1) Which process is not involved in genetic recombination of prokaryotic organisms?
A) conjugation
B) binary fission
C) transformation
D) transduction

2) Gregor Mendel discovered the fundamental principle of genetics:
A) the law of allele segregation into separate gametes
B) the law of linked genes on the same chromosome
C) the law of conservation of genetic material in DNA
D) the law of codominant heredity of ABO blood group

3) What is the probability that a heterozygote parent pair (Aa x Aa) will have a child with the dominant phenotype?
A) 25%
B) 50%
C) 75%
D) 100%

4) A man with A blood group marries a woman with B blood group. Their child has O blood group. What are the genotypes of these individuals (parents)?
A) AA x BB
B) AO x BB
C) AA x BO
D) AO x BO

5) Color-blindness (daltonism) is X-linked recessive disease. A color-blind man married a phenotype normal woman. Their daughter is healthy. What is the probability that a son of this daughter will suffer from daltonism, in the case that daughter will be married with healthy men?
A) 0%
B) 25%
C) 50%
D) 75%
6) If \(2n = 12\) for a particular cell, then the number of chromosomes in egg cell after meiosis would be:
   A) 24
   B) 12
   C) 6
   D) 3

7) What is the result of nondisjunction of 1 chromosomal pair:
   A) aneuploidy
   B) euploidy
   C) disploidy
   D) polyploidy

8) Chromosome mutation includes:
   A) trisomy of chromosome 21
   B) translocation between chromosomes 9 and 22
   C) multiplication of chromosome set (from number 2n to number 4n)
   D) deletion of three nucleotides on chromosome 7

9) The most common genetic disorders are:
   A) single-gene disorders
   B) chromosome disorders
   C) mitochondrial disorders
   D) multifactorial disorders

10) The incidence of recessive albinism is 0.0004 in a human population. What is the frequency of the recessive allele, if the population is in Hardy-Weinberg equilibrium?
    A) 0.02
    B) 0.006
    C) 0.0008
    D) 0.0002

11) Which physical process accounts for heat gain or loss?
    A) conduction
    B) convection
    C) evaporation
    D) all of three processes account for heat gain or loss

12) Thalamus is the brain structure belonging to:
    A) cerebrum
    B) cerebellum
    C) diencephalon
    D) medulla oblongata
13) The organ of Corti is present in:
A) eye
B) ear
C) taste buds
D) olfactory epithelium

14) The cortex of adrenal glands secretes:
A) aldosterone
B) adrenalin
C) antidiuretic hormone (ADH)
D) adrenocortico-tropic hormone (ACTH)

15) Bleeding can be caused by dysfunction of the blood cells called:
A) erythrocytes
B) lymphocytes
C) leucocytes
D) thrombocytes

16) Vernon Ingram found that sickle cell hemoglobin differs from normal hemoglobin by one _____ in the beta chains of this protein.
A) nucleotide
B) nitrogenous base
C) amino acid
D) phosphate group

17) Mad cow disease is an example of a disease caused by:
A) viruses
B) viroids
C) prions
D) bacteriophages

18) If a DNA molecule contains 30% of cytosine, approximately what percentage of adenine is present?
A) 20%
B) 30%
C) 40%
D) 60%

19) In humans, enzymatic digestion is not present in the:
A) mouth
B) stomach
C) small intestine
D) large intestine
20) Which are arranged in the correct order by size, from smallest to largest:
A) nucleotide – nucleus – nitrogenous base - gene
B) nucleotide – nitrogenous base - gene – chromosome
C) nitrogenous base – nucleotide – gene – chromosome
D) nitrogenous base – chromosome – nucleus – gene

21) To the facial part of the human skull one of following bones does not belong:
A) lacrimal bone
B) mandible
C) maxilla
D) occipital bone

22) At one point as a cell carried out its day-to-day activities, the nucleotides CUA were paired with the nucleotides GAU. This pairing occured:
A) during replication
B) during transcription
C) when an mRNA codon paired with a tRNA anticodon
D) when rRNA codon paired with an amino acid

23) In 1953, J. D. Watson and F. Crick speculated that the hereditary information is contained in what feature of DNA?
A) sugar backbone of the strands
B) the sequence of nitrogenous bases
C) the antiparallel nature of the strands
D) the hydrogen bonding between nitrogenous bases

24) Mesoderm, one of the three primary cell layers, forms following structures of the human body EXCEPT:
A) blood
B) bones
C) organs of reproductive system
D) brain

25) Which one of the following vitamins is synthesized by bacteria in the human intestines?
A) vitamin C
B) vitamin K
C) vitamin D
D) all water-soluble vitamins

