

1. If P is the effort required to lift a load W , then mechanical advantage is given by

1. P/W 2. $P \times W$ 3. W/P 4. $\frac{1}{P \times W}$

Ans: 3

2. Efficiency of a simple machine in terms of mechanical advantage (M.A.) and velocity ratio (V.R.) is given by

1. $\frac{V.R.}{M.A.}$ 2. $\frac{1}{(V.R.) \times (M.A.)}$ 3. $\frac{M.A.}{V.R.}$ 4. $(V.R.) \times (M.A.)$

Ans: 3

3. Co-efficient of friction is the ratio of:

1. force of friction to normal reaction between two bodies
2. force of limiting friction to normal reaction between two bodies

Coefficient of friction, ratio of the frictional force resisting the motion of two surfaces in contact to the normal force pressing the two surfaces together. It is usually symbolized by the Greek letter mu (μ). Mathematically, $\mu = F/N$, where F is the frictional force and N is the normal force. Because both F and N are measured in units of force (such as newtons or pounds), the coefficient of friction is dimensionless. The coefficient of friction has different values for static friction and kinetic friction. In static friction, the frictional force resists force that is applied to an object, and the object remains at rest until the force of static friction is overcome. In kinetic friction, the frictional force resists the motion of an object. The frictional force itself is directed oppositely to the motion of the object.

<https://www.britannica.com/science/coefficient-of-friction>
 Britannica, The Editors of Encyclopaedia. "Coefficient of friction". *Encyclopedia Britannica*, 24 Jun. 2020, <https://www.britannica.com/science/coefficient-of-friction>. Accessed 30 January 2021.

4. If D is the distance moved by the effort and d is the distance moved by the load, then velocity ratio (V.R.) is given by

1. d/D 2. D/d 3. $D \times D$ 4. $\frac{1}{d \times D}$

Ans: 2

5. One metric horse power is equal to

1. 746 watt

2.736 watt

3.550 watt

4. 75 watt

Ans: 2

6. The pressure of a gas will vary indirectly as the volume. ... This represents

(1)Boyles' law

(2) Gay Lussac's law

(3)Charle's law

(4) Kirchoff's law

7. Which type of bond is present in hydrogen molecule?

(1) Ionic

(2) Covalent

(3) Metallic

(4) None

Ans: 2

8. Absolute zero may be defined as the temperature at which

(1) Molecular motion in a gas would cease

(2) all substances freeze

(3) water freezes

(4) a liquid is converted into solid

Ans. 1

9. Thermoplastic objects are produced by

(1) die casting process

(2) shell moulding process

(3) cold forming process

(4) injection moulding process

Ans: 4

10. Density, ρ of mercury is

(1) 1 gram/cm³

(2) 7.6 gram/cm³

(3) 13.6 gram/cm³

(4) 19.3 gram/cm³

Ans : 3

Note: Density of

(1) Water at 4°C =1 gram/cm³

(2) Iron =7.6 gram/cm³

(3) Gold =19.3 gram/cm³

11. Quartz is made of
- (1) ferroelectric material (2) ferromagnetic material
 (3) silicon dioxide (SiO₂) (4) diamagnetic material

Ans : 3

What is Quartz?

Quartz is a chemical compound consisting of one part silicon and two parts oxygen. It is silicon dioxide (SiO₂). It is the most abundant **mineral** found at Earth's surface, and its unique properties make it one of the most useful natural substances. Quartz has great economic importance.

1. Many varieties are gemstones, including amethyst, citrine, smoky quartz, and rose quartz. Sandstone, composed mainly of quartz, is an important building stone. Large amounts of quartz sand (also known as silica sand) are used in the manufacture of glass and ceramics and for foundry molds in metal casting.

2. Crushed quartz is used as an abrasive in sandpaper, silica sand is employed in sandblasting, and sandstone is still used whole to make whetstones, millstones, and grindstones. Silica glass (also called fused quartz) is used in optics to transmit ultraviolet light.

3. Tubing and various vessels of fused quartz have important laboratory applications, and quartz fibres are employed in extremely sensitive weighing devices.

4. Used as piezoelectric material

Britannica, The Editors of Encyclopaedia. "Quartz". *Encyclopedia Britannica*, 21 May. 2020, <https://www.britannica.com/science/quartz>. Accessed 12 March 2021.

12. Invar is used for measuring tapes primarily due to its
- (1) Non-magnetic properties (2) High nickel content
 (3) Low coefficient of thermal expansion (4) Harden ability

Ans : 3

Invar, also known generically as **FeNi36 (64%Fe and 36% Ni)**, is a nickel-iron alloy notable for its uniquely low coefficient of thermal expansion (CTE or α). The name *Invar* comes from the word *invariable*, referring to its relative lack of expansion or contraction with temperature changes. The discovery of the alloy was made in 1896 by Swiss physicist Charles Édouard Guillaume for which he received the Nobel Prize in Physics in

1920. It enabled improvements in scientific instruments.

<https://en.wikipedia.org/wiki/Invar#:~:text=Invar%2C%20also%20known%20generically%20as,or%20contraction%20with%20temperature%20changes>.

Invar was formerly used for absolute standards of length measurement and is now used for surveying tapes and in watches and various other temperature-sensitive devices.

Britannica, The Editors of Encyclopaedia. "Invar". *Encyclopedia Britannica*, 17 Jun. 2016, <https://www.britannica.com/technology/Invar>. Accessed 12 March 2021.

13. Best conductor of heat among liquids is

- (1) Water (2) Ether (3) Alcohol (4) Mercury

Ans : 4

According to the thermal properties of matter, **mercury** is the only liquid good conductor of heat. That is why it is also used in a mercury thermometer.

14. Which is the material having maximum density?

- (1) Lead (2) gold (3) Platinum (4) osmium

Ans : 4

15. Among the following which is the lightest material?

- (1) Magnesium (2) aluminium
(3) Cesium (4) osmium

Ans : 3. Note: Cesium density: 1.872 g/cc

17. Among the following, which is the lightest material?

- (1) Aluminum (2) magnesium (3) Cadmium (4) lithium

Ans: 4

Note: Lithium density: 0.534 g/cc

18. The weight of the body is
- (1) The same everywhere on the surface of the earth
 - (2) **Maximum at the poles**
 - (3) Maximum at the equator
 - (4) More the hills than in the pole

Ans: 2

At poles acceleration due to gravity, g is maximum. In combination, the equatorial bulge and the effects of the surface centrifugal force due to rotation mean that sea-level gravity increases from about 9.780 m/s^2 at the Equator to about 9.832 m/s^2 at the poles, so an object will weigh approximately 0.5% more at the poles than at the Equator.

https://en.wikipedia.org/wiki/Gravity_of_Earth

20. Which of the following is not an amorphous form of carbon.
- (1) Coke
 - (2) Charcoal
 - (3) Lamp black
 - (4) **Graphite**

Ans : 4

The amorphous forms of carbon includes coal, coke, charcoal, carbon black and lamp-black. Amorphous carbon does not have any crystalline structure. Amorphous carbon is a noncrystalline solid allotropic form of carbon.

Crystalline Form

There are two types of crystalline forms: **Diamond** and **Graphite**.



Diamond

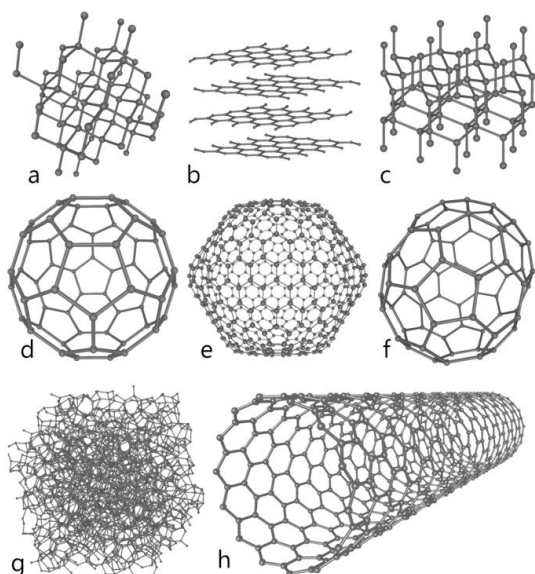


Graphite

http://quiznext.in/study-material/learning_material/ICSE-8-Chemistry/Carbon-and-its-Compounds_1/crystalline-and-amorphous-forms-of-carbon/

21. Which of the following is not an allotrope of carbon?

- (1) Coke (2) Charcoal (3) Lamp black (4) Graphite



Allotropes of Carbon: a) Diamond, b) Graphite, c) Lonsdaleite, d) C₆₀ (Buckminsterfullerene or buckyball), e) C₅₄₀, f) C₇₀, g) Amorphous carbon, and h) single-walled carbon nanotube, or buckytube.

<https://courses.lumenlearning.com/introchem/chapter/allotropes-of-carbon/>

22. Aluminium is extracted from purified bauxite (Alumina) by
- (1) Chemical reduction (2) **Electrolytic reduction**
- (3) Thermal decomposition (4) Electrolytic oxidation

Ans : 2

The **bauxite** is **purified** to produce **aluminium** oxide, a white powder from which **aluminium** can be **extracted**. The **extraction** is done by electrolysis. The ions in the **aluminium** oxide must be free to move so that electricity can pass through it.

Electrolytic reduction- Electrolytic reduction is a form of electrolysis in which electric current passes through an ionic substance in a molten or dissolved state causing the electrodes to react chemically and the materials to decompose. By using this process, the hydroxides, oxides and chlorides of metals in the combined state are electrically reduced. At the cathode, the metals are collected. Some metals such as K, Na, Al are obtained through the process of electrolytic reduction.

<https://www.bbc.co.uk/bitesize/guides/zxyq4qt/revision/4>

26. The chemical styrene is industrially used for manufacture of
 (1) Pharmaceutical (2) Dyes (3) Plastic (4) Rubber

Ans: 4

Styrene-butadiene rubber is the most-widely **used** synthetic rubber in the elastomer **industry**, with the largest volume **production**. It is a copolymer of **styrene**

24. According to Dalton's atomic theory an atom can
 (1) Be created (2) Be destroyed
 (3) Neither be created nor destroyed (4) None of the above

Ans:3

Dalton's Atomic Theory

The main points of Dalton's atomic theory include

1. Everything is composed of atoms, which are the indivisible building blocks of matter and cannot be destroyed.
2. All atoms of an element are identical.
3. The atoms of different elements vary in size and mass.
4. Compounds are produced through different whole-number combinations of atoms.
5. A chemical reaction results in the rearrangement of atoms in the reactant and product compounds.

<https://courses.lumenlearning.com/introchem/chapter/john-dalton-and-atomic-theory/>

29. Rectified spirit contains ethyl alcohol to the extent of
 (1) 100% (2) 99%
 (3) 95% (4) 50%

Ans : 3

30. Which one of the following is an ionic compound?
 (1) CH₄ (2) CCL₄ (3) NaCl (4) H₂H₂

Ans : 3

An **ionic compound** is a chemical compound composed of ions held together by electrostatic forces termed ionic bonding. The compound is neutral overall, but consists of positively charged ions called cations and negatively charged ions called anions. Ionic bond is typically between a metal and a non-metal. The structure of the bond is rigid, strong and often crystalline and solid. Ionic compounds typically have high melting and boiling points, and are hard and brittle. As solids they are almost always electrically insulating, but when melted or dissolved they become highly conductive, because the ions are mobilized.

Examples of ionic bonds and ionic compounds:

NaCl: sodium chloride

NaF: sodium fluoride

KI: potassium iodide

KCl: potassium chloride

CaCl₂: calcium chloride

K₂O: potassium oxide

MgO: magnesium oxide

<https://www.thoughtco.com/examples-of-ionic-bonds-and-compounds-603982>

31. The compound having a carbon double bond is known as

- (1) Alkanes (2) Alkenes
(3) Acetylene (4) Alkynes

Ans : 2

Alkenes contain carbon-carbon double bonds and are unsaturated hydrocarbons with the molecular formula is C_nH_{2n}.

Alkynes are hydrocarbons which have carbon-carbon triple bond functional group.

