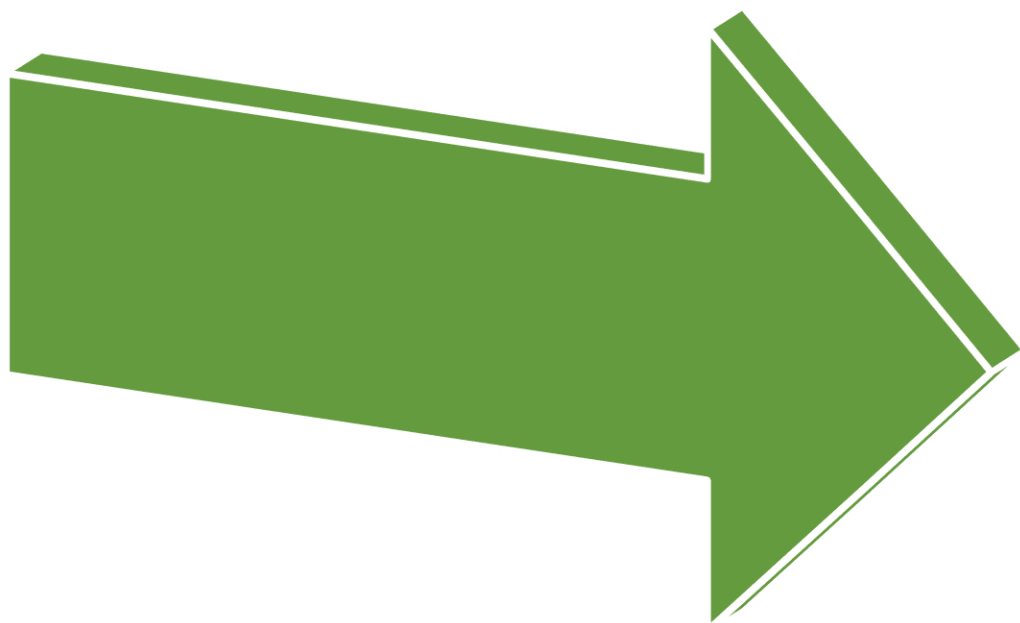


MATHEMATIC



موسسه مهاجرتی پارسینیکا



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PROBLEMAS

1.- (2,5 puntos). Tres familias realizan una compra. La primera compra 4 kg de garbanzos, 5 kg de pasta y 4 kg de arroz. La segunda familia compra 6 kg de garbanzos y 8 de pasta. La tercera familia compra 6 kg de garbanzos, 6 kg de pasta y 1 kg. de arroz. Cada familia ha pagado 23€ por la compra. Calcular el precio del kg de cada producto.

NOTA: Usar Gauss o cálculo matricial en la resolución del problema

2.- (2,5 puntos). Determinar el valor de k y de q para que la función sea continua en todos sus puntos

$$f(x) = \begin{cases} x^2 & x \in (-\infty, 2] \\ 2k/x & x \in (2, 4] \\ q - x & x \in (4, +\infty) \end{cases}$$

TEST

1.- The opposite of the matrix $A = \begin{pmatrix} 2 & 1 & 3 \\ 0 & 2 & 1 \end{pmatrix}$ is:

a) $\begin{pmatrix} 2 & 0 \\ 1 & 2 \\ 3 & 1 \end{pmatrix}$

b) $\begin{pmatrix} -2 & -1 & -3 \\ 0 & -2 & -1 \end{pmatrix}$

c) Matrix A has no opposite

2.- Given the matrices $A = \begin{pmatrix} 2 & 1 & 0 \\ 0 & 1 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 0 \\ 1 & 1 \\ 2 & 2 \end{pmatrix}$, the result of the product of matrices $A \times B$ is

a) $\begin{pmatrix} 5 & 1 \\ 5 & 5 \end{pmatrix}$

b) It is not possible to determine the product of the matrices $A \times B$

c) $\begin{pmatrix} 4 & 2 & 0 \\ 2 & 2 & 2 \\ 4 & 4 & 4 \end{pmatrix}$

3.- Two inequalities are equivalent:

a) If they have similar solutions

b) If the general solutions are the same

c) There are no equivalent inequalities

4.- In order for $f(x) = \begin{cases} \frac{x}{2}, & \text{si } x < 2 \\ 3x - k, & \text{si } 2 \leq x \end{cases}$ to be continuous, the value of k is equal to

a) 5

b) 1

c) None of the above

5.- Calculate $\int (x^{-2}) dx$

a) $-x^{-1} + C$

b) $x^{-2} + C$

c) It is not possible to calculate the integral

6.- If A and B are events in a probability space, verify:

- a) $P(B) = P(A \cup B) - P(A - B)$
- b) $P(A - B) = P(A) - P(B)$
- c) $P(A - B) = P(A)P(B^c)$.

7.- If upon rolling a die $P(\text{even}) = 2/5$, the following:

- a) $P(\text{odd}) = 1/2$
- b) $P(\text{odd}) = 0'4$
- c) $P(\text{odd}) = 3/5$

8.- A student knows that his roommate takes a two hour nap and sleeps six hours at night. Our student also sleeps 8 hours, but $4/5$ of his sleep takes place at nighttime. If his friend comes home from a trip at any hour, the probability that it is nighttime and that he finds him sleeping is:

- a) $2/5$
- b) $4/15$
- c) Duración de la noche/4

9.- A die has four sides marked as heads and two as tails. Upon throwing the die and a coin, the probability of obtaining just one head is:

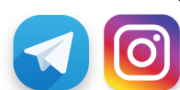
- a) $1/3$
- b) $2/3$
- c) $1/2$

10.- The variance of a random variable represents:

- a) The value that varies the most in the population.
- b) The degree of dispersion of data with respect to the mean.
- c) The degree of dispersion of data with respect to the mean point of the interval.

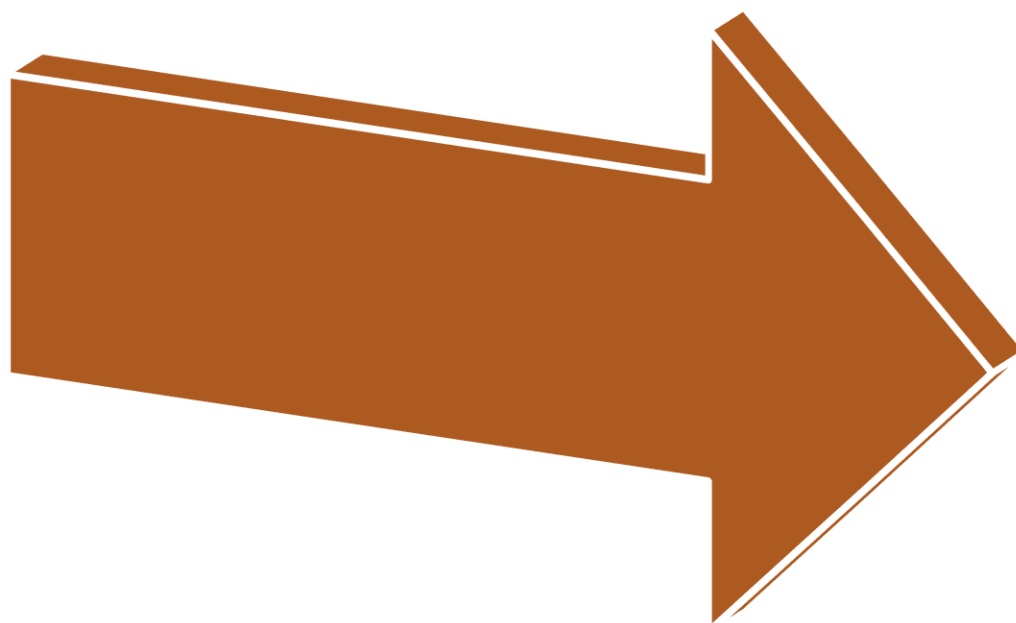


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English



موسسه مهاجرتی پارسینیکا



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Instrucciones:

- a) El examen se escribirá con tinta azul o negra, no roja o verde ni lápiz.
- b) No utilice ningún corrector (Tipp-Ex), porque el lector óptico puede no reconocer su respuesta.
- c) No puede utilizar ningún material.
- d) Se dispondrá de 90 minutos para hacer el examen.
- e) La puntuación de las preguntas está indicada en las mismas.

Bloque I (Part I). Preguntas objetivas de opción múltiple

- a) Las respuestas se marcarán en la hoja destinada a este fin.
- b) Solo hay una respuesta correcta – a), b) o c) – para cada pregunta.
- c) Las respuestas incorrectas y en blanco no restan puntuación.

Instructions:

- a) The answers must be written in either blue ink or black ink. Do not use red ink, green ink or pencil.
- b) Do not use any corrector (for example, Tipp-Ex); the optical reader may not be able to recognize your answer.
- c) No additional material is permitted.
- d) You have 90 minutes to complete the exam.
- e) The maximum mark available for each question is shown in the exam.

Block I (Part I). Multiple choice questions

- a) The answers should be given on the sheet provided for this purpose.
- b) There is only one correct answer for each question: either a), or b) or c).
- c) No marks are deducted for an incorrect answer or for not answering.

Part I**A) Comprehension questions on the text. Read the text and choose the correct answer (0,5 points each).**

There is good news and bad news regarding the number of trees on our planet. The good news is that there are seven times more trees on Earth than we thought. Until a few years ago, scientists estimated that the world had around 400 billion trees. However, a new study from Yale University estimates that there are around three trillion trees. That's a three followed by 12 zeroes. That means there are more than 420 trees for every person alive today. Lead researcher Dr Thomas Crowther told the BBC that the new estimate will not change anything. He said: "It's not like we've discovered a load of new trees. It's not good news for the world or bad news that we've produced this new number."

The bad news is that thousands of years ago the earth had around six trillion trees. Human activity has cut in half the number of trees on the planet. A good example of this is the fact that Europe used to be one giant forest. Now much of it is farmland, fields, cities and towns. Dr Crowther said people are responsible for the loss of three trillion trees over the past several thousand years. Humans are destroying around 15 billion more trees every year because of deforestation and the demand

for farmland. The scientists said this figure is "considerably higher" than just a century ago. Dr Crowther warned that: "This study highlights how much more effort is needed if we are to restore healthy forests worldwide."

1. According to the text, ...

- a) there are three million more trees on Earth nowadays than a few years ago.
- b) there are fewer trees on Earth than we believed.
- c) there are more trees than people on Earth.

2. According to the text, ...

- a) many of Europe's forests have become farmland or cities.
- b) the decrease in trees has been caused by natural disasters and human activity.
- c) humans have been cutting trees for the last hundred years.

3. Dr Crowther ...

- a) works for the BBC.
- b) said that the news about the amount of trees on Earth were bad news.
- c) explained that deforestation nowadays is bigger than 100 years ago.

B) Use of English. Choose the correct answer (0,5 points each).

4. Choose the right option to complete the sentence: *We have two sons. We are staying in this neighbourhood _____*

- a) for the sake of our childs
- b) for our childrens's sake
- c) for our children's sake

5. Complete the sentence with the right word: *Everyone _____ we are a happy couple.*

- a) know
- b) knows
- c) is knowing

6. Complete the sentence: *I _____ homesick, but I have found a new job which _____ me busy.*

- a) feel/keep
- b) am feeling/is keeping
- c) feel/keeping



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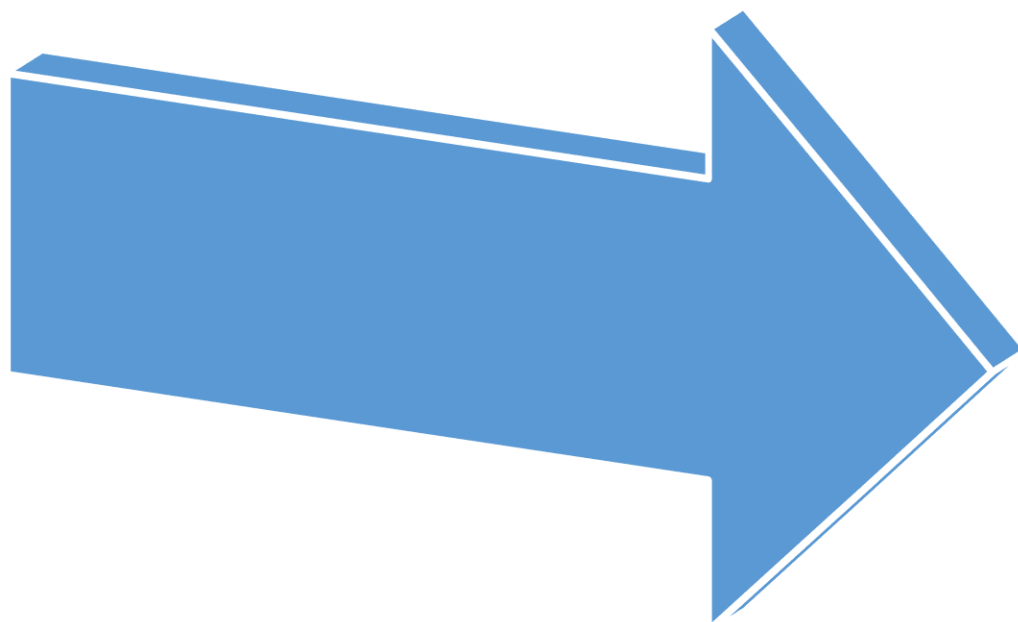
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CHEMISTRY



