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SCO INTERNATIONAL OLYMPIAD

GRADE 9 CHEMISTRY

SAMPLE QUESTION PAPER

Sample Question Paper Set S | With Answers and Explanations

- Designed for Grade 9 learners and aligned with SCO International Chemistry Olympiad preparation.
- Covers Matter in Our Surroundings, Pure Substances & Mixtures, Atoms and Molecules, and Atomic Structure.
- lobal reference orientation: particle models, evidence-based enquiry, data interpretation, and chemistry reasoning.

Matter | **Mixtures** | **Atoms** | **Molecules** | **Chemistry**

States | **Separation** | **Formulae** | **Ions** | **Reasoning**

SCO International Chemistry Olympiad- Class 9

Sample Question Paper Set S | With Answers and Explanations

Candidate Guidelines

Exam Name	SCO International Chemistry Olympiad
Class / Grade	Class 9
Question Paper Set	Set H
Duration	60 minutes
Type of Exam	Objective Type / Multiple Choice Questions
Total Questions	50
Marking	General, Case Study, and Reason/Assertion questions carry 1 mark each; Achievers Section questions carry 2 marks each.
Calculator	Not allowed unless specifically permitted by the examination authority.

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Important Instructions

- Read each question carefully and choose only one correct option.
- Use the OMR sheet or online answer screen exactly as instructed by the invigilator/platform.
- Rough work should be done only in the space provided or on permitted rough sheets.
- This paper is designed for conceptual understanding, evidence-based reasoning, and application of chemistry in familiar situations.

Syllabus Coverage

- Matter in Our Surroundings: particle model, states of matter, diffusion, evaporation, latent heat.
- Is Matter Around Us Pure?: pure substances, mixtures, solutions, suspensions, colloids, concentration, separation methods.
- Atoms and Molecules: laws of chemical combination, symbols, formulae, molecular mass, mole concept, ions.
- Structure of the Atom: subatomic particles, Rutherford and Bohr models, shells, atomic number, mass number, isotopes and isobars.

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General Chemistry Reasoning

Q1. Which observation best supports the idea that particles of matter are continuously moving?

A. A drop of blue ink spreads through water without stirring.
B. A stone remains at the bottom of a beaker.
C. A notebook has fixed pages.
D. A metal spoon shines in light.

Answer: A

Explanation: Ink spreads because its particles and water particles move randomly and mix by diffusion.

Q2. Which statement correctly describes gases?

A. Gases have fixed shape and fixed volume.
B. Gas particles are tightly packed in layers.
C. Gas particles are far apart and move rapidly in all directions.
D. Gas particles cannot exert pressure.

Answer: C

Explanation: Gas particles are widely spaced, move rapidly, and collide with container walls, producing pressure.

Q3. Naphthalene balls slowly disappear when kept in a cupboard. This is an example of:

A. condensation
B. sublimation
C. freezing
D. sedimentation

Answer: B

Explanation: Naphthalene changes directly from solid to vapour, a process called sublimation.

Q4. Which situation involves condensation?

A. Water vapour forming droplets on a cold glass
B. Ice changing into water
C. Water changing into steam
D. Camphor changing into vapour

Answer: A

Explanation: Condensation is the change of gas/vapour into liquid, seen as droplets on a cold surface.

Q5. Which factor does NOT generally increase evaporation?

A. Increasing surface area
B. Increasing temperature
C. Increasing humidity
D. Increasing wind speed

Answer: C

Explanation: High humidity slows evaporation because the air already contains more water vapour.

Q6. A pure substance differs from a mixture because a pure substance:

A. has fixed composition
B. can always be separated by filtration
C. always has many visible parts
D. is always a gas

Answer: A

Explanation: Pure substances have fixed composition and characteristic properties.

Q7. Which is a true solution?

A. Milk
B. Muddy water
C. Salt dissolved completely in water
D. Smoke

Answer: C

Explanation: A true solution is homogeneous; salt water is a common example.

Q8. Which statement about colloids is correct?

