Q.1) Which of the following statements is/are correct regarding 'White Holes'?

1. They are a region of space time which cannot be entered from the outside, although matter and light can escape from it.
2. They are only hypothetical reverse of Black holes and as of now there is no conclusive report of finding one in space.

Select the code from following:

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.1) Solution (c)

In general relativity, a white hole is a hypothetical region of spacetime which cannot be entered from the outside, