

BIOLOGY

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%
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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

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7) What is the result of nondisjunction of 1 chromosomal pair:

- A) aneuploidy
- B) euploidy
- C) disploidy
- D) polyploidy

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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

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9) The most common genetic disorders are:

- A) single-gene disorders
- B) chromosome disorders
- C) mitochondrial disorders
- D) multifactorial disorders

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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

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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

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12) Thalamus is the brain structure belonging to:

- A) cerebrum
- B) cerebellum
- C) diencephalon
- D) medulla oblongata

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13) The organ of Corti is present in:

- A) eye
 - B) ear
 - C) taste buds
 - D) olfactory epithelium
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14) The cortex of adrenal glands secretes:

- A) aldosterone
 - B) adrenalin
 - C) antidiuretic hormone (ADH)
 - D) adrenocortico-tropic hormone (ACTH)
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15) Bleeding can be caused by dysfunction of the blood cells called:

- A) erythrocytes
 - B) lymphocytes
 - C) leucocytes
 - D) thrombocytes
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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
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17) Mad cow disease is an example of a disease caused by:

- A) viruses
 - B) viroids
 - C) prions
 - D) bacteriophages
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18) If a DNA molecule contains 30% of cytosine, approximately what percentage of adenine is present?

- A) 20%
 - B) 30%
 - C) 40%
 - D) 60%
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19) In humans, enzymatic digestion is not present in the:

- A) mouth
 - B) stomach
 - C) small intestine
 - D) large intestine
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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
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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
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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 occurred:

- 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
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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
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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
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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
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26) Mitosis occurs in all the following life cycle events EXCEPT:

- A) wound healing
 - B) growth
 - C) body cell replacement
 - D) gamete formation
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27) Which structure is mainly responsible for the rigidity of the plant cell?

- A) cell wall
- B) plasma membrane
- C) nucleolus
- D) mitochondrion

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28) In humans, the main artery leaving the heart is:

- A) aorta
- B) vena cava superior
- C) vena cava inferior
- D) portal vein

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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

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30) Urine of healthy man does not contain:

- A) sodium chloride
- B) water
- C) urea
- D) glucose

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CHEMISTRY

1. Which of these elements does not belong to trace elements in the human body :

- A) iron
- B) copper
- C) phosphorus
- D) selenium

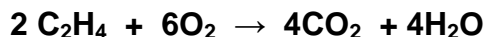
2. The number of electrons in an atom of Al (with atomic number 13 and mass number 27) is:

- 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 :



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
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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

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8. If $[H^+] = 1 \times 10^{-5} M$, which of the following is not true ?

- A) pH = 5
- B) pOH = 9
- C) $[OH^-] = 1 \times 10^{-5} M$
- D) The solution is acidic

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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

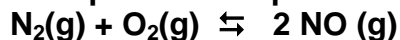
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10. The name of the isotope containing one proton and two neutrons is :

- A) protium
- B) tritium
- C) deuterium
- D) helium

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11. In the equilibrium represented by



as the pressure is increased, the amount of NO formed

- A) increases
- B) decreases
- C) remains the same
- D) increases and decreases irregularly

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12. Determine correct name for Fe₂(SO₃)₃ :

- A) ferrous sulfate
- B) ferric sulfate
- C) ferrous sulfite
- D) ferric sulfite

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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

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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_3O^+
 - C) A Brønsted acid is a proton (H^+) donor
 - D) A Brønsted base is a proton (H^+) acceptor
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15. Determine correct formula for ammonium nitrite

- A) $(NH_4) N_3$
 - B) $NH_4 NO_3$
 - C) $NH_4 NO_2$
 - D) $(NH_4)_2NO_3$
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16. Choose the trivial name of the aromatic compound: $H_3C-C_6H_4-CH_3$:

- A) benzene
 - B) toluene
 - C) xylene
 - D) naphthalene
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17. What is the systematic name of $CH_2=CH-Cl$?