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Block 1

1. In the reaction of calcium carbonate with hydrochloric acid, carbon dioxide, calcium chloride and water is produced.
 - a. Calculate the quantity of limestone, whose richness in calcium carbonate is 90%, which is needed in order to obtain 1.5 Kg of calcium chloride.
 - b. What volume will the carbon dioxide occupy when mixed at 37 °C and at a pressure of 790 mm of mercury, if 200 g of limestone have reacted (90% richness in calcium carbonate)?Data: Atomic masses: H = 1; C = 12; O=16; Cl = 35.5; Ca = 40 g·mol⁻¹;
R = 0,082 atm·L·K⁻¹·mol⁻¹
2. Given the following organic compounds: CH₃CH₂CH₃; CH₃OH; CH₂=CHCH₃. Reasonably indicate:
 - a. Which is soluble in water?
 - b. Which are hydrocarbons?
 - c. Which has addition reactions?

Block 2

1. Indicate the correct response. The ionic compounds are characterized by:
 - a. Having high melting points and low hardness.
 - b. Being solid at room temperature and soluble in polar solvents.
 - c. Being hard and soluble in non-polar solvents.

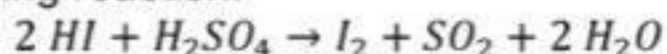
Statement 1: Hydrochloric acid (HCl(aq)) is prepared by dissolving HCl (gas) in water. When dissolving 150 L of gaseous HCl, measured at 15 °C and 1 atm, in 500 mL of water, a solution of 1.17 g·mL⁻¹ is obtained.

Data: R = 0.082 atm·L·K⁻¹·mole⁻¹; Atomic masses: Cl = 35.5 ; H = 1.0 g·mol⁻¹ .
Density of water = 1 Kg·L⁻¹ .

2. See Statement 1. What is the weight percentage of HCl present in the solution?
 - a. 31.7 %
 - b. 2.32 %
 - c. 23.2 %
3. See Statement 1. What is the concentration of the solution, expressed in g·L⁻¹ ?
 - a. 317 g HCl·L⁻¹
 - b. 371 g HCl·L⁻¹
 - c. 37.1 g HCl·L⁻¹



4. According with the following reaction:



Indicate the **incorrect** response:

- The oxidation number of sulphur in the H_2SO_4 is 6
- The oxidation number of sulphur in the O_2 is 4
- The oxidation number of iodine in the I_2 is -1

5. Indicate the **correct** response. In a redox reaction:

- The reduction means an increase of the oxidation number of the atom
- The oxidation means a decrease of the oxidation number of the atom
- The reduction means a decrease of the oxidation number of the atom

Statement 2: In a two-liter recipient, 127.0 g of iodine and 2.0 g of hydrogen are introduced to obtain hydrogen iodide. The recipient is heated to 450 °C and when it reaches equilibrium, 119.3 g of hydrogen iodide are obtained.

Data: Atomic masses: I = 127; H = 1 g·mole⁻¹

6. See Statement 2. Which is the adjusted reaction?

- $\frac{1}{2} I_2 + H_2 \rightleftharpoons HI$
- $I_2 + H_2 \rightleftharpoons 2 HI$
- Both of the above

7. See Statement 2. Indicate the **correct** response. In light of the reaction taking place and the data provided, the equilibrium constant is:

- $K_C = 1.74$
- $K_C = 47.84$
- $K_C = 11.96$

8. Indicate the **incorrect** response:

- A weak acid has a weak conjugate base.
- A weak acid has a strong conjugate base.
- A strong acid has a weak conjugate base.

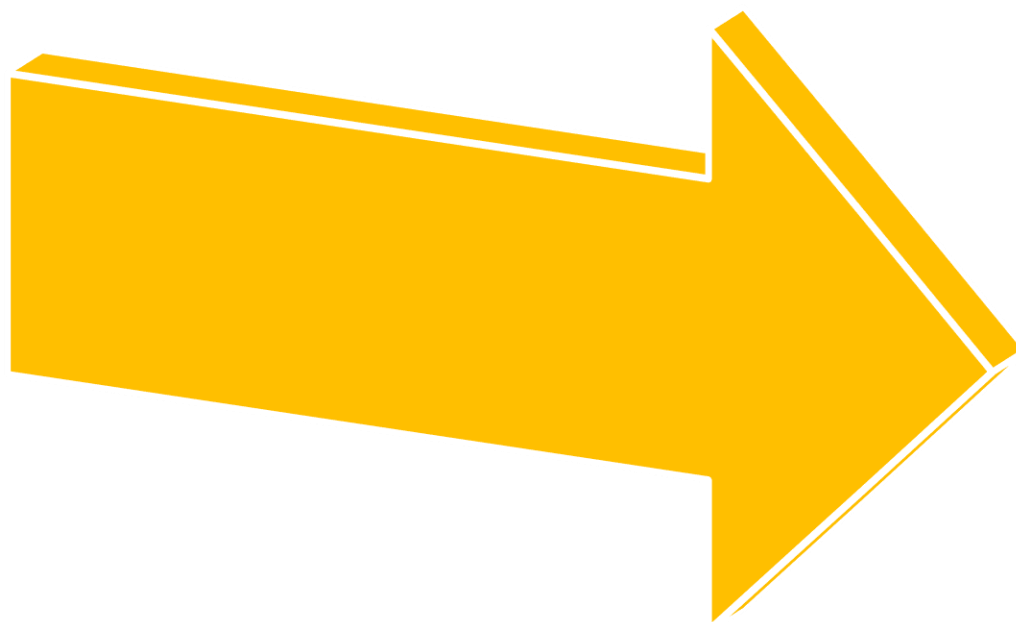
9. Indicate the **correct** response. Butane and isobutene are isomers of:

- Chain.
- Function.
- Position.

10. Indicate the **incorrect** response. Amino acids:

- They are molecules that include an amine group and an ester group.
- They are molecules that include an amine group and a carboxylic acid group.
- They make up the proteins that are fundamental for life.

Biology



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ATTENTION: EACH QUESTION HAS A PUNCTUATION OF 0.25 POINTS. WRONG OR UNANSWERED QUESTIONS DO NOT PENALIZE. THE QUESTIONS SHOULD BE ANSWERED ON THE OPTICAL READING SHEET.

1. Which of the following would cause cells to switch from cellular respiration to fermentation?

- a. The final electron acceptor in the electron transport chain (ETC) is not available
- b. The cell is under aerobic conditions
- c. Pyruvate is not available

2. The production of adenosine triphosphate (ATP) is represented by the following equation $ADP + P_i \rightarrow ATP$

The production of ATP:

- a. Is a catabolic reaction
- b. Requires an overall input of energy
- c. Only occurs in the absence of oxygen

3. Which polysaccharide has an energy reserve function in plant cells? :

- a. Glycogen
- b. Starch
- c. Cellulose

4. Which organ of the eukaryotic cell is responsible for the synthesis of lipids? :

- a. The Golgi apparatus
- b. The ribosome
- c. The smooth endoplasmic reticulum

5. Genetic transformation

- a. Occurs between cloned cells
- b. Involves plasmid or exogenous DNA uptake in bacteria
- c. Is necessary for gene sequencing

6. Where does the Krebs cycle or citric acid cycle occur in eukaryotes?

- a. In the cytosol
- b. In the mitochondrial matrix
- c. In the inner membrane of mitochondria

7. Indicate the size of the peptide to be formed from the following sequence, knowing that the translation initiation codon is ATG:

AATTATTACATGTACAGTTTCGATTCTCAATATAGT

- a. 12
- b. 9
- c. 15

8. Reverse transcriptase catalyses the production of:

- a. DNA from an mRNA template
- b. DNA from a protein template
- c. mRNA from a DNA template

9. A prion is:

- a. A DNA fragment
- b. A carbohydrate
- c. A protein

10. The complementary base found at the fourth nucleotide (marked *) in the sequence transcribed from this DNA template strand is:

DNA template strand \rightarrow T G G A T G A C

- a. C
- b. G
- c. U

11. The function of DNA helicase in the replication process is:

- a. Close the double helix after the action of DNA polymerase II
- b. Break the hydrogen bonds between the nucleotide base pairs in double-stranded DNA
- c. Generate a double helix during DNA synthesis

12. A prokaryotic cell contains:

- a. A nucleus
- b. A vacuole
- c. Ribosomes

13. The four main types of macromolecules in a cell are:

- a. Monomers, polymers, DNA and RNA
- b. Proteins, carbohydrates, DNA and RNA
- c. Nucleic acids, proteins, carbohydrates and lipids

14. Which of the following statements is correct about protein structure?

- a. There are four levels of protein structure. The primary protein structure is held by covalent and hydrogen bonding
- b. Enzymes have an active site that is a three-dimensional structure produced by secondary level folding of the protein
- c. The secondary structure of a protein is stabilized by the hydrogen bonds

15. Which of the following statements is correct?

- a. Oxidation can involve the removal of oxygen from a compound
- b. The solution inside a mitochondrion is called the matrix and the solution inside a chloroplast is called the stroma
- c. The photosynthetic pigments in a chloroplast are found on the cristae

16. After the S phase, what comprises a single chromosome?

- a. Two sister chromatids
- b. A double-stranded DNA molecule
- c. Two single-stranded molecules of DNA

17. The list 1–4 below describes events and outcomes of the replication of DNA within a eukaryotic cell:

1. Complementary nucleotides bind to each of the two strands.
2. Sugar phosphate bonds form between the nucleotides.
3. The newly formed DNA molecules are semi-conserved.
4. Unwinding of the DNA molecule forms two single strands.

The correct order of these events during DNA replication is:

- a. 1, 2, 3, 4
- b. 4, 1, 3, 2
- c. 4, 1, 2, 3

18. Homologous chromosomes contain the same:

- a. DNA sequences
- b. Number of guanine and adenine nucleotides
- c. Genes

19. When using a light microscope, magnification of the structure being observed can be increased by a variation in the:

- a. Light intensity
- b. Iris diaphragm setting
- c. Objective lens power

20. The plasma membrane of a cell:

- a. Is inflexible due to the presence of protein molecules
- b. Allows substances to pass through only by active transport
- c. Is relatively impermeable to large water-soluble molecules due to the presence of the lipid bilayer

21. The part of a molecule referred to as an anticodon can be found in the

- a. Ribosomal RNA
- b. Transfer RNA
- c. Messenger RNA

22. Which one of the following is a correct statement about mitosis?

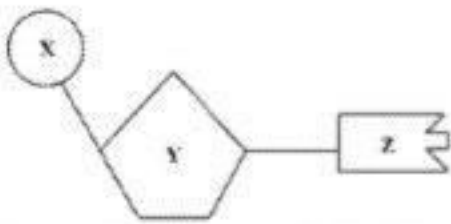
- a. The spindle forms during prophase
- b. Chromatids separate to opposite poles of the spindle during metaphase
- c. Homologous chromosomes line up at the equator of the cell during telophase

23. The following diagram represents a nucleotide with subunits X, Y and Z.



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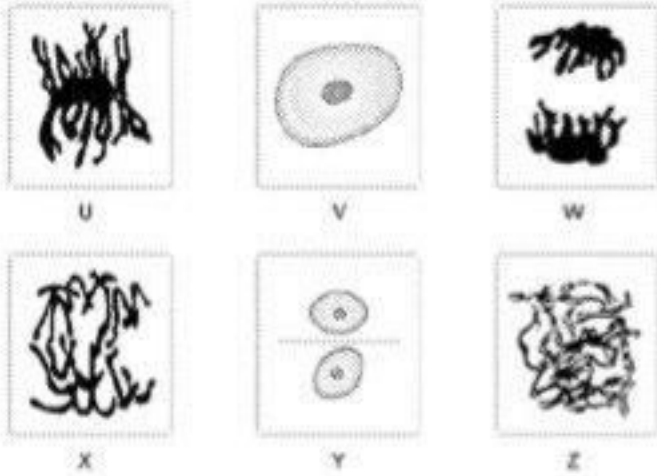
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This nucleotide could be identified as a monomer of DNA but not RNA if:

- X is ribose
- Y is deoxyribose
- Y is ribose

24. Which letter shows a telophase? :



- U
- W
- Z

25. Consider the following molecular structure.



This could be part of a:

- Lipid
- Protein
- Carbohydrate

26. Cytotoxic T cells are:

- Antibodies
- Able to kill virus-infected cells
- Part of the humoral response

27. In humans, widow's peak (W) is dominant over a continuous hairline (w), and short fingers (F) are dominant over long fingers (f). Two individuals with widow's peak and short fingers have a child with continuous hairline and long fingers. Determine the genotype of the parents:

- WwFf x WwFf
- WWFf x WwFF
- WwFf x WWFf

28. The first line of defense of an organism to the invasion of microorganisms is:

- Skin and mucous membranes
- Red blood cells
- The antibodies

29. The term 'genome' applies best to all the

- Genes present in a cell
- Organelles present in a cell
- Proteins present in a cell

30. What is the function of lysosomes in the eukaryotic cell? :

- Synthesize proteins and lipids
- They contain digestive enzymes and participate in the processes of intracellular digestion
- Produce hydrogen peroxide

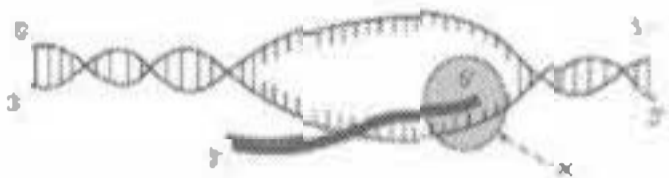
31. Plasmids, prokaryotic chromosomes and eukaryotic chromosomes:

- a. Are all circular in shape
- b. All replicate during mitosis
- c. Are all made out of double-stranded DNA

32. Defective alleles may result in genetic defects. Replacement of a defective allele with a normal allele is called:

- a. Cell cloning
- b. Gene therapy
- c. DNA replacement

33. The molecule labelled X represents:



- a. DNA
- b. RNA polymerase
- c. DNA polymerase

34. Cystic fibrosis is an autosomal recessive trait that affects many parts of the body, particularly the lungs and other organs. Parents who show none of the characteristics of cystic fibrosis have an affected child. The chance that their next child will be phenotypically normal is:

- a. Three in four (3/4)
- b. One in four (1/4)
- c. One in two (1/2)

35. The activity of an enzyme is:

- a. Decreased by the presence of an inhibitor
- b. Unaffected by the pH or the cytosol of a cell
- c. Reduced at very low temperatures due to denaturation

36. The process that produces the largest number of ATP molecules is:

- a. Synthesis of polypeptide molecules
- b. Breakdown of glucose during glycolysis
- c. The electron transport chain in cellular respiration

37. Which of the following statements is correct?

- a. The components of a nucleotide are sugar molecule attached to two phosphate groups and a nitrogenous base
- b. In a molecule of DNA, the bases thymine and uracil are held together by hydrogen bonds
- c. During DNA replication, new nucleotides are added using the enzyme DNA polymerase

38. A segment of a DNA molecule that carries instructions for a specific trait is called a:

- a. Gene
- b. Nucleotide
- c. Chromosome

39. What are the necessary elements to perform a polymerase chain reaction (PCR)?

- a. Primer, DNA and deoxyribonucleotides
- b. Primer, DNA polymerase, DNA and ribonucleotides
- c. Primer, thermostable DNA polymerase, DNA and deoxyribonucleotides

40. In meiosis, recombination between homologous chromosomes occurs in:

- a. Prophase II
- b. Prophase I
- c. Metaphase I



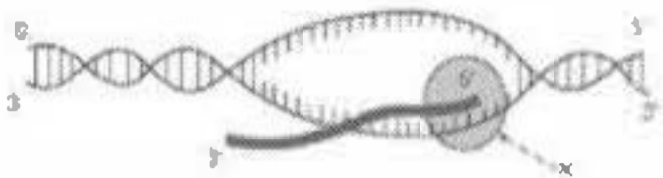
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