5. Condensation

32. Calculate the degree of ionization of a weak acid at a concentration of 0.2 M if its K_a is 2×10^{-7} :

1. 0.1%
2. 5%
3. $4 \times 10^{-6}\%$
4. 0.001%
5. 100%

33. If the ionization constant of a weak base is 5×10^{-7} , the constant of its conjugate acid will be:

1. 2×10^{-8}
2. 5×10^{-21}
3. 5×10^7
4. 2×10^6
5. This cannot be calculated without knowing the identity of the base

34. The pH of a solution of a 0.001 M weak acid is 4. Calculate the K_a of the acid:

1. 0.01
2. 2.5×10^{-8}
3. 10^4
4. 10^{-5}
5. 10^{-3}

35. The pH of a 5 M solution of Ca(OH)_2 will be:

1. 13.80
2. 13.60
3. 13.30
4. 13.00
5. 12.00

36. In the acid-base titration of 200 ml of a solution of hydrochloric acid with 0.2 M NaOH, the equivalence point is reached after adding 50 ml of NaOH. Determine the concentration of HCl in the original solution:

1. 0.00062 M
2. 0.001 M
3. 0.05 M
4. 0.1 M
5. 0.125 M

37. With regard to the action of a catalyst on a chemical reaction:

1. It does not modify the change in free energy of the reaction
2. It accelerates arrival at the equilibrium point
3. It diminishes the activation energy
4. All the previous answers are true
5. All the previous answers are false

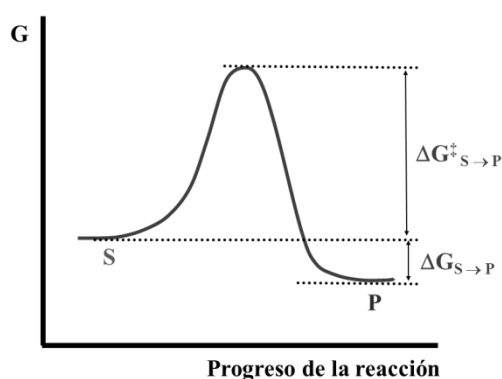
38. The state of maximum energy over the course of a chemical reaction is known as:

1. The state of instability
2. The exergonic point
3. The Bohr point
4. The transition state
5. The activation state

39. In a first order reaction, the rate of the reaction is:

1. Directly proportional to the concentration of one of the reagents
2. Directly proportional to the concentration of all of the reagents
3. Directly or inversely proportional to the concentration of all of the reagents
4. Proportional to the product of the concentrations of all of the reagents
5. Independent of the concentrations of the reagents

40. According to the following diagram (in which the x axis is progress of the reaction):



The parameter ΔG^{\ddagger} represents:

1. The activation energy
2. The standard change in free energy of the reaction
3. The entropy of the system
4. The change of enthalpy of the reaction
5. The work done

41. In the same diagram, the parameter ΔG^{\ddagger} affects:

1. The amount of heat liberated
2. The irreversibility of the process
3. The free energy liberated in the process
4. The spontaneity of the process
5. The rate of the process

42. According to Hess's Law, in a series of processes:

1. Equilibrium constants become normalized
2. The removal of products displaces the process to the left
3. Changes in enthalpy are summative
4. Tend towards greater entropy
5. The amount of work must remain constant

43. Applying the Le Chatelier principle to the reaction $A(g) + B(g) \leftrightarrow C(g)$ $\Delta H^{\circ} = -15$ kJ, indicate the correct answer:

1. On increasing the concentration of A, the system displaces to the left
2. On increasing the pressure of C, the system displaces to the right
3. On increasing the volume of the container, the system displaces to the right
4. On decreasing the temperature, the system displaces to the right
5. On increasing the concentration of B, the change of entropy increases

