Chemistry Ch 2: Matter – Answer Key

Class 9 Chemistry (FBISE pattern) | Al Amal Learning Center

Tip: the **circled** option is correct. Read why, then try the question again yourself.

SECTION A (MCQs)

Q	Question	A	B	C	D
1.	A substance is a solid below 60 °C, a cloudy fluid with some properties of solids between 60 °C and 90 °C, and a clear liquid above 90 °C. What is its state at 75 °C?	Solid	Transparent liquid	Gas	**Liquid crystal**

Why D? 75 °C lies between 60 and 90 °C. There it is a **cloudy fluid** with some **solid properties** → this is the **liquid crystal** state (flows like a liquid, partly ordered like a solid).

2.	Which pair consists of allotropes of the same element?	**Diamond and buckyball**	Water and steam	Brass and bronze	Carbon dioxide and carbon monoxide

Why A? **Allotropes** = same element in different forms. Diamond and buckyball are both pure **carbon**. Water/steam is one compound in two states, brass/bronze are alloys, CO_2/CO are different compounds.

3.	Which pair contains only homogeneous mixtures?	Milk and ink	**Brass and vinegar**	Muddy water and blood	Sugar syrup and jelly

Why B? **Homogeneous** = same composition throughout (a solution). Brass and vinegar are solutions. Milk, ink, blood, jelly are colloids and muddy water is a suspension (heterogeneous).

4.	Which statement is true for both colloids and suspensions but not for true solutions?	Their particles are smaller than 1 nm	They are homogeneous mixtures	Their particles pass through ultra-filter paper	**They are heterogeneous mixtures**

Why D? Solutions are homogeneous, with particles < 1 nm that pass through ultra-filter

paper. Colloids and suspensions are ***heterogeneous***. So (A), (B), (C) describe solutions.

5.	In the ghee industry, hydrogen gas is used on the surface of nickel metal. Which statement is correct?	Both are solutes	Hydrogen is the solvent and nickel is the solute	Hydrogen is the solute and nickel is the solvent	Both are solvents

Why C? Hydrogen gas is absorbed into solid nickel. The substance that dissolves is the ***solute*** (hydrogen), the substance it dissolves in is the ***solvent*** (nickel).

6.	Which pair consists of solutions in which a liquid is dissolved in a liquid?	Brine and sugar syrup	Carbonated drink and brine	Amalgam and brass	Vinegar and rectified spirit

Why D? Vinegar = acetic acid in water, rectified spirit = ethanol in water (***liquid in liquid***). Brine and sugar syrup are solid in liquid, carbonated drink is gas in liquid, amalgam and brass are metal solutions.

7.	Which pair of solutes shows a decrease in solubility as the temperature rises?	Na_2SO_4 and $Ca(OH)_2$	KCl and NH_4Cl	KCl and $Ca(OH)_2$	NH_4Cl and Na_2SO_4

Why A? On the solubility curves KCl and NH_4Cl go ***up*** with temperature. Na_2SO_4 and $Ca(OH)_2$ go ***down***. Only option (A) has both falling.

8.	The solubility of KCl is 56 g per 100 g of water at 100 °C and 34.7 g per 100 g of water at 20 °C. A saturated solution of KCl is prepared in 200 g of water at 100 °C and cooled to 20 °C. What mass of KCl crystallizes out?	21.3 g	69.4 g	42.6 g	112 g

Why C? Working:

Water = 200 g = 2 × 100 g

Dissolved at 100 °C = 56 × 2 = ***112 g***

Can stay dissolved at 20 °C = 34.7 × 2 = ***69.4 g***

Crystallizes out = 112 − 69.4 = ***42.6 g***

9.	Graphite and diamond are both pure carbon, but only graphite conducts electricity. This is because in graphite:	Carbon atoms form a tetrahedral network	Its layers are held together by strong bonds	Each carbon atom is bonded to only three others, leaving free electrons	It contains hollow ring structures

Why C? Each carbon in graphite uses **3** of its 4 outer electrons for bonding. The 4th electron is ***free to move***, so graphite conducts. In diamond all 4 are used.

10.	Which of the following is NOT a physical technique for changing the state of matter?	Heating	Cooling	Burning	Changing the pressure

Why C? Heating, cooling and changing pressure only change the ***state*** (physical change). ***Burning*** forms new substances, so it is a chemical change.

11.	In a buckyball (C-60), each carbon atom is bonded to how many other carbon atoms?	3	4	2	6

Why A? In C-60 every carbon bonds to **3** other carbons (hexagons and pentagons forming a hollow ball).

12.	Which of the following is a pure substance?	Air	Sea water	Tea	Diamond

Why D? Diamond is pure carbon (an ***element***). Air, sea water and tea are mixtures.

Scenario: (MCQs 13–16) 40 g KCl is added to 100 g water at 20 °C and stirred. Solubility of KCl = 34.7 g/100 g at 20 °C and 56 g/100 g at 100 °C. The mixture is then heated to 100 °C.

Q	Question	A	B	C	D
13.	What mass of KCl dissolves at 20 °C?	40 g	34.7 g	56 g	5.3 g

Why B? Only the ***solubility*** amount can dissolve: 34.7 g per 100 g water.

14.	What mass of KCl remains undissolved at 20 °C?	5.3 g	34.7 g	40 g	0 g

Why A? 40 − 34.7 = **5.3 g**

15.	What happens when the mixture is heated to 100 °C and stirred?	The same 5.3 g stays undissolved	All the KCl dissolves and the solution is unsaturated	All the KCl dissolves and the solution is saturated	The solution becomes supersaturated at once

Why B? At 100 °C up to 56 g can dissolve. We have only 40 g (**less than 56 g**), so all dissolves and the solution is **unsaturated**.

