

Class 6 | Science Olympiad

Instructions: Each question has one correct answer. Choose the best option (A/B/C/D). Answer key is provided at the end. This paper is for practice only — not an official exam paper. Recommended time: **45 minutes**.

Q1. Avogadro's number (6.022×10^{23}) represents the number of particles in one:

A. gram of any substance

B. litre of gas at STP

C. mole of a substance

D. molecule

Q2. In an electrochemical cell, oxidation occurs at the:

A. cathode

B. salt bridge

C. anode

D. electrolyte

Q3. The Hardy-Weinberg principle states that allele frequencies in a population remain constant if:

A. natural selection occurs

B. no mutation, migration, or selection occurs and mating is random

C. the population is very small

D. genetic drift is present

Q4. Which quantum number describes the shape of an atomic orbital?

A. principal quantum number (n)

B. spin quantum number (ms)

C. magnetic quantum number (ml)

D. azimuthal (angular momentum) quantum number (l)

Q5. The equation for work done is $W = Fd \cos\theta$. If $F = 10 \text{ N}$, $d = 5 \text{ m}$, $\theta = 60^\circ$, then W equals:

A. 50 J

B. 86.6 J

C. 25 J

D. 43.3 J

Q6. Entropy in thermodynamics is a measure of:

A. the total energy in a system

B. the minimum usable energy

C. disorder or randomness in a system

D. heat flow rate

Q7. Which of the following best describes COMPETITIVE inhibition of an enzyme?

A. the inhibitor binds permanently to the active site

B. the inhibitor changes the shape of the active site

C. the inhibitor binds to the active site and blocks the substrate

D. the inhibitor denatures the enzyme

Q8. The Pauli Exclusion Principle states that no two electrons in an atom can have:

A. the same spin

B. the same principal quantum number

C. all four quantum numbers the same

D. the same energy level

Q9. Which type of radioactive decay INCREASES the atomic number by 1?

A. alpha decay

B. gamma decay

C. neutron emission

D. beta-minus decay

Q10. In the human immune system, B cells produce:

A. T cells

B. phagocytes

C. antibodies

D. antigens

Q11. Le Chatelier's Principle states that a system at equilibrium will respond to a stress by:

A. stopping the reaction

B. shifting to oppose the change and re-establish equilibrium

C. increasing the temperature

D. reducing the concentration of all species

Q12. The Hertzsprung-Russell (H-R) diagram plots stellar ___ against ___.

A. mass vs age

B. luminosity vs surface temperature

C. size vs distance

D. colour vs distance from Earth

Q13. Which of the following correctly describes the process of MEIOSIS II?

A. homologous chromosomes separate

B. DNA replication occurs

C. sister chromatids separate, producing 4 haploid cells

D. the nuclear envelope dissolves and spindle fibres form

Q14. The rate of a chemical reaction can be increased by all EXCEPT:

A. increasing temperature

B. adding a catalyst

C. increasing the surface area

D. decreasing the concentration of reactants

Q15. Which law states: 'The total pressure of a gas mixture equals the sum of the partial pressures of each gas'?

A. Boyle's Law

B. Gay-Lussac's Law

C. Dalton's Law of Partial Pressures

D. Henry's Law

Q16. The process of OSMOSIS moves water:

A. from low to high solute concentration

B. from high to high solute concentration

C. from high to low solute concentration (down the concentration gradient)

D. from low to low water potential

Q17. In a standing wave on a string, nodes are points of:

A. maximum displacement

B. maximum amplitude

C. zero displacement

D. constructive interference

Q18. Which of these correctly describes a TYPE II supernova?

A. occurs when a white dwarf accretes mass and exceeds the Chandrasekhar limit

B. is caused by a neutron star collision

C. occurs when a massive star (>8 solar masses) exhausts its nuclear fuel and core collapses

D. is caused by two white dwarfs merging

Q19. Fick's Law of Diffusion states that the rate of diffusion is proportional to:

A. the surface area and concentration gradient

B. only the concentration gradient

C. temperature and pressure only

D. particle size only

Q20. The primary structure of a protein is determined by:

A. hydrogen bonds between amino acids

B. disulfide bonds

C. the sequence of amino acids

D. van der Waals forces

Q21. Which subatomic particle determines the chemical behaviour of an element?

