NSO-Style · Original Practice Content

Class 8 | Science Olympiad

40 Questions · With Answer Key
Syllabax Olympiad Series
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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. Which of the following correctly defines the Gibbs free energy equation?

A. G = H + TS
B. G = H – TS
C. G = E + PV
D. G = U – TS + PV

Q2. In an SN1 reaction, the rate-determining step involves:

A. backside attack by the nucleophile
B. formation of a carbocation intermediate
C. inversion of configuration
D. bimolecular collision

Q3. The Haber process produces ammonia using $N_2 + 3H_2 \rightleftharpoons 2NH_3$. A higher yield of NH_3 is favoured by:

A. high temperature and low pressure
B. low temperature and high pressure
C. high temperature and high pressure
D. low temperature and low pressure

Q4. In electrophoresis, DNA fragments migrate towards the POSITIVE electrode because DNA is:

A. positively charged
B. neutral
C. negatively charged (due to phosphate groups)
D. both positive and negative

Q5. Which protein complex is responsible for unwinding the DNA double helix during replication?

A. DNA polymerase
B. ligase
C. helicase
D. primase

Q6. The threshold potential for triggering an action potential in a neuron is approximately:

A. –90 mV
B. 0 mV
C. –55 mV
D. +30 mV

Q7. In plants, the apical meristem is responsible for:

A. lateral (secondary) growth

B. root hair formation

C. primary growth — increase in length

D. fruit formation

Q8. The photoelectric effect equation is KE_max = hf – φ, where φ is the:

A. frequency of light

B. work function (minimum energy needed to remove an electron)

C. electron's mass

D. Planck's constant

Q9. Beta-oxidation of fatty acids occurs in the:

A. cytoplasm

B. smooth endoplasmic reticulum

C. mitochondrial matrix

D. lysosome

Q10. Which of the following statements about ENTROPY is FALSE?

A. entropy of a perfect crystal at 0 K is zero (Third Law)

B. entropy always decreases in chemical reactions

C. entropy increases when a gas expands

D. dissolving a solid in water generally increases entropy

Q11. In a transformer, if the primary coil has 100 turns and the secondary has 500 turns, and the primary voltage is 20 V, the secondary voltage is:

A. 4 V

B. 100 V

C. 200 V

D. 2500 V

Q12. The Nernst equation calculates the equilibrium potential for an ion. It includes the term RT/zF, where z is:

A. atomic number

B. the number of moles of electrons transferred

C. the valence (charge) of the ion

D. the equilibrium constant

Q13. PCNA (Proliferating Cell Nuclear Antigen) functions as a sliding clamp for:

A. RNA polymerase

B. DNA polymerase δ during replication

C. ribosomes

D. restriction enzymes

Q14. Raman spectroscopy detects:

A. radioactive decay

B. changes in magnetic spin

C. inelastic scattering of photons revealing molecular vibrations

D. UV absorption by conjugated systems

Q15. Which of these correctly identifies a key difference between Type I and Type II diabetes?

A. Type I: insulin resistance; Type II: autoimmune destruction of beta cells

B. Type I: autoimmune destruction of beta cells (no insulin); Type II: insulin resistance

C. both involve insufficient insulin production

D. Type II always requires insulin injections

Q16. The Friedel-Crafts alkylation reaction adds an alkyl group to an aromatic ring using:

A. a free radical mechanism

B. an electrophilic aromatic substitution mechanism

C. a nucleophilic aromatic substitution

D. an addition reaction

Q17. In the Standard Model of particle physics, which particle mediates the electromagnetic force?

A. gluon

B. W boson

C. Z boson

D. photon

Q18. Fluorescence microscopy uses:

A. electrons instead of photons

B. X-rays to image cells

C. fluorescent dyes excited by specific wavelengths of light

D. atomic force to image surfaces

Q19. The Hardy-Weinberg equation $p^2 + 2pq + q^2 = 1$ gives the frequency of genotypes. If $q = 0.3$, what is the frequency of the homozygous recessive genotype?

A. 0.7

B. 0.42

C. 0.09

D. 0.49

Q20. In atmospheric chemistry, ozone (O_3) is destroyed by CFCs through:

A. photolysis producing chlorine radicals that catalyse O_3 breakdown

B. direct reaction with UV light

C. reaction with water vapour

D. combination with nitrogen oxides

Q21. Which of the following enzymes is used in PCR to synthesise new DNA strands?

A. RNA polymerase

B. DNA ligase

C. restriction endonuclease

D. Taq polymerase (thermostable DNA polymerase)

Q22. The Hall effect demonstrates that moving charge carriers in a magnetic field experience a force that is perpendicular to both the current and the magnetic field, a consequence of:

A. Coulomb's Law

B. Ampère's Law

C. the Lorentz Force

D. Faraday's Law

Q23. Which neurotransmitter is associated with the reward pathway and is implicated in Parkinson's disease when depleted?