A. They always settle immediately.
B. They scatter light and may show the Tyndall effect.
C. They are always pure substances.
D. They can be separated by ordinary filtration like sand.

Answer: B

Explanation: Colloidal particles are small but large enough to scatter light.

Q9. A student wants to separate iron filings from sulphur powder. Which method is best?

A. Evaporation
B. Chromatography
C. Magnetic separation
D. Fractional distillation

Answer: C

Explanation: Iron is magnetic, so a magnet can separate iron filings from sulphur.

Q10. Which method is used to separate cream from milk?

A. Centrifugation
B. Sublimation
C. Crystallisation only
D. Magnetic separation

Answer: A

Explanation: Centrifugation separates components based on density by rapid spinning.

Q11. Which is the dispersed phase in fog?

A. Liquid water droplets
B. Solid dust only
C. Air molecules only
D. Dissolved salt

Answer: A

Explanation: Fog is a colloid in which liquid water droplets are dispersed in air.

Q12. What is the mass percentage of a solution made by dissolving 15 g of solute in 85 g of water?

A. 15%
B. 17.6%
C. 85%
D. 100%

Answer: A

Explanation: Total mass = 100 g; solute percentage = 15/100 x 100 = 15%.

Q13. Which of the following is a compound?

A. Oxygen gas
B. Distilled water
C. Air
D. Brass

Answer: B

Explanation: Water is made of hydrogen and oxygen chemically combined in a fixed ratio.

Q14. Which law is illustrated when carbon and oxygen always combine in a fixed mass ratio to form carbon dioxide?

A. Law of conservation of energy
B. Law of constant proportions
C. Law of variable shapes
D. Law of diffusion

Answer: B

Explanation: A compound has elements in a fixed ratio by mass; this is the law of constant proportions.

Q15. If calcium forms Ca^{2+} and chloride forms Cl^-, the formula of calcium chloride is:

A. CaCl
B. $CaCl_2$
C. Ca_2Cl
D. Ca_2Cl_2

Answer: B

Explanation: One Ca^{2+} ion needs two chloride ions to balance charge.

Q16. What is the formula of water?

A. HO
B. H2O
C. H2O2
D. OH2O

Answer: B

Explanation: Water contains two hydrogen atoms and one oxygen atom in each molecule.

Q17. Find the molecular mass of NH3. (N = 14, H = 1)

A. 15 u
B. 16 u
C. 17 u
D. 18 u

Answer: C

Explanation: NH3 = 14 + 3(1) = 17 u.

Q18. Which particle has a negative charge?

A. Proton
B. Neutron
C. Electron
D. Nucleus

Answer: C

Explanation: Electrons are negatively charged particles found outside the nucleus.

Q19. Which scientist proposed the nuclear model of the atom after the gold foil experiment?

A. J. J. Thomson
B. Ernest Rutherford
C. John Dalton
D. Dmitri Mendeleev

Answer: B

Explanation: Rutherford's gold foil experiment led to the nuclear model of the atom.

Q20. The maximum number of electrons in the first shell is:

A. 1
B. 2
C. 8
D. 18

Answer: B

Explanation: For n = 1, maximum electrons = 2n^2 = 2.

Q21. Which represents electronic configuration of magnesium (atomic number 12)?

A. 2,8,2
B. 2,6,4
C. 2,10
D. 8,4

Answer: A

Explanation: Magnesium has 12 electrons arranged as 2,8,2.

Q22. Which statement about neutrons is correct?

A. They are negatively charged.
B. They are positively charged.
C. They have no charge and are present in the nucleus.
D. They revolve in shells like electrons.

Answer: C

Explanation: Neutrons are neutral particles present in the nucleus.

Q23. An atom has atomic number 8 and mass number 16. How many neutrons does it have?

A. 8
B. 16
C. 24
D. 4

Answer: A

Explanation: Neutrons = mass number - atomic number = 16 - 8 = 8.

Q24. Which pair represents isotopes?