- A) ethyl chlorine
 - B) 1-iodoprop-2-ene
 - C) chlorethene
 - D) 2-chlorethyne
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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) $CH_3(CH_2)_7CH = CH(CH_2)_7COOH$ oleic acid
 - B) C_6H_5COOH benzoic acid
 - C) CH_3COOH acetic acid
 - D) $CH_3(CH_2)_{16}COOH$ palmitic acid
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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
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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
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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:**

triacylglycerol + 3 NaOH → glycerol + ?

- A) 3 carboxylic acids
 - B) 3 acyls
 - C) water
 - D) soap
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24. **Which of the following compounds is the least water soluble?**

- A) benzene
 - B) propanoic acid
 - C) phenol
 - D) methanol
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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) —NH_2 group is the functional group of secondary amines
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26. **Which of the following compounds is an amino acids?**

- A) glutamic acid
 - B) succinic acid
 - C) glucuronic acid
 - D) stearic acid
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27. **Choose the pair of saccharides which are not isomers:**

- A) D-glucose / L-glucose
 - B) glucose / fructose
 - C) α -D-glucose / β -D-glucose
 - D) glucose / ribose
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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
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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
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30. **Choose the incorrect statement:**

- A) $C_6H_5-NH_2$ is an amine
 - B) CH_3-CH_2-OH is an alcohol
 - C) H_3C-CHO is an aldehyde
 - D) $H_3C-CH_2-CO-CH_3$ is an ether
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PHYSICS

1. The volume of 1 L is:

- A) 10^{-1} m^3
 - B) 10^{-3} m^3
 - C) 10^{-6} m^3
 - D) 10 m^3
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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
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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
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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
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5. What is the volume of 1kg 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
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6. What isotope is formed by the radioactive decay of a ($A=14, Z=6$) C nucleus by β^- emission?

- A) $(14,7) \text{ N}$
 - B) $(12,6) \text{ C}$
 - C) $(11,5) \text{ B}$
 - D) $(9, 4) \text{ Be}$
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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

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8. What is the correct expression of the unit watt (W)?

- A) $1 \text{ W} = 1 \text{ N} \cdot \text{m}^2$
- B) $1 \text{ W} = 0.981 \text{ kg}$
- C) $1 \text{ W} = 1 \text{ J/s}$
- D) $1 \text{ W} = 1 \text{ m/s}^2$

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9. What is the temperature of 42°C on the Kelvin scale?

- A) 42 K
- B) -142 K
- C) 315 K
- D) 100 K

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10. The spreading of white light into the full spectrum of colors is called:

- A) reflection
- B) refraction
- C) dispersion
- D) diffracion

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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

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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

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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

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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

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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

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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

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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

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18. The unit of heat is

- A) kelvin
- B) celsius
- C) pascal
- D) joule

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19. Which of the following units is not a base SI unit?

- A) newton
- B) candela
- C) mole
- D) kelvin

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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

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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 α radiation is typical

- A) positive charge
 - B) deep penetration
 - C) wavelength of 550 nm
 - D) negative charge
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23. What particle is emitted when a nucleus decays by β decay?

- A) proton
 - B) neutron
 - C) electron
 - D) a nucleus of helium
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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, $10\,000\Omega$ and $30k\Omega$, is:

- A) $40\,k\Omega$
 - B) $10\,k\Omega$
 - C) $30\,k\Omega$
 - D) $10\,030\,\Omega$
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26. Which of the following colors has shorter wavelength than green?

- A) red
 - B) yellow
 - C) orange
 - D) blue
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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
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28. A typical application of semiconductors is:

- A) diode
- B) transformer
- C) capacitor
- D) microscope

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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

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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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ENTRANCE EXAM KEY

Question	BIOLOGY	CHEMISTRY	PHYSICS
1	B	C	B
2	A	A	C
3	C	D	B
4	D	B	B
5	C	C	D
6	C	B	A
7	A	B	C
8	B	C	C
9	D	A	C
10	A	B	C
11	D	C	C
12	C	D	D
13	B	D	A
14	A	B	C
15	D	C	D
16	C	C	A
17	C	C	B
18	A	D	D
19	D	D	A
20	C	A	C
21	D	B	B
22	C	D	A
23	B	D	C
24	D	A	B
25	B	B	A
26	D	A	D
27	A	D	B
28	A	D	A
29	C	B	A
30	D	D	A