26) Mitosis occurs in all the following life cycle events EXCEPT:
A) wound healing
B) growth
C) body cell replacement
D) gamete formation
27) Which structure is mainly responsible for the rigidity of the plant cell?
A) cell wall
B) plasma membrane
C) nucleolus
D) mitochondrion

28) In humans, the main artery leaving the heart is:
A) aorta
B) vena cava superior
C) vena cava inferior
D) portal vein

29) Which stage of mitosis is not matched correctly?
A) prophase: chromosomes condense
B) prometaphase: chromosomes attach to the mitotic spindle
C) metaphase: chromosomes separate
D) telophase: chromosomes relax

30) Urine of healthy man does not contain:
A) sodium chloride
B) water
C) urea
D) glucose
1. Which of these elements does not belong to trace elements in the human body:
   A) iron
   B) copper
   C) phosphorus
   D) selenium

2. The number of electrons in an atom of Al (with atomic number 13 and mass number 27) is:
   A) 13
   B) 14
   C) 27
   D) 40

3. A 16-g sample of oxygen
   A) is 1 mol of O₂
   B) contains 6.022 x 10²³ molecules of O₂
   C) is 0.50 molecule of O₂
   D) is 0.50 molar mass of O₂

4. Let us consider reaction:
   \[ 2 \text{C}_2\text{H}_4 + 6\text{O}_2 \rightarrow 4\text{CO}_2 + 4\text{H}_2\text{O} \]
   How many grams of CO₂ can be produced from 2.0 g of C₂H₄ and 5.0 g of O₂?
   A) 5.5 g
   B) 4.6 g
   C) 7.6 g
   D) 6.3 g

5. The process by which a solid changes directly to a vapor is called:
   A) vaporization
   B) evaporation
   C) sublimation
   D) condensation

6. How many milliliters of 6.0 M H₂SO₄ must you use to prepare 500 mL of 0.20 M sulfuric acid solution?
   A) 30
   B) 17
   C) 12
   D) 100
7. What volume of 0.40 M NaOH is required to neutralize 20.0 mL 0.30 M H₂SO₄:
   A) 53  
   B) 30  
   C) 5.3  
   D) 3.0  

8. If [H⁺] = 1 x 10⁻⁵ M, which of the following is not true?
   A) pH = 5  
   B) pOH = 9  
   C) [OH⁻] = 1 x 10⁻⁵ M  
   D) The solution is acidic  

9. In which of the following is the formula correct for the name given?
   A) Copper (II) sulfate, CuSO₄  
   B) Sodium chlorite, NaClO  
   C) Hydrosulfuric acid, H₂SO₄  
   D) Mercury (I) carbonate, HgCO₃  

10. The name of the isotope containing one proton and two neutrons is:
    A) protium  
    B) tritium  
    C) deuterium  
    D) helium  

11. In the equilibrium represented by
     \[ N_2(g) + O_2(g) \rightleftharpoons 2 \text{NO (g)} \]
    as the pressure is increased, the amount of NO formed
    A) increases  
    B) decreases  
    C) remains the same  
    D) increases and decreases irregularly  

12. Determine correct name for \( \text{Fe}_2(\text{SO}_3)_3 \):
    A) ferrous sulfate  
    B) ferric sulfate  
    C) ferrous sulfite  
    D) ferric sulfite  

13. What is the pH of 0.1 mol/L HCl solution after ten times dilution with distilled water?
    A) 1  
    B) 11  
    C) 12  
    D) 2  

14. Which statement is not correct?
   A) An Arrhenius acid solution contains an excess of H\(^+\) ions
   B) An Arrhenius acid solution contains an excess of H\(_3\)O\(^+\)
   C) A Brønsted acid is a proton (H\(^+\)) donor
   D) A Brønsted base is a proton (H\(^+\)) acceptor

15. Determine correct formula for ammonium nitrite
   A) (NH\(_4\)) N\(_3\)
   B) NH\(_4\) NO\(_3\)
   C) NH\(_4\) NO\(_2\)
   D) (NH\(_4\))\(_2\)NO\(_3\)

16. Choose the trivial name of the aromatic compound: H\(_3\)C—C\(_6\)H\(_4\)—CH\(_3\):
   A) benzene
   B) toluene
   C) xylene
   D) naphtalene

17. What is the systematic name of CH\(_2\)=CH—Cl?
   A) ethyl chlorine
   B) 1-iodoprop-2-ene
   C) chlorethene
   D) 2-chlorethyne

18. Choose the compound containing a primary alcohol group:
   A) HCHO
   B) CH\(_3\)—CH\(_2\)—C(O)—OH
   C) CH\(_3\)—CH\(_2\)(OH)—CH\(_3\)
   D) HOOC—CH\(_2\)—OH

19. Choose the wrong pair of the formula and the compound name:
   A) CH\(_3\)(CH\(_2\))\(_7\)CH = CH(CH\(_2\))\(_7\)COOH oleic acid
   B) C\(_6\)H\(_5\)COOH benzoic acid
   C) CH\(_3\)COOH acetic acid
   D) CH\(_3\)(CH\(_2\))\(_{16}\)COOH palmitic acid

20. What compound is a carbonyl compound?
   A) CH\(_3\)—CO—CH\(_3\)
   B) CH\(_3\)—O—CH\(_3\)
   C) CH\(_3\)—CH\(_2\)—OH
   D) HCOOH
21. **Hydrolysis of an ester gives the product(s):**
   A) two alcohols
   B) one alcohol and one acid
   C) salt and water
   D) hydroxy derivative of the ester

22. **Which of the transformation is an oxidative reaction?**
   A) $\text{CH}_3\text{--CO--COOH} \rightarrow \text{CH}_3\text{--CH(OH)--COOH}$
   B) $\text{CH}_3\text{--CH═CH}_2 \rightarrow \text{CH}_3\text{--CH}_2\text{--CH}_3$
   C) $\text{HCOOH} \rightarrow \text{HCHO}$
   D) $\text{CH}_3\text{--CH}_2\text{--OH} \rightarrow \text{CH}_3\text{--CHO}$

23. **Choose the expected product of the reaction called saponification:**
   $\text{triacylglycerol} + 3 \text{NaOH} \rightarrow \text{glycerol} + ?$
   A) 3 carboxylic acids
   B) 3 acyls
   C) water
   D) soap

24. **Which of the following compounds is the least water soluble?**
   A) benzene
   B) propanoic acid
   C) phenol
   D) methanol

25. **Choose the correct statement about the organic nitrogen-containing compounds:**
   A) purine contains 2 nitrogen atoms (altogether) in its molecule
   B) amides are derivatives of carboxylic acids
   C) quaternary ammonium ions are negatively charged
   D) $\text{―NH}_2$ group is the functional group of secondary amines

26. **Which of the following compounds is an amino acids?**
   A) glutamic acid
   B) succinic acid
   C) glucuronic acid
   D) stearic acid

27. **Choose the pair of saccharides which are not isomers:**
   A) D-glucose / L-glucose
   B) glucose / fructose
   C) $\alpha$-D-glucose / $\beta$-D-glucose
   D) glucose / ribose
28. **Glycerolphospholipid can be composed of**
A) glycerol, 2 phosphoric acids, 2 fatty acids
B) glycerol and 3 phosphoric acids
C) glycerol, 1 phosphoric acid, 1 fatty acid and 1 amino acid
D) glycerol, 1 phosphoric acid, 2 fatty acids and an amino alcohol

29. **Choose the correct statement about proteins:**
A) primary structure of a protein is stabilized by hydrogen bonds
B) proteins are polymers of L-amino acids
C) peptide bond found in proteins belongs among weak noncovalent interactions
D) proteins are polynucleotides

30. **Choose the incorrect statement:**
A) C₆H₅-NH₂ is an amine
B) CH₃-CH₂ – OH is an alcohol
C) H₃C—CHO is an aldehyde
D) H₃C—CH₂—CO—CH₃ is an ether
1. The volume of 1 L is:
   A) $10^{-1} \text{ m}^3$
   B) $10^3 \text{ m}^3$
   C) $10^{-6} \text{ m}^3$
   D) $10 \text{ m}^3$

2. Gas occupies 2 m$^3$ at a pressure of 100 kPa. What is the pressure when the volume is 1.5 m$^3$ and the temperature is unchanged?
   A) 67 kPa
   B) 100 kPa
   C) 133 kPa
   D) 300 kPa

3. A ballplayer catches a ball 2s after throwing it vertically upward. What height did it reach?
   A) 2 m
   B) 5 m
   C) 10 m
   D) 20 m

4. What force is needed to accelerate a 75 kg person at 0.8 g?
   A) 60 N
   B) 600 N
   C) 6000 N
   D) 60000 N

5. What is the volume of 1 kg of gold (the density of gold is $19.3 \times 10^3 \text{ kg/m}^3$)?
   A) 5.2 m$^3$
   B) 0.052 m$^3$
   C) 5.2 dm$^3$
   D) 0.052 dm$^3$

6. What isotope is formed by the radioactive decay of a $(A=14, Z=6)$ C nucleus by $\beta^-$ emission?
   A) (14,7) N
   B) (12,6) C
   C) (11,5) B
   D) (9, 4) Be
7. A pacemaker triggers 75 pulses per minute. It corresponds to the frequency of:
   A) 0.01 s
   B) 0.8 Hz
   C) 1.25 s⁻¹
   D) 75 Hz

8. What is the correct expression of the unit watt (W)?
   A) 1 W = 1 N·m²
   B) 1 W = 0.981 kg
   C) 1 W = 1 J/s
   D) 1 W = 1 m/s²

9. What is the temperature of 42°C on the Kelvin scale?
   A) 42 K
   B) -142 K
   C) 315 K
   D) 100 K

10. The spreading of white light into the full spectrum of colors is called:
    A) reflection
    B) refraction
    C) dispersion
    D) diffraction

11. A light bulb with incoming power of 100W is operated at the voltage of 220V. What is the current through the light bulb?
    A) 1.00 A
    B) 2.20 A
    C) 0.45 A
    D) 100 A

12. The charge of a neutron is
    A) equal to the charge of a proton
    B) equal to the charge of an electron
    C) equal to the charge of a positron
    D) none

13. What is the force on a straight 1m wire carrying 2A current, if the wire is perpendicular to 1.5T magnetic field?
    A) 3 N
    B) 2 N
    C) 1.5 N
    D) 1 N
14. What is the water pressure at the water faucet, if the surface of the water in the storage tank is 30 m above the water faucet?
   A) 0.3 Pa  
   B) 30 Pa  
   C) 300 kPa  
   D) 3 MPa  

15. How much charge passed through the wire, if a steady current of 2.5 A flowed for 4 min?
   A) 2.5 C  
   B) 4 C  
   C) 10 C  
   D) 600 C  

16. The frequency range of audible sound is approximately:
   A) 16 Hz – 16 kHz  
   B) 20 kHz – 250 kHz  
   C) 0.2 Hz – 20 Hz  
   D) 200 kHz – 3 MHz  

17. The power of lens is +5 D for
   A) a converging lens with the focal length of 5 cm  
   B) a converging lens with the focal length of 20 cm  
   C) a diverging lens with focal the length of 5 cm  
   D) a diverging lens with focal the length of 20 cm  

18. The unit of heat is
   A) kelvin  
   B) celsius  
   C) pascal  
   D) joule  

19. Which of the following units is not a base SI unit?
   A) newton  
   B) candela  
   C) mole  
   D) kelvin  

20. What is the power output of a 70kg man running up a long flight of stairs in 4s in the vertical height of the stairs in 4.5m?
   A) 8 W  
   B) 80 W  
   C) 0.8 kW  
   D) 8 kW
21. Choose the correct formula for kinetic energy:
   A) \( E_k = m g h \)
   B) \( E_k = \frac{1}{2} m v^2 \)
   C) \( E_k = m g h^2 \)
   D) \( E_k = \frac{1}{2} m v \)

22. For \( \alpha \) radiation is typical
   A) positive charge
   B) deep penetration
   C) wavelength of 550 nm
   D) negative charge

23. What particle is emitted when a nucleus decays by \( \beta \) decay?
   A) proton
   B) neutron
   C) electron
   D) a nucleus of helium

24. A radioactive material registers 1280 counts per minute on a Geiger counter at one time, and 6 h later registers 320 counts per minute. What is its half-life?
   A) 1 h
   B) 3 h
   C) 6 h
   D) 18 h

25. The resistance of a serial combination of two resistors, 10 k\( \Omega \) and 30 k\( \Omega \), is:
   A) 40 k\( \Omega \)
   B) 10 k\( \Omega \)
   C) 30 k\( \Omega \)
   D) 10 030 \( \Omega \)

26. Which of the following colors has shorter wavelength than green?
   A) red
   B) yellow
   C) orange
   D) blue

27. What is the wavelength of a 440 Hz sound wave in air?
   A) 0.08 m
   B) 0.78 m
   C) 1.78 m
   D) 17.8 m
28. A typical application of semiconductors is:
   A) diode
   B) transformer
   C) capacitor
   D) microscope

29. Which of the wavelengths in vacuum belongs to the visible light?
   A) 0.5 μm
   B) 5 μm
   C) 500 μm
   D) 5 000 μm

30. An electron acquired 6000 eV of kinetic energy when it is accelerated by an electric field from plate A to plate B. What is the potential difference between plates?
   A) 6 kV
   B) 6000 C
   C) 220 V
   D) \(1.602 \cdot 10^{-19} \text{V}\)
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