A. C-12 and C-14
B. Na-23 and Mg-24
C. O-16 and N-14
D. Cl-35 and Ar-40

Answer: A

Explanation: Isotopes are atoms of the same element with different mass numbers.

Q25. Why do isotopes of chlorine show similar chemical properties?

A. They have the same number of electrons in neutral atoms.
B. They have identical mass numbers.
C. They have different atomic numbers.
D. They contain no neutrons.

Answer: A

Explanation: Chemical properties depend mainly on electronic configuration, which is same in neutral isotopes.

Q26. Which is an isobar pair?

A. C-12 and C-14
B. K-40 and Ca-40
C. H-1 and H-2
D. Cl-35 and Cl-37

Answer: B

Explanation: Isobars have same mass number but different atomic numbers.

Q27. A substance is made of only one type of atom. It is:

A. an element
B. a compound
C. a suspension
D. a solution

Answer: A

Explanation: An element contains only one kind of atom.

Q28. Which option best represents a mixture?

A. Only identical H_2O molecules
B. Sodium and chlorine chemically combined in fixed ratio
C. Iron filings and sand physically together
D. Only oxygen atoms

Answer: C

Explanation: A mixture contains substances physically combined and separable by physical methods.

Q29. Which formula is correct for sodium oxide if sodium is Na^+ and oxide is O^{2-}?

A. NaO
B. Na_2O
C. NaO_2
D. Na_2O_2

Answer: B

Explanation: Two Na^+ ions balance one O^{2-} ion, giving Na_2O.

Q30. Which of the following has the smallest particles that do not scatter light visibly?

A. True solution
B. Colloid
C. Suspension
D. Foam

Answer: A

Explanation: True-solution particles are too small to scatter light visibly.

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Case Study and Data-Based Questions

Q31. Case Study: A student heats a beaker containing ice and records the temperature every minute. During melting, what should the student expect?

A. Temperature remains nearly constant until melting is complete.
B. Temperature falls below zero throughout heating.
C. Temperature rises sharply every second.
D. Ice becomes a new element.

Answer: A

Explanation: A plateau occurs during melting because heat is used as latent heat.

Q32. After all ice becomes water, continued heating increases the temperature. What does this show?

A. Thermal energy now increases the average kinetic energy of particles.
B. Water has stopped absorbing energy.
C. Particles have disappeared.
D. The sample becomes a pure metal.

Answer: A

Explanation: After state change is complete, heat increases particle motion and temperature.

Q33. The student uses equal masses of ice in repeated trials. Why is this useful?

A. It makes the comparison fairer.
B. It removes the need for a thermometer.
C. It changes water into salt.
D. It stops all heat loss.

Answer: A

Explanation: Controlling mass keeps the investigation fair and improves reliability.

Q34. If salt is added to ice, the melting behaviour may change because the sample is now:

A. a pure substance
B. a mixture
C. an element
D. a single atom

Answer: B

Explanation: Adding salt creates a mixture and can change melting behaviour.

Q35. Which graph feature would suggest boiling of a pure liquid?

A. A horizontal temperature region at the boiling point
B. A sudden loss of all mass
C. A zig-zag line without pattern
D. A negative temperature after heating

Answer: A

Explanation: A pure liquid shows a constant temperature during boiling.

Q36. Case Study: A teacher gives a mixture of sand, salt, and iron filings. What should students remove first using the simplest method?

A. Iron filings using a magnet
B. Salt using a magnet
C. Sand by evaporation
D. All components by hand picking only

Answer: A

Explanation: Iron filings are magnetic and can be removed with a magnet.

Q37. After iron is removed, water is added and the mixture is filtered. What remains on the filter paper?

A. Sand
B. Dissolved salt
C. Pure water only
D. Sodium ions only

Answer: A

Explanation: Sand is insoluble and is retained on the filter paper.

Q38. What method obtains salt from the filtrate?

A. Evaporation or crystallisation
B. Magnetism
C. Winnowing
D. Decantation only

Answer: A

Explanation: Evaporating water or crystallising the solution gives salt.