44. In the molecule NH_4NO_3 , the oxidation numbers of the nitrogens are:
1. -3 and +5
 2. -4 and +3
 3. +3 and +3
 4. -4 and +6
 5. -2 and +8
45. With regard to the combustion reaction of glucose, $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$:
1. The O_2 acts as reducing agent
 2. The carbons of the glucose are oxidized
 3. The oxidation number of the C is constant
 4. It is an endothermic process
 5. The O_2 donates electrons
46. A volt meter applied to two points of an electrical circuit measures the difference in:
1. Amperes
 2. Resistance
 3. Potential
 4. Solubility
 5. Charge
47. If a compound has a positive standard reduction potential (E^0):
1. It cannot be oxidized
 2. It has a greater affinity for electrons than for H^+
 3. In an electrolytic battery, it acts always as anode
 4. It cannot react with another compound that also has a positive E^0
 5. All of the previous statements are false
48. The conjugate acid of CO_3^{2-} will be:
1. HCO_3^-
 2. H^+
 3. H_2CO_3
 4. CO_2
 5. HCO_3

49. You have a 12M solution of H₂SO₄. To prepare 250 cm³ of 0.40M solution of H₂SO₄ it will be necessary to:

1. Mix 3.3 cm³ of H₂SO₄ with 250 cm³ of water
2. Make a dilution to a volume 25 times greater and take 250 cm³ of that solution
3. Dilute 8.33 cm³ of the available H₂SO₄ until you reach a total volume of 250 cm³
4. Mix 2 cm³ of H₂SO₄ and 1200 cm³ of water and take 250 cm³ of this solution
5. None of the above

50. A solution of potassium permanganate (MW=158) prepared by dissolving 15.8 g of salt in water and topping up to 200 cm³, has molarity:

1. 0.25 M
2. 0.50 M
3. 0.75 M
4. 1.00 M
5. 1.50 M

PHYSICS EXAM

1. The ratio between the displacement vector between two positions and the interval of time that has passed is given the name:

1. Instantaneous velocity vector
2. Average speed
3. Average velocity vector
4. Average acceleration vector
5. Average position vector

2. Regarding normal acceleration (a_n) in circular movement, it is true to say that:

1. It is an extrinsic component of acceleration
2. Its value is always greater than zero
3. It will be positive if the magnitude of the velocity increases over time and negative if this decreases
4. It is independent of the radius of curvature of the trajectory
5. It expresses the variation in magnitude of the velocity

3. A spring gets longer by 20 cm when we apply a force of 24 N to it. Calculate the value of the constant of elasticity (the stiffness) of the spring:

1. 1.2 N/m
2. 480 N/m
3. 120 N/m
4. 4.8 N/m
5. 0.83 N/m

4. Regarding gravitational forces between two particles of matter, it is true that:

1. They have the same direction
2. The direction is different
3. They are always attractive
4. They are of great intensity between bodies whose masses are relatively small
5. They are scalar magnitudes

5. Newton's third law refers to:

1. The property of bodies that opposes any change in their state of rest or movement
2. The fundamental law of dynamics
3. The conservation of the quantity of movement
4. The principle of action and reaction
5. The impulse produced by a force on a body over the time during which it is applied

6. Regarding the frictional force that acts on bodies in movement, indicate which statement is FALSE:

1. It has a direction that is perpendicular to the surface of sliding
2. The sense is opposite to the velocity
3. Its magnitude is proportional to the magnitude of the normal force, N , that acts on the body
4. The coefficient of kinetic friction is a non-dimensional number
5. It is the force that appears in the surface of contact between bodies

7. The force that is needed to be applied to a body in order that it follows a circular trajectory, that is, the centripetal force, is:

1. Inversely proportional to the square of the radius of turn and directly proportional to the magnitude of the velocity
2. Directly proportional to the magnitude of the velocity and to the square of the radius of turn
3. Inversely proportional to the mass of the body
4. Directly proportional to the square of the magnitude of the velocity and inversely proportional to the radius of turn
5. Directly proportional to the angular velocity

8. Of the following forces, indicate which is NOT conservative:

1. The force of friction
2. The weight of bodies
3. The elastic force of a spring
4. Electrical forces
5. Gravitational force