16.	How much more KCl can the solution dissolve at 100 °C?	56 g	16 g	21.3 g	40 g

Why B? 56 − 40 = **16 g**

Scenario: (MCQs 17–20) Liquid P: clear, no light path visible, no residue on any filter paper. Liquid Q: clear, light path visible, residue only on ultra-filter paper. Liquid R: cloudy, settles on standing, residue on ordinary filter paper.

Q	Question	A	B	C	D
17.	Liquid P is most likely:	Chalk in water	Muddy water	Sea water	Milk

Why C? Clear + no Tyndall effect + no residue = **true solution**. Sea water is a solution.

18.	Liquid Q is most likely:	Sugar syrup	Milk	Chalk in water	Sea water

Why B? **Light path visible** (Tyndall effect), passes ordinary filter paper = **colloid**. Milk is a colloid.

19.	The particles in liquid R are most likely larger than:	0.1 nm	1 nm	100 nm	1000 nm

Why D? R is cloudy, **settles** and stays on ordinary filter paper = **suspension**. Suspension particles are larger than **1000 nm**.

20.	Which single test best distinguishes liquid P from liquid Q?	Shining a beam of light through each	Filtering each through ordinary filter paper	Leaving both undisturbed for an hour	Observing the colour of each

Why A? Both are clear. The ***Tyndall effect*** shows the beam in the colloid (Q) but not in the solution (P).

SECTION B (Short Questions)

Q1 (a) [1 mark]

Allotropy is the existence of an element in **two or more different forms** in the same physical state, with different **physical properties**. Example: diamond, graphite, buckyball (forms of carbon).

Q1 (b) [2 marks]

Point	Graphite	Diamond
Structure	C atoms in flat **layers**	Each C bonded to **4** other C in a rigid **3D network**
Bonding	**Weak forces** between layers, layers **slide**	Strong bonds in all directions
Property	Soft and slippery	**Very hard**
Use	**Lubricant**	**Cutting tools**

Q1 OR [3 marks]

Property	Solids	Liquids	Gases
Density	High	Medium	Very low
Compressibility	Cannot be compressed	Almost incompressible	**Highly** compressible
Fluidity	Do not flow (rigid)	**Flow** easily	Flow very easily, fill the container

Q2 [3 marks]

Solution	Amount of solute	Can it dissolve more?
Saturated	**Maximum** amount at that temperature	No
Unsaturated	**Less** than the maximum	Yes
Supersaturated	**More** than the saturated amount (unstable)	No

Preparation: make a saturated solution at **high temperature** → cool it **slowly without disturbing** → extra solute stays dissolved (no crystals/dust to start crystallization).

Q2 OR [3 marks]

Solubility in g per 100 g water:

Solute	At 20 °C	At 100 °C	Effect of temperature
KCl	34.7 g	56 g	Solubility *increases*
$Ca(OH)_2$	0.173 g	0.066 g	Solubility *decreases*

Conclusion: temperature affects different solutes ***differently***. For most solids solubility rises, but for some it falls.

Q3 [3 marks]

Point	Element	Compound	Mixture
Meaning	Pure substance of *one kind of atoms*	*2 or more elements* chemically combined	*2 or more substances* physically mixed
Composition	One kind of atom	*Fixed* ratio	*Any* ratio, keep own properties
Example	Sodium, O_2	H_2O, CO_2	Air, sea water

Q3 OR [3 marks]

Point	Solution	Suspension
Particle size	*< 1 nm* (single ions/molecules)	*> 1000 nm* (large, heavy)
Effect of gravity	Cannot pull particles down	*Gravity pulls* particles down
On standing	Do *not* separate	Particles *settle*

SECTION C (Long Question)

Q4 [2+2+2 marks]

Given: solubility of KCl = 56 g/100 g water (100 °C), 34.7 g/100 g water (20 °C). Water = 250 g.

(a) [2]

Water	KCl dissolved at 100 °C
100 g	56 g
250 g	(56 / 100) × 250 = **140 g**

KCl dissolved = 140 g

(b) [2]

Temperature	KCl in 250 g water
100 °C	140 g
20 °C	(34.7 / 100) × 250 = **86.75 g**
Crystallized out	140 − 86.75 = **53.25 g**

KCl crystallized = 53.25 g

(c) [2]

At 20 °C the solution is SATURATED

The extra KCl has ***crystallized out*** and separated, so what is left holds exactly the maximum for 20 °C. (It would be supersaturated only if the extra KCl stayed dissolved.)

Particle level: on cooling, particles ***lose kinetic energy***. The solvent can hold fewer solute particles, so K^+ and Cl^- ions ***attract each other*** and join to form ***crystals***.

Q4 OR [6 marks]

State	Particles	Shape / volume	Example
Solid	Tightly packed, fixed positions	Fixed shape, fixed volume	Ice
Liquid	Close but free to move	No fixed shape, fixed volume	Water
Gas	Far apart, move freely	No fixed shape or volume	Oxygen
Plasma	*Ionized* gas: ions + free electrons, very high temperature	No fixed shape or volume	Lightning, sun

Special state	*How it differs from common states*
Liquid crystal	Flows like a liquid but keeps some ***ordered arrangement*** like a solid (e.g. LCD screens).
Bose-Einstein condensate	Atoms cooled very close to ***absolute zero*** lose individual identity and act as a ***single entity***.