Q39. Why is the salt recovered from the filtrate not visible before evaporation?

A. It is dissolved in water.
B. It has become an element.
C. It has no mass.
D. It turns into sand.

Answer: A

Explanation: Dissolved salt is uniformly distributed in the solution.

Q40. Which skill is most important in this separation activity?

A. Choosing a method based on particle properties
B. Guessing without observing
C. Changing all materials chemically
D. Ignoring solubility

Answer: A

Explanation: Separation methods depend on properties such as magnetism, solubility, and particle size.

Reason and Assertion Answer Format

- A: Both Assertion and Reason are true, and Reason correctly explains Assertion.
- B: Both are true, but Reason does not correctly explain Assertion.
- C: Assertion is true but Reason is false / or as specified in the options.
- D: Assertion is false but Reason is true / or both false as specified in the options.

Q41. Assertion: A true solution does not show the Tyndall effect. Reason: The solute particles in a true solution are extremely small.

A. Both true and Reason correctly explains Assertion.
B. Both true but Reason does not explain Assertion.
C. Assertion true but Reason false.
D. Assertion false but Reason true.

Answer: A

Explanation: Very small particles in true solutions do not scatter light visibly.

Q42. Assertion: Rutherford concluded that most of the atom is empty space. Reason: Most alpha particles passed through the gold foil without deflection.

A. Both true and Reason correctly explains Assertion.
B. Both true but Reason does not explain Assertion.
C. Assertion true but Reason false.
D. Assertion false but Reason true.

Answer: A

Explanation: Most particles passed through because the atom is mostly empty space.

Q43. Assertion: The mass number of an atom equals protons plus neutrons. Reason: Electrons contribute almost no mass compared with protons and neutrons.

A. Both true and Reason correctly explains Assertion.
B. Both true but Reason does not explain Assertion.
C. Assertion true but Reason false.
D. Assertion false but Reason true.

Answer: A

Explanation: Mass number is based on nucleons; electron mass is negligible in this context.

Q44. Assertion: A mixture always has a fixed composition. Reason: Components of a mixture are chemically bonded in a fixed ratio.

A. Both true and Reason explains Assertion.
B. Both true but Reason does not explain Assertion.
C. Assertion false and Reason false.
D. Assertion false but Reason true.

Answer: C

Explanation: Mixtures do not have fixed composition and components are not chemically bonded in a fixed ratio.

Q45. Assertion: Valency helps predict chemical formulae. Reason: Formulae must balance combining capacity or charge of the combining species.

A. Both true and Reason correctly explains Assertion.
B. Both true but Reason does not explain Assertion.
C. Assertion true but Reason false.
D. Assertion false but Reason true.

Answer: A

Explanation: Valency/charge balance is used to write formulae such as $MgCl_2$ and Al_2O_3.

Achievers Section

Q46. Achievers: A solution has 12 g solute in 108 g water. What is the mass percentage of solute?

A. 10%
B. 11.1%
C. 12%
D. 20%

Answer: A

Explanation: Total mass = 120 g; percentage = 12/120 x 100 = 10%.

Q47. Achievers: How many moles are present in 9 g of water? (Molar mass of water = 18 g/mol)

A. 0.25 mol
B. 0.5 mol
C. 1 mol
D. 2 mol

Answer: B

Explanation: Moles = mass/molar mass = 9/18 = 0.5 mol.

Q48. Achievers: An atom has 11 protons, 12 neutrons, and 10 electrons. Which statement is correct?

A. It is a neutral atom of sodium.
B. It is Na^+ with mass number 23.
C. It is Mg^{2+} with mass number 22.
D. It has atomic number 12.

Answer: B

Explanation: 11 protons identify sodium; 10 electrons means +1 charge; mass number = 11 + 12 = 23.

Q49. Achievers: Which separation sequence is best for a mixture of iron filings, sand, salt, and water?

A. Evaporation first, then magnet, then filtration
B. Magnet, filtration, then evaporation
C. Chromatography, then sublimation only
D. Decantation only

Answer: B

Explanation: Use magnet for iron, filter for sand, and evaporate filtrate to get salt.