9. The electrostatic potential energy (E_p) of charge (q) when an electric field generated by a charge (Q) acts on it is:

1. Directly proportional to the sum of the charges
2. Inversely proportional to the distance between the two charges
3. Inversely proportional to the square of the distance between the two charges
4. Directly proportional to the sum of the squares of the charges
5. Inversely proportional to the constant of proportionality

10. Regarding the intensity of electric current, indicate the correct statement:
1. It is the ratio between the work done and the time used to carry it out
 2. It is the electrostatic potential energy that a unit of positive electric charge situated at a point would have
 3. Its SI unit is the Joule (J)
 4. Between two points, it is the work necessary to move a unit of charge
 5. It is the quantity of charge that passes through a cross-section of a conductor per unit of time
11. Of the characteristics of electrical resistance it is true that:
1. It increases with the cross-section of the conductor
 2. It does not depend on the material the conductor is made of
 3. It increases with the length of the conductor
 4. Its SI unit is the ampere (A)
 5. In a metallic conductor, it does not vary with temperature
12. Regarding the frequency of periodic movement, it is true that:
1. It is an inverse function of the period
 2. In SI units, it is expressed in seconds
 3. It is defined as the time between two successive situations with the same kinematic characteristics.
 4. It is represented by the letter T
 5. Frequency depends on amplitude
13. With regard to wave movement, indicate the correct answer:
1. Electromagnetic waves need a material medium for their propagation
 2. Mechanical waves do not need a material medium to propagate; they can propagate in a vacuum
 3. There is no transport of matter, but there is transport of energy
 4. In transverse waves the direction of propagation coincides with the direction in which the perturbation takes place
 5. In longitudinal waves the direction of propagation is perpendicular to the direction in which the perturbation takes place
14. In wave movement, the name for the geometric location of points of the perturbation reached at the same time is:
1. Node
 2. Phase
 3. Phase opposition
 4. Wavefront
 5. Wavelength

15. In the phenomenon of wave reflection, it is true that:
1. The direction of incidence of the wave, the direction of departure and the normal to the surface of reflection are in distinct planes
 2. The angle of incidence and that of reflection are related by Snell's law
 3. It is observed when the wave hits an obstacle whose size is of the same order of magnitude as the wavelength
 4. The angle of incidence is equal to the angle of reflection
 5. It only happens when the phenomenon of refraction does not occur
16. The visual deformation of a pencil introduced in water is due to the phenomenon of:
1. Refraction
 2. Specular reflection
 3. Diffuse reflection
 4. Total reflection
 5. Interference
17. The only magnitude of a wave that does not vary on changing the medium is:
1. The wavelength
 2. The frequency
 3. Propagation velocity
 4. Wave amplitude
 5. Phase
18. A photon of violet light has more energy than a photon of red light because:
1. The frequency of violet light is higher
 2. The frequency of violet light is lower
 3. The wavelength of violet light is greater
 4. The wavelength of red light is shorter
 5. The two have the same energy
19. The SI unit of electrical capacitance is the:
1. Volt
 2. Newton
 3. Ampere
 4. Farad
 5. Joule

20. Indicate which of the following statements is correct:

1. A magnetic field is a field of conservative forces
2. The value of magnetic permeability is the same in all mediums
3. A magnetic field is characterized by the value of the magnetic potential at each point in the field
4. The equations that describe the gravitational field are analogous to those that describe the electric field
5. In the gravitational field, the work necessary to displace a mass between two points in the field depends on the trajectory taken

21. Of the following statements indicate which is the correct one:

1. Electromagnetic waves are transverse waves
2. The velocity of light is the same in all mediums
3. X rays have a longer wavelength than visible light
4. Microwaves have a higher frequency than visible light
5. The wavelength of visible light is between 4000 and 7000 nm

22. If the equation for a harmonic wave is: $y = 0.05 \sin \pi (4t - 5x)$ where x and y are in metres and t , in seconds. The value of the wavelength is:

