Biology

1. Concerning the phenomenon of osmosis:
   1. H_2O crosses a semi-permeable membrane from the side with a greater solute concentration to that with a 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, H_2O leaves, and the cells and vacuoles contract.

2. 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

3. 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.

4. The subphase of prophase of the 1^{st} division of meiosis, in which chromosomal crossing-over occurs is denominated:
   1. Leptotene.
   2. Zygotene.
   3. Pachytene.
   4. Diplotene.
   5. Diakinesis.

5. 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

6. 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%

7. 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.

8. Indicate which of the following concepts has no connection at all with reproduction
   1. Ovulation
   2. External fecundation
   3. Segmentation
   4. Viviparity
   5. Metamorphosis

9. The contacts between neurons are called
   1. Axons
   2. Dendrites
   3. Synapses
   4. Astrocytes
   5. Schwann cells

10. The process of destruction of all forms of life is called:
    1. Sterilization
    2. Disinfection
    3. Germination
    4. Antisepsis
    5. Autophagia

Physics

1. 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

2. 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

3. 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

4. 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

5. 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

6. 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

7. 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

8. Indicate which are the SI units for distance, temperature and mass.
1. m, K, g.
2. km, ºC, g.
3. m, ºC, g.
4. m, K, kg.
5. m, K, kg.

9. The magnitude of the acceleration of gravity on the surface of the Earth is $g=9.8m/s^2$. 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.

10. A body of mass m=10kg 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 $g=10m/s^2$):
1. 100 J
2. 1000 J
3. 1100 J
4. 200 J
5. 10100 J

Chemistry

1. 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. $1.42x10^{24}$ *
3. $6.023x\ 10^{24}$
4. 32
5. 10

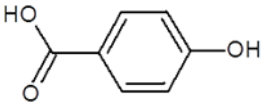
2. Which is true with regard to atomic magnitudes?

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 (u or Da) 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

3. What are the functional groups present in the compound
CH_3-CO-CH_2-CH_2-COOH

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

4. 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

5. 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

6. 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

7. 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

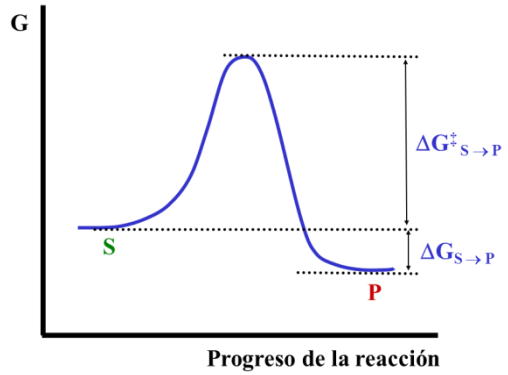
8. If the ionization constant of a weak base is 5×10^{-7}, the constant of its conjugate acid will be:

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

9. 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

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



The parameter ΔG‡ 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