A. neutrons

B. protons

C. electrons

D. quarks

Q22. In a p-n junction diode, current flows easily when the diode is:

A. reverse biased

B. unbiased

C. forward biased

D. insulated

Q23. The Krebs cycle (citric acid cycle) occurs in the:

A. cytoplasm

B. nucleus

C. mitochondrial matrix

D. endoplasmic reticulum

Q24. Which of these is correctly matched with its SI unit?

A. power — joule

B. pressure — newton

C. frequency — hertz

D. electric charge — volt

Q25. The VSEPR theory predicts the shape of a molecule based on:

A. the mass of the central atom

B. repulsion between electron pairs around the central atom

C. the electronegativity difference between atoms

D. the number of protons in the molecule

Q26. A water molecule (H_2O) is polar because:

A. it has equal sharing of electrons

B. hydrogen is heavier than oxygen

C. oxygen is more electronegative and the molecule has a bent shape

D. it has ionic bonds

Q27. Which of the following is a consequence of special relativity?

A. gravity causes space-time to curve

B. mass and energy are equivalent ($E = mc^2$)

C. objects fall at the same rate regardless of mass

D. light slows down in a vacuum

Q28. The refractive index of a medium is defined as:

A. angle of incidence \div angle of refraction

B. speed of light in vacuum \div speed of light in medium

C. wavelength in vacuum \div wavelength in medium

D. both B and C are correct

Q29. Which element has the highest ELECTRONEGATIVITY?

A. oxygen

B. chlorine

C. nitrogen

D. fluorine

Q30. Gene expression involves transcription ($\text{DNA} \rightarrow \text{mRNA}$) and then:

A. replication ($\text{mRNA} \rightarrow \text{DNA}$)

B. translation ($\text{mRNA} \rightarrow \text{protein}$)

C. mutation ($\text{mRNA} \rightarrow \text{altered DNA}$)

D. osmosis ($\text{mRNA} \rightarrow \text{cell membrane}$)

Q31. Which of the following is an example of NEGATIVE feedback in the human body?

A. childbirth contractions increasing in intensity

B. blood clotting amplifying itself

C. insulin lowering blood glucose when it rises

D. fever increasing body temperature

Q32. Kirchhoff's Voltage Law states that:

A. current is the same at all points in a series circuit

B. charge is conserved at a junction

C. the sum of voltages around a closed loop equals zero

D. resistance doubles when temperature halves

Q33. In DNA base pairing, adenine pairs with ___ and guanine pairs with ___.

A. cytosine, thymine

B. guanine, cytosine

C. thymine, cytosine

D. uracil, cytosine

Q34. The principle of superposition for waves states that:

A. waves cancel each other completely

B. only transverse waves can interfere

C. the resultant displacement is the vector sum of individual displacements

D. two waves cannot occupy the same space

Q35. Which of these is NOT a type of chemical bond?

A. ionic

B. covalent

C. metallic

D. gravitational

Q36. According to the Second Law of Thermodynamics:

A. energy is always conserved

B. total entropy of an isolated system increases over time

C. heat flows from cold to hot naturally

D. work can be fully converted to heat and back

Q37. In gel electrophoresis, DNA fragments are separated by:

A. colour

B. mass only

C. size (shorter fragments migrate farther)

D. temperature

Q38. Which of these correctly describes DARK MATTER?

A. matter that has no mass

B. matter made of ordinary atoms in dark regions

C. matter that interacts gravitationally but does not emit or absorb light

D. matter found only in black holes

Q39. In the lytic cycle of a bacteriophage, the virus:

A. inserts its DNA into the host chromosome

B. replicates slowly over many generations

C. replicates rapidly and lyses (destroys) the host cell

D. exits the cell by budding without killing it

Q40. The photoelectric effect demonstrated that light behaves as:

A. only a wave

B. only a particle

C. neither a wave nor a particle

D. both a wave and a particle (wave-particle duality)

Answer Key

Q1: C Q2: C Q3: B Q4: D Q5: C Q6: C Q7: C Q8: C Q9: D Q10: C
Q11: B Q12: B Q13: C Q14: D Q15: C Q16: C Q17: C Q18: C Q19: A
Q20: C Q21: C Q22: C Q23: C Q24: C Q25: B Q26: C Q27: B Q28: D
Q29: D Q30: B Q31: C Q32: C Q33: C Q34: C Q35: D Q36: B Q37: C
Q38: C Q39: C Q40: D