A. serotonin

B. GABA

C. dopamine

D. acetylcholine

Q24. The concept of 'junk DNA' has been revised because much non-coding DNA:

A. codes for viral proteins

B. has no function at all

C. encodes structural proteins

D. includes regulatory elements, non-coding RNAs, and other functional sequences

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Q25. Which of these correctly describes quorum sensing in bacteria?

A. bacteria competing for nutrients

B. bacteria communicating via chemical signals to coordinate behaviour based on population density

C. bacteria becoming resistant to antibiotics

D. bacteria forming spores under stress

Q26. In protein folding, the 'hydrophobic core' forms because:

A. polar residues attract water and face inward

B. non-polar residues are excluded from water and cluster in the interior

C. disulfide bonds hold the core together

D. hydrogen bonds between all residues force folding

Q27. Mass spectrometry identifies compounds by measuring:

A. electrical conductivity

B. heat of combustion

C. colour and wavelength

D. mass-to-charge ratio (m/z) of ionised fragments

Q28. The Coriolis effect causes winds and ocean currents to deflect:

A. eastward in both hemispheres

B. towards the equator

C. to the right in the Northern Hemisphere, to the left in the Southern

D. towards the poles in both hemispheres

Q29. Epigenetics studies heritable changes in gene expression that do NOT involve:

A. methylation of DNA

B. histone modification

C. changes to the underlying DNA sequence

D. chromatin remodelling

Q30. In the citric acid cycle, acetyl-CoA combines with oxaloacetate to form:

A. succinyl-CoA

B. alpha-ketoglutarate

C. citrate

D. fumarate

Q31. Which of the following best describes resonance in organic chemistry?

A. the physical oscillation of a molecule

B. a single bond alternating between double and single

C. the delocalisation of electrons across multiple structures described by contributing resonance forms

D. only found in aromatic compounds

Q32. The James Webb Space Telescope primarily observes in which part of the electromagnetic spectrum?

A. X-ray

B. ultraviolet

C. infrared

D. visible only

Q33. In the ELISA test, the enzyme-linked antibody produces a colour change to indicate:

A. the age of a sample

B. whether DNA has been replicated

C. the presence of a specific antigen

D. the pH of a solution

Q34. Which of the following is the correct molecular orbital configuration indicating that O_2 is paramagnetic?

A. O_2 has no unpaired electrons

B. O_2 has two unpaired electrons in its π^* antibonding orbitals

C. O_2 has one unpaired electron in a σ antibonding orbital

D. O_2 is diamagnetic because all electrons are paired

Q35. The 'founder effect' is a type of genetic drift that occurs when:

A. a new allele appears due to mutation

B. a large population evolves

C. natural selection favours specific traits

D. a small group colonises a new area, carrying only a subset of the original gene pool

Q36. In a Michelson-Morley experiment, the result was that:

A. the speed of light varied with direction

B. the ether could be detected

C. the speed of light was constant regardless of direction (no ether)

D. magnetic fields affect light speed

Q37. Which of these correctly describes the function of restriction endonucleases?

A. join DNA fragments together

B. copy DNA during PCR

C. cut DNA at specific recognition sequences

D. translate mRNA into protein

Q38. The Gibbs Phase Rule states F = C – P + 2, where F is degrees of freedom, C is components, and P is phases. For water at the triple point, F =

A. 3

B. 2

C. 1

D. 0

Q39. Which of these correctly describes a key feature of prion diseases (e.g., CJD, BSE)?

A. caused by a virus attacking the brain

B. caused by a bacterial toxin

C. caused by misfolded proteins that template the misfolding of normal proteins

D. caused by a genetic deletion

Q40. Hawking radiation is the theoretical prediction that:

A. black holes emit gamma rays from their accretion disks

B. black holes slowly emit thermal radiation due to quantum effects near the event horizon

C. neutron stars produce X-rays when accreting matter

D. quasars emit radiation across all wavelengths

Answer Key

Q1: B Q2: B Q3: B Q4: C Q5: C Q6: C Q7: C Q8: B Q9: C Q10: B

Q11: B Q12: C Q13: B Q14: C Q15: B Q16: B Q17: D Q18: C Q19: C

Q20: A Q21: D Q22: C Q23: C Q24: D Q25: B Q26: B Q27: D Q28: C

Q29: C Q30: C Q31: C Q32: C Q33: C Q34: B Q35: D Q36: C Q37: C

Q38: D Q39: C Q40: B