Q50. Achievers: If an element has atomic number 16, which electronic configuration is correct?

A. 2,8,6
B. 2,6,8
C. 8,8
D. 2,10,4

Answer: A

Explanation: Sixteen electrons fill shells as 2,8,6.

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Answer Key with Short Explanations

Q.No.	Answer	Short Explanation
1	A	Ink spreads because its particles and water particles move randomly and mix by diffusion.
2	C	Gas particles are widely spaced, move rapidly, and collide with container walls, producing pressure.
3	B	Naphthalene changes directly from solid to vapour, a process called sublimation.
4	A	Condensation is the change of gas/vapour into liquid, seen as droplets on a cold surface.
5	C	High humidity slows evaporation because the air already contains more water vapour.
6	A	Pure substances have fixed composition and characteristic properties.
7	C	A true solution is homogeneous; salt water is a common example.
8	B	Colloidal particles are small but large enough to scatter light.
9	C	Iron is magnetic, so a magnet can separate iron filings from sulphur.
10	A	Centrifugation separates components based on density by rapid spinning.
11	A	Fog is a colloid in which liquid water droplets are dispersed in air.
12	A	Total mass = 100 g; solute percentage = 15/100 x 100 = 15%.
13	B	Water is made of hydrogen and oxygen chemically combined in a fixed ratio.
14	B	A compound has elements in a fixed ratio by mass; this is the law of constant proportions.
15	B	One Ca2+ ion needs two chloride ions to balance charge.
16	B	Water contains two hydrogen atoms and one oxygen atom in each molecule.
17	C	NH3 = 14 + 3(1) = 17 u.
18	C	Electrons are negatively charged particles found outside the nucleus.
19	B	Rutherford's gold foil experiment led to the nuclear model of the atom.
20	B	For n = 1, maximum electrons = 2n^2 = 2.
21	A	Magnesium has 12 electrons arranged as 2,8,2.
22	C	Neutrons are neutral particles present in the nucleus.
23	A	Neutrons = mass number - atomic number = 16 - 8 = 8.
24	A	Isotopes are atoms of the same element with different mass numbers.
25	A	Chemical properties depend mainly on electronic configuration, which is same in neutral isotopes.
26	B	Isobars have same mass number but different atomic numbers.
27	A	An element contains only one kind of atom.

28	C	A mixture contains substances physically combined and separable by physical methods.
29	B	Two Na+ ions balance one O2- ion, giving Na2O.
30	A	True-solution particles are too small to scatter light visibly.
31	A	A plateau occurs during melting because heat is used as latent heat.
32	A	After state change is complete, heat increases particle motion and temperature.
33	A	Controlling mass keeps the investigation fair and improves reliability.
34	B	Adding salt creates a mixture and can change melting behaviour.
35	A	A pure liquid shows a constant temperature during boiling.
36	A	Iron filings are magnetic and can be removed with a magnet.
37	A	Sand is insoluble and is retained on the filter paper.
38	A	Evaporating water or crystallising the solution gives salt.
39	A	Dissolved salt is uniformly distributed in the solution.
40	A	Separation methods depend on properties such as magnetism, solubility, and particle size.
41	A	Very small particles in true solutions do not scatter light visibly.
42	A	Most particles passed through because the atom is mostly empty space.
43	A	Mass number is based on nucleons; electron mass is negligible in this context.
44	C	Mixtures do not have fixed composition and components are not chemically bonded in a fixed ratio.
45	A	Valency/charge balance is used to write formulae such as MgCl2 and Al2O3.
46	A	Total mass = 120 g; percentage = 12/120 x 100 = 10%.
47	B	Moles = mass/molar mass = 9/18 = 0.5 mol.
48	B	11 protons identify sodium; 10 electrons means +1 charge; mass number = 11 + 12 = 23.
49	B	Use magnet for iron, filter for sand, and evaporate filtrate to get salt.
50	A	Sixteen electrons fill shells as 2,8,6.