1. 0.4 m
2. 0.5 m
3. 2.5 m
4. 4.5 m
5. 1.5 m

23. If the effect of a force on a body is to do work that only depends on the initial point and the end point and not the route taken, then:

1. The body's velocity is zero
2. The body's velocity is constant
3. The movement undergone is accelerated
4. The body is subject to the action of a conservative force
5. The body's velocity slows down until it stops

24. If a body that moves in a gravitational field falls in height but does not dissipate energy, then we can say that in terms of energy:

1. Potential increases, kinetic decreases, mechanical increases
2. Potential decreases, kinetic and mechanical increase
3. Potential increases, kinetic and mechanical decrease
4. Potential decreases, kinetic increases and mechanical is constant
5. Potential decreases, kinetic is constant and mechanical increases

25. Indicate which are the SI units for distance, temperature and mass:

1. m, K, g
2. km, °C, g
3. m, °C, g
4. m, K, kg
5. m, K, kg

26. The vector product of two vectors with magnitudes A and B and an angle a between them is:

1. A vector perpendicular to the two with magnitude $AB \cos(a)$
2. A vector perpendicular to the two with magnitude $AB \sin(a)$
3. A vector coplanar with the two with magnitude $AB \cos(a)$
4. A vector coplanar with the two with magnitude $AB \sin(a)$
5. A scalar of value $AB \sin(a)$

27. In the presence a friction force, a body in movement:

1. Will end up stopping
2. Will move with constant velocity
3. Will go faster and faster
4. Is subjected to a non-conservative force
5. Little by little increases in mechanical energy

28. Two bodies that move with different velocities collide and remain together after the collision. We can say that:

1. Momentum changes and kinetic energy is conserved
2. Momentum decreases and mechanical energy is conserved
3. Momentum and the work of friction are conserved
4. Momentum and the thermal energy are conserved
5. Momentum is conserved and the kinetic energy changes

29. The magnitude of the acceleration of gravity on the surface of the Earth is $g=9.8\text{m/s}^2$. If we place ourselves at a distance of 10km above the surface, we can say that:

1. Gravitational acceleration decreases and weight is reduced
2. Gravitational acceleration increases and weight is conserved
3. Gravitational acceleration is constant and weight is reduced
4. Gravitational acceleration is conserved and weight is constant
5. Gravitational acceleration increases and weight is reduced

30. Let A B and C be three unit vectors in the X, Y and Z axes, respectively. It is true that:

1. $B \times A = C$
2. $A \times B = C$
3. $A \cdot B = C$
4. $B \cdot A = C$
5. $A + B = C$

31. In the gravitational field of the Earth, potential energy decreases (choose which seems most correct):

1. In horizontal planes
2. Along the length of vertical lines
3. Along the length of vertical lines near the surface of the Earth
4. In a radial direction with respect to the centre of the Earth
5. In spherical surfaces around the Earth

32. A body of mass $m=10\text{kg}$ starts off at rest and is accelerated horizontally by a force of 10N that acts over 10m . In the moment that the force stops acting, the body arrives at the border of a 10m -high precipice, from which it falls to the ground. The kinetic energy of the impact is (take $g=10\text{m/s}^2$):

1. 100 J
2. 1000 J
3. 1100 J
4. 200 J
5. 10100 J

33. State which equivalence is correct:

1. $1\text{ atm} = 1.013 \cdot 10^5\text{ Pa}$
2. $1\text{ atm} = 750\text{ mmHg}$
3. $760\text{ mmHg} = 10^5\text{ Pa}$
4. $1\text{ bar} = 760\text{ mmHg}$
5. $1.13\text{ bar} = 1\text{ atm}$

34. In the International System of Units, which is a correct interpretation of prefixes:

1. nano- indicates 1000 micro-
2. nano- indicates 1000 pico-
3. nano- indicates 1000 femto-
4. nano- indicates 1000 hecto-
5. nano- indicates 1000 milli-

35. Given two angles whose sides are cut to form a right angle, we can say that:

1. They are the same
2. They are 90 degrees
3. They are complementary
4. They are supplementary
5. Their sum is 180 degrees