32. The strongest acid of the following is

- (1) HCL (2) H₂SO₄
(3) H₃PO₄ (4) HClO₄

Ans : 4

Table of Acid and Base Strength

Ka	Acid		Base	
	Name	Formula	Formula	Name
Large	Perchloric acid	HClO ₄	ClO ₄ ⁻	Perchlorate ion
3.2 * 10 ⁰	Hydroiodic acid	HI	I ⁻	Iodide
1.0 * 10 ⁰	Hydrobromic acid	HBr	Br ⁻	Bromide
1.3 * 10 ⁶	Hydrochloric acid	HCl	Cl ⁻	Chloride
1.0 * 10 ³	Sulfuric acid	H ₂ SO ₄	HSO ₄ ⁻	Hydrogen sulfate ion
2.4 * 10 ¹	Nitric acid	HNO ₃	NO ₃ ⁻	Nitrate ion
-----	Hydronium ion	H ₃ O ⁺	H ₂ O	Water
5.4 * 10 ⁻²	Oxalic acid	HO ₂ C ₂ O ₂ H	HO ₂ C ₂ O ₂ ⁻	Hydrogen oxalate ion
1.3 * 10 ⁻²	Sulfurous acid	H ₂ SO ₃	HSO ₃ ⁻	Hydrogen sulfite ion
1.0 * 10 ⁻²	Hydrogen sulfate ion	HSO ₄ ⁻	SO ₄ ²⁻	Sulfate ion
7.1 * 10 ⁻³	Phosphoric acid	H ₃ PO ₄	H ₂ PO ₄ ⁻	Dihydrogen phosphate ion
7.2 * 10 ⁻⁴	Nitrous acid	HNO ₂	NO ₂ ⁻	Nitrite ion
6.6 * 10 ⁻⁴	Hydrofluoric acid	HF	F ⁻	Fluoride ion
1.8 * 10 ⁻⁴	Methanoic acid	HCO ₂ H	HCO ₂ ⁻	Methanoate ion
6.3 * 10 ⁻⁵	Benzoic acid	C ₆ H ₅ COOH	C ₆ H ₅ COO ⁻	Benzoate ion
5.4 * 10 ⁻⁵	Hydrogen oxalate ion	HO ₂ C ₂ O ₂ ²⁻	O ₂ C ₂ O ₂ ²⁻	Oxalate ion
1.8 * 10 ⁻⁵	Ethanoic acid	CH ₃ COOH	CH ₃ COO ⁻	Ethanoate (acetate) ion
4.4 * 10 ⁻⁷	Carbonic acid	CO ₃ ²⁻	HCO ₃ ⁻	Hydrogen carbonate ion
1.1 * 10 ⁻⁷	Hydrosulfuric acid	H ₂ S	HS ⁻	Hydrogen sulfide ion
6.3 * 10 ⁻⁸	Dihydrogen phosphate ion	H ₂ PO ₄ ⁻	HPO ₄ ²⁻	Hydrogen phosphate ion
6.2 * 10 ⁻⁸	Hydrogen sulfite ion	HS ⁻	S ²⁻	Sulfite ion
2.9 * 10 ⁻⁸	Hypochlorous acid	HClO	ClO ⁻	Hypochlorite ion
6.2 * 10 ⁻¹⁰	Hydrocyanic acid	HCN	CN ⁻	Cyanide ion
5.8 * 10 ⁻¹⁰	Ammonium ion	NH ₄ ⁺	NH ₃	Ammonia
5.8 * 10 ⁻¹⁰	Boric acid	H ₃ BO ₃	H ₂ BO ₃ ⁻	Dihydrogen

.com

<https://depts.washington.edu/eoptics/links/acidstrength.html>

33. For hydrogen and hydrogen like single electron systems, the energy and size of an orbital is determined exclusively by

- (1) principal quantum number, n
- (2) principal and spin quantum numbers
- (3) spin and magnetic quantum numbers
- (4) magnetic and principal quantum numbers

Ans: 1

34. Which is not acid refractory brick ?

- (1) Silica
- (2) Alumina
- (3) Mullite
- (4) Magnesite

Ans : 4

Classification of refractory bricks

Acidic refractories consist of acidic materials like alumina (Al_2O_3), and silica (SiO_2). They are impervious to acidic materials, but easily attacked by basic materials. Important members of this group are alumina, silica, and fireclay refractories.

Basic refractories consist of basic materials such as CaO , MgO , etc. These are impervious to basic materials, but easily attacked by acidic materials. Important members of this group are magnesite and dolomite refractories.

Neutral refractories are made from weakly acid/basic materials such as carbon, silicon carbide (SiC), chromite (FeCr_2O_4) and zirconia (ZrO_2).

