Chemistry Ch 1: Nature of Science in Chemistry – Answer Key

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

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

SECTION A (MCQs)

Q	Question	A	B	C	D
1.	Which statement correctly describes organic chemistry as defined in this course?	It deals with all compounds of carbon without any exception	It deals with substances containing hydrogen	**It deals with substances containing carbon except carbonates, bicarbonates, oxides and carbides**	It deals with the large-scale production of carbon compounds

Why C? Organic chemistry = carbon compounds **except carbonates, bicarbonates, oxides and carbides**. (A) ignores these exceptions, (B) hydrogen is not the defining element, (D) describes industry.

2.	Which of the following is studied under inorganic chemistry rather than organic chemistry?	Ethanol	Methane	Acetic acid	**Sodium carbonate (Na_2CO_3)**

Why D? Na_2CO_3 is a **carbonate**, so it is **inorganic**. Ethanol, methane and acetic acid are carbon-hydrogen compounds (organic).

3.	Which of the following is an essential question for physical chemistry?	Why is carbon considered the backbone of organic compounds?	**How do different types of chemical bonds (ionic, covalent, metallic) form and function?**	What role do greenhouse gases play in climate change?	How are drugs designed and developed for specific therapeutic purposes?

Why B? Physical chemistry asks about **bonding, energy and rates**. (A) is organic, (C) is environmental, (D) is medicinal chemistry.

4.	A forensic laboratory examines body fluids, fibres and unknown coloured powders to find out which drugs they contain. This work is an application of:	**Analytical chemistry**	Polymer chemistry	Nuclear chemistry	Geochemistry

Why A? Finding **which drugs** are present in samples = **analytical chemistry** (identifying and measuring substances). Polymer, nuclear and geochemistry do not fit.

5.	Which set contains only examples of synthetic polymers?	Nylon, glucose and Teflon	Plastic bags, proteins and polyester	**Nylon bearings, polyethylene cups and epoxy glue**	Epoxy glue, starch and Teflon

Why C? Synthetic = man-made. Nylon, polyethylene and epoxy are synthetic polymers. Glucose, proteins and starch are **natural**.

6.	One chemist studies the chemical composition of rocks, minerals and soils in the Earth's crust. Another studies reactions in comets and interstellar space. The two chemists belong to:	Environmental and nuclear chemistry	Astrochemistry and geochemistry	Inorganic and physical chemistry	Geochemistry and astrochemistry

Why D? Rocks, minerals and soils = ***geochemistry***. Comets and interstellar space = ***astrochemistry***. The question asks in order: geochemistry first, astrochemistry second ((B) has them reversed).

7.	Which statement correctly describes medicinal chemistry?	It deals with the large-scale production of drugs in factories	It deals with the interaction between drugs and biological targets and the development of new medicinal agents	It deals with physical and chemical changes in living organisms	It deals with pollutants that harm human beings

Why B? Medicinal chemistry = drug and biological ***target interaction*** + development of new medicinal agents. (A) is industry, (C) is biochemistry, (D) is environmental.

8.	Which set of methods is used to protect water that has been polluted?	Sedimentation, filtration and disinfection	Hydrogenation, polymerization and cracking	Titration, chromatography and distillation	Electroplating, galvanizing and alloying

Why A? Sedimentation, filtration, disinfection are water-treatment methods. The others are industrial, laboratory or metal-finishing methods.

9.	A chemist investigates why elements react the way they do. A technologist develops an instrument that analyses substances more quickly. A chemical engineer designs a plant to manufacture detergents on a large scale. These three activities are examples of, in order:	Technology, science, engineering	Engineering, science, technology	Science, technology, engineering	Science, engineering, technology

Why C? Why elements react = ***science*** (understanding). Faster instrument = ***technology*** (tools). Plant for detergents = ***engineering*** (design and construction).

10.	Which statement about technology is NOT correct?	It is the systematic process of constructing and organising knowledge about the universe	It is the application of scientific knowledge to practical purposes	It results in the creation of tools, machines and systems	It has helped chemists analyse and identify substances more effectively

Why A? (A) describes ***science***, not technology. Technology = ***application*** of scientific knowledge to practical purposes, creating tools, machines and systems.

11.	Which statement best describes green chemistry?	The study of chemical processes occurring in plants	The large-scale production of chemicals at the lowest cost	The study of chemical and toxic substances that pollute the environment	The design of chemical products and processes that reduce the use of hazardous substances

Why D? Green chemistry = designing products and processes that ***reduce hazardous substances***. (B) is industrial chemistry, (C) is environmental chemistry.

12.	Which branch of chemistry is correctly matched with the area it studies?	Industrial chemistry: chemical and toxic pollutants	Nuclear chemistry: changes that occur in atomic nuclei	Astrochemistry: composition of the Earth's crust	Inorganic chemistry: all substances containing carbon

Why B? Nuclear chemistry studies changes in **atomic nuclei**. Industrial = large-scale production, astrochemistry = space, inorganic = mostly non-carbon substances.

Scenario: (MCQs 13–16) A university chemistry department has several research groups. Group 1 studies how carbohydrates, proteins, nucleic acids and lipids function in living organisms. Group 2 works on the question "How are drugs designed and developed for specific therapeutic purposes?" Group 3 investigates how greenhouse gases contribute to climate change.