36. The relationship between calorie and Joule is:

1. $1 \text{ cal} = 0.13 \text{ J}$
2. $4.18 \text{ cal} = 1 \text{ J}$
3. $1 \text{ cal} = 4.18 \text{ J}$
4. $0.13 \text{ cal} = 1 \text{ J}$
5. $1 \text{ cal} = 1 \text{ J}$

37. A magnetic force of 1 N acts to change the course of an electron in movement over the course of a half circumference of radius 1m. The work done is:

1. 1 J
2. 3.1416 J
3. 6.2832 J
4. 0J
5. 2J

38. If two waves of the same amplitude interact, the result:

1. Is a wave of double the amplitude
2. Depends on the relative phase; they will add or subtract
3. Is that they cancel each other out
4. Is a sum whose amplitude squared is the sum of the squares of the starting amplitudes (the intensities are summed)
5. Depends on whether the waves are transverse or longitudinal

39. Ignoring the action of gravity, the movement of a mass placed on a spring without damping is:

1. Uniformly accelerated movement
2. Uniform movement
3. Simple harmonic movement
4. Oscillatory movement
5. Hooke movement

40. The equation $\sin^2(a)+\cos^2(a)=1$ is complied with:

1. When $a = 45$ degrees
2. When $a = 0$ degrees
3. Always
4. When $a = 60$ degrees
5. When $a = 30$ degrees

41. If I divide a magnet along a line equidistant from its N and S poles, I get:

1. A magnet with a N pole and another with a S pole
2. The magnetic field is destroyed
3. Two magnets, each with N and S poles
4. Two bodies, magnetized at one end, one N and the other S
5. The magnetic field becomes zero in the centre

42. A negative charge in movement penetrates a region of space where there is a magnetic field. The effect produced:

1. Depends on the angle between the velocity and the field
2. Is that the charge deviates and follows a circular trajectory
3. Is that the charge changes in terms of the magnitude of its velocity
4. Is nothing, the magnetic fields only act on magnets
5. Is that the charge follows a spiral trajectory

43. No work is done on a moving body when:

1. The force applied is opposite the displacement
2. The kinetic energy of the object increases
3. No forces act on the body
4. The total force applied is zero, because if the total force is non-zero, the work done is force times displacement.
5. The total force applied is zero, or, if the total force is non-zero, it acts perpendicular to the direction of movement

44. Imagine a system of two point-particles of equal mass and velocity vectors that are equal in magnitude and direction, but of opposite sense.

1. The total kinetic energy is double that of each particle individually
2. The kinetic energy is zero
3. The kinetic energy is half that of each particle individually
4. The kinetic energy cannot be calculated without knowing the potential energy
5. The kinetic energy is four times that of each particle individually

45. Newton's third law concerns:

1. Contact forces
2. Forces of action at a distance
3. Electrical forces
4. All forces
5. Gravitational forces

46. Indicate which of these units is for power:

1. W / m^2
2. kWh
3. Pa
4. J
5. kW

47. In dynamics (select that which you consider WRONG):

1. Linear velocity and angular velocity have different dimensions
2. The particles of a rigid body rotate with the same angular velocity
3. Any unbalanced force brings about a change in angular velocity
4. The moment of inertia of a body depends on how the mass is distributed around the axis of rotation
5. The moment of inertia of a body never depends on the orientation of the axis of rotation

48. A force is a vectorial physical magnitude, and so is defined by:

1. Magnitude and direction
2. Its components in the three directions of space
3. Magnitude and sense
4. Direction and sense
5. The angle it creates with unit vector magnitudes

49. Heat is:

1. A form of "vibrational" energy and so it cannot be completely converted into work
2. A synonym for electrical energy, and it allows work to be done.
3. The absence of cold
4. What thermometers measure
5. The same as internal energy

50. In a body that moves over a horizontal surface, under only the action of gravity and of a frictional force, the final mechanical energy must:

1. Increase
2. Decrease
3. Remain constant
4. There is not enough data
5. First decrease, and later increase slowly