<https://www.durocast.co.za/refractory-products/news-of-durocast/106-classification-of-refractory-materials>

35. The equilibrium constant, K , for a chemical reaction depends on

- (1) temperature only (2) pressure only
 (3) temperature and pressure (4) ratio of reactants

Ans : 4

The **equilibrium constant** (K_{eq}) is the ratio of the mathematical product of the concentrations of the products of a reaction to the mathematical product of the concentrations of the reactants of the reaction. Each concentration is raised to the power of its coefficient in the balanced chemical equation. For the general reaction above, the equilibrium constant expression is written as follows:

$$K_{eq} = \frac{[C]^c [D]^d}{[A]^a [B]^b}$$

<https://courses.lumenlearning.com/cheminter/chapter/equilibrium-constant/#:~:text=As%20detailed%20in%20the%20above,the%20temperature%20of%20the%20reaction.>

36. A Carnot cycle consists of the following steps

- (1) two isothermals and two isentropics
 (2) two isobarics and two isothermals

- (3) two isochorics and two isobaries
- (4) two isothermals and two isochorics

Ans : 1

Carnot Cycle

The Carnot cycle is composed of four totally reversible processes:

- a. Isothermal heat addition at high temperature (T_H)
- b. Isentropic expansion
- c. Isothermal heat rejection at low temperature (T_L)
- d. Isentropic compression.

37. The efficiency of a Carnot engine depends on

- (1) working pressure
- (2) design of engine
- (3) type of fuel fired
- (4) temperatures of source (T_1) and sink (T_2)

Thermal efficiency of Carnot cycle, $\eta = \frac{T_1 - T_2}{T_1} = \frac{T_H - T_L}{T_H}$

38. When pure water is kept exposed to the atmosphere for a few days, what happens to its pH?

- (1) Increases to a level at least 1 or 3 units above 7 (basic)
- (2) Decreases slightly from 7
- (3) Remains unchanged
- (4) Decreases from 7 and becomes acidic

Ans: 4

Note: SO_x, NO_x, CO₂ other acidic oxides from atmosphere will dissolve.

39. Silica in any form is

- (1) Reactive
- (2) Unreactive
- (3) Highly reactive
- (4) Inert

Ans : 1

Silicon dioxide is very weakly acidic, reacting with strong bases.

Reaction with water: Silicon dioxide does not react with water, due to the thermodynamic difficulty of breaking up its network covalent structure.

40. The metal which does not give H_2 on reaction with dil. HCl is

- (1) Iron (2) Zinc (3) Calcium (4) Silver

Ans : 4

41. Brown ring test is used for the detection of

- (1) Nitrite (2) Nitrate (3) Sulphate (4) Sulphide

Ans: 2

Brown ring test is mainly used for the detection of nitrate. It is used to detect presence of nitrate in many food samples, soil and water

42. The total number of quantum numbers needed to describe an electron in an atom is

- (1) 4 (2) 3 (3) 2 (4) 1

Ans: 1

To completely describe an electron in an atom, **four** quantum numbers are needed: energy (n), angular momentum (l), magnetic moment (m_l), and spin (m_s). The first quantum number describes the electron shell, or energy level, of an atom.

43. The compounds having same molecular formula but possessing different properties that result from a difference in structure are termed as

- (1) Hydrocarbons (2) Isomers
(3) Carbon chain compounds (4) Allotropes

Ans: 2

Isomers are molecules with the same molecular formulas, but different structural formula, i.e., different arrangements of atoms.

44. A mixture of carbon monoxide and hydrogen () is called

- (1) Solid gas (2) Carbon gas (3) Hydrogen gas (4) Water gas

Ans: 4

Water gas: A mixture of carbon monoxide and hydrogen produced from passing steam over hot incandescent coke is called water gas. Water gas is a useful product but requires careful handling due to its flammability and the risk of carbon monoxide poisoning.

https://en.wikipedia.org/wiki/Water_gas

Liquefied natural gas (LNG), natural gas (primarily methane) that has been liquefied for ease of storing and transporting. Liquefied natural gas (LNG) is 600 times smaller than natural gas when the latter is in its gaseous form, and it can be easily shipped overseas. LNG is produced by cooling natural gas below its boiling point, $-162\text{ }^{\circ}\text{C}$ ($-259\text{ }^{\circ}\text{F}$), and is stored in double-walled cryogenic containers at or slightly above atmospheric pressure. It can be converted back to its gaseous form by simply raising the temperature.

Special tankers, known as LNG carriers and outfitted with supercooled cryogenic tanks, transport LNG from such countries as Qatar, Australia, Indonesia, and Algeria to markets in China, Europe, and Japan. LNG is usually reverted to its gaseous state (regasified) at the import terminals in the receiving countries, where it can then be injected into natural gas pipelines to be moved to power plants and distribution companies for various industrial uses.