Q	Question	A	B	C	D
13.	Group 1 is working in which branch of chemistry?	Organic chemistry	Analytical chemistry	Biochemistry	Medicinal chemistry

Why C? Carbohydrates, proteins, nucleic acids and lipids in living organisms = **biochemistry**.

14.	Group 2 is working in which branch of chemistry?	Medicinal chemistry	Biochemistry	Environmental chemistry	Polymer chemistry

Why A? Drug design and development for therapeutic purposes = **medicinal chemistry**.

15.	The research of Group 3 belongs to:	Astrochemistry	Nuclear chemistry	Physical chemistry	Environmental chemistry

Why D? Greenhouse gases and climate change = **environmental chemistry**.

16.	Group 1 and Group 2 often work together on a drug and enzyme project. This shows that:	Their branches of chemistry are identical	Chemistry has interdisciplinary areas in which sub-fields overlap	Medicinal chemistry is a part of geochemistry	Enzymes cannot be studied by chemists

Why B? Biochemistry and medicinal chemistry **overlap**. This shows chemistry has **interdisciplinary areas**.

Scenario: (MCQs 17–20) In a pharmaceutical factory, chemists study how a compound interacts with an enzyme. Technologists develop instruments that check the purity of the tablets. Chemical engineers design the plant that produces the medicine in large quantities.

Q	Question	A	B	C	D
17.	The chemists' study of how the compound interacts with the enzyme is an example of:	Science	Technology	Engineering	Green chemistry

Why A? Studying **how** the compound interacts with the enzyme is **understanding nature** = science.

18.	The instruments that check the purity of the tablets are the product of:	Science, because they explain the behaviour of the compound	Technology, because they apply scientific knowledge to create tools and machines	Engineering, because they study natural phenomena	Biochemistry, because they work on living organisms

Why B? Instruments are **tools** made by applying scientific knowledge = **technology**.

19.	Which statement about the work of the chemical engineers is correct?	They investigate the natural world without any practical purpose	They develop new scientific theories only	They use science and mathematics to design and construct the production system	They only repair the tools made by technologists

Why C? Chemical engineers use ***science and mathematics*** to ***design and construct*** the production system.

20.	Which statement best describes how the three groups are related?	Each group works independently and their work has no connection	Technology and engineering produce the knowledge that science only applies	Engineering seeks to understand nature while science designs the plant	Science provides understanding that technology and engineering apply to practical problems

Why D? *Science* gives understanding, which ***technology and engineering*** apply to practical problems.

Answer Key at a Glance

1	2	3	4	5	6	7	8	9	10
C	D	B	A	C	D	B	A	C	A
11	12	13	14	15	16	17	18	19	20
D	B	C	A	D	B	A	B	C	D

SECTION B (Short Questions)

Q1 (a) [1 mark]

Chemistry is the branch of science that deals with the ***composition, structure and properties*** of matter, the ***changes*** it undergoes, and the ***energy changes*** that go with them.

Q1 (b) [2 marks]

Point	*The definition says*	*The student's statement says*
What chemistry studies	Composition, structure and properties of ***all matter***	Only ***making*** new substances
Other work	***Changes*** in matter and the ***energy*** involved	Leaves out analysis, natural materials, living things, environment
Conclusion	Chemistry is much broader	Making substances is only ***one part***

Q2 [3 marks]

Branch	*Sample essential question (any suitable question)*
(a) Physical chemistry	How do different types of chemical bonds (ionic, covalent, metallic) ***form and function***?
(b) Organic chemistry	Why is ***carbon*** considered the backbone of organic compounds?
(c) Environmental chemistry	What role do ***greenhouse gases*** play in climate change?

Q3 [3 marks]

Point	Science	Technology	Engineering
Meaning	Systematic process of **constructing and organising knowledge** about the universe	**Application** of scientific knowledge to practical purposes (tools, machines, systems)	Using **science and mathematics** to **design and construct** systems and processes
Aim	To **understand** nature	To create **tools** that solve problems	To build solutions at **large scale**
Example (chemistry)	Investigating why elements react the way they do	An instrument that analyses substances more quickly	Designing a plant to manufacture detergents on a large scale

SECTION C (Long Question)

Q4 [1+1+1+1+1+1 marks]

Given: a plant makes nylon fibre and plastic bags. A laboratory finds the composition of the products. Another team finds that the waste gases add to greenhouse gases. Three more teams do the work given in (d), (e), (f).

(a) [1]

Substance	Type	Branch
Nylon, plastic bags	**Synthetic polymers**	**Polymer chemistry**

Polymer chemistry (synthetic polymers)

Focus: the **synthesis, structure, properties** and **applications** of polymers (large molecules made of repeating units).

(b) [1]

Analytical chemistry

Sample essential question: What substances are present in a sample, and **how much** of each is there?

(c) [1]

Environmental chemistry

Greenhouse gases (such as **carbon dioxide** and **methane**) **trap heat** in the atmosphere. This raises the Earth's temperature (**global warming**) and causes **climate change**.

(d), (e), (f) [1 mark each]

Part	Work of the team	Branch
(d)	Team 3: **rates** of polymerization reactions and the **energy changes**	**Physical chemistry**
(e)	Team 4: **metal catalysts** and **inorganic salts**	**Inorganic chemistry**
(f)	Team 5: process redesigned to use and release **fewer hazardous substances**	**Green chemistry**

Marks Summary

Section	Marks
Section A (20 MCQs x 0.5)	10
Section B (Q1 + Q2 + Q3)	9
Section C (Q4)	6
Total	**25**