Britannica, The Editors of Encyclopaedia. "Liquefied natural gas". *Encyclopedia Britannica*, 6 Feb. 2020, <https://www.britannica.com/science/liquefied-natural-gas>. Accessed 22 June 2021.

Liquefied petroleum gas (LPG), also called **LP gas**, any of several liquid mixtures of the volatile hydrocarbons propene, propane, butene, and butane. A typical commercial mixture may also contain ethane and ethylene, as well as a volatile mercaptan, an odorant added as a safety precaution.

Liquefied petroleum gas (LPG) is recovered from "wet" natural gas (gas with condensable heavy petroleum compounds) by absorption. The finished product is transported by pipeline and by specially built seagoing tankers. Transportation by truck, rail, and barge has also developed, particularly in the United States.

LPG reaches the domestic consumer in cylinders under relatively low pressures. The largest part of the LPG produced is used in central heating systems, and the next largest as raw material for chemical plants. LPG commonly is used as fuel for gas barbecue grills and gas cooktops and ovens, for gas fireplaces, and in portable heaters. I

Britannica, The Editors of Encyclopaedia. "Liquefied petroleum gas". *Encyclopedia Britannica*, 12 Oct. 2018, <https://www.britannica.com/science/liquefied-petroleum-gas>. Accessed 22 June 2021.

Coal gas, gaseous mixture—mainly hydrogen, methane, and carbon monoxide—formed by

the destructive distillation (*i.e.*, heating in the absence of air) of bituminous coal and used as a fuel. Sometimes steam is added to react with the hot coke, thus increasing the yield of gas. Coal tar and coke (*qq.v.*) are obtained as by-products.

Britannica, The Editors of Encyclopaedia. "Coal gas". *Encyclopedia Britannica*, 18 Sep. 2007, <https://www.britannica.com/science/coal-gas>. Accessed 22 June 2021.

Producer gas, mixture of flammable gases (principally [carbon monoxide](#) and hydrogen) and nonflammable gases (mainly nitrogen and carbon dioxide) made by the partial combustion of carbonaceous substances, usually coal, in an atmosphere of air and steam. Producer gas has lower heating value than other gaseous fuels, but it can be manufactured with relatively simple equipment; it is used mainly as a fuel in large industrial furnaces.

Britannica, The Editors of Encyclopaedia. "Producer gas". *Encyclopedia Britannica*, 20 Jul. 1998, <https://www.britannica.com/science/producer-gas>. Accessed 22 June 2021

Dry ice, carbon dioxide in its solid form, a dense, snowlike substance that sublimates (passes directly into the vapour without melting) at $-78.5\text{ }^{\circ}\text{C}$ ($-109.3\text{ }^{\circ}\text{F}$), used as a refrigerant, especially during shipping of perishable products such as meats or ice cream. In the production of dry ice, advantage is taken of the spontaneous cooling that occurs when compressed, liquefied carbon dioxide at $-57\text{ }^{\circ}\text{C}$ ($-71\text{ }^{\circ}\text{F}$) or lower is allowed suddenly to expand to atmospheric pressure: the liquid freezes to a finely divided solid that is compacted into cakes, weighing about 20 kg (45 pounds).

Britannica, The Editors of Encyclopaedia. "Dry ice". *Encyclopedia Britannica*, 23 Jun. 2011, <https://www.britannica.com/technology/dry-ice>. Accessed 22 June 2021.

45. Which type of bond is present in hydrogen molecule?

- (1) Ionic (2) Covalent (3) Metallic (4) None

Ans : 2

46. Marsh test is used for the detection of

- (1) Cadmium (2) Bismuth (3) Arsenic (4) Copper

Ans : 3

The **Marsh test** is a highly sensitive method in the **detection** of arsenic, especially useful in the field of forensic toxicology when arsenic was **used** as a poison. It was developed by the chemist James **Marsh** and first published in 1836.

https://en.wikipedia.org/wiki/Marsh_test#:~:text=The%20Marsh%20test%20is%20a,and%20first%20published%20in%201836.

47. Absolute zero may be defined as the temperature at which

- (1) Molecular motion in a gas would cease
- (2) all substances freeze
- (3) water freezes
- (4) a liquid is converted into solid

Ans : 1

48. X-ray beam is

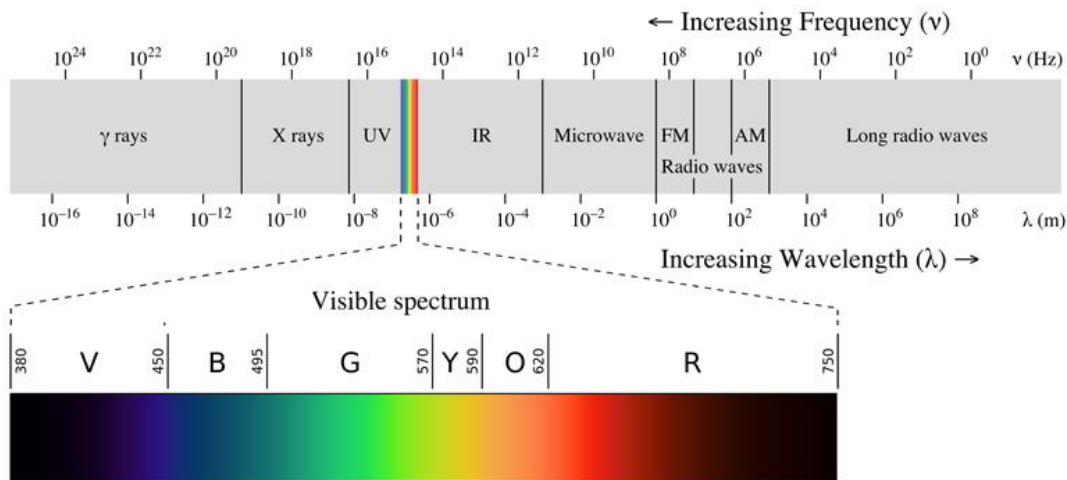
- (1) an electromagnetic radiation
- (2) emitted from the atomic nucleus
- (3) is capable of penetration of bones
- (4) is made of electrons

Ans: 1

An **X-ray** is a penetrating form of high-energy electromagnetic radiation. Most X-rays have a wavelength ranging from 10 picometer to 10 nanometer corresponding to frequencies in the range 30 petahertz to 30 exahertz (30×10^{15} Hz to 30×10^{18} Hz) and energies in the range 124 eV to 124 keV. X-ray wavelengths are shorter than those of UV rays and typically longer than those of gamma rays. In many languages, X-radiation is referred to as **Röntgen radiation**, after the German scientist Wilhelm Conrad Röntgen, who discovered it on November 8, 1895.

<https://en.wikipedia.org/wiki/X-ray>

.....



https://commons.wikimedia.org/wiki/File:EM_spectrumrevised.png

Source	File:EM spectrum.svg and File:Linear visible spectrum.svg
Author	Philip Ronan, Gringer

48. Absolute zero may be defined as the temperature at which

- (1) **Molecular motion in a gas would cease**
 (2) all substances freeze
 (3) water freezes
 (4) a liquid is converted into solid

49. Esters are usually

- (1) Non-volatile (2) Volatile
 (3) pleasant smelling (4) **(2) and (3)**

Ans: 4

Ester, any of a class of organic compounds that react with water to produce alcohols and organic or inorganic acids. Esters derived from carboxylic acids are the most common. The term *ester* was introduced in the first half of the 19th century by German chemist Leopold Gmelin.

The hydrolysis of esters in the presence of alkalies such as potassium hydroxide (lye) or sodium—a reaction called saponification—is utilized in the preparation of soaps from fats and oils and is also used for the quantitative estimation of esters. Wet chemical fire extinguishers, which are used for fires that involve fats and oils, rely on saponification reactions to convert burning fats to soap, which is noncombustible.

Britannica, The Editors of Encyclopaedia. "ester". *Encyclopedia Britannica*, 31 May. 2021, <https://www.britannica.com/science/ester-chemical-compound>. Accessed 16 October 2021.

50. A bucket of water weighing 10 kg is pulled up from a well 20 metre deep by rope weighing 1 Kg/m length, then the work done is-

- (1) 220 Kg.m (2) **400 Kg.m** (3) 600 Kg.m (4) 800 Kg.m

Ans: 2

Ans. $WD = Fd = \int_0^{20} (10 + x)dx = 400$ (Here $x = 1$ kg/m and hence force or weight of the bucket of water + rope weight per unit length)

51. A 20 mm diameter hole is to be punched in a 20 mm thick steel plate. If shear stress of steel is 30 kg/mm^2 , the force required for punching will be in the range:

1. 15-20 T 2. 20-25 T 3. 25-30 T 4. **35-40 T**

Note: Force, $F = \pi d.t.\sigma_s$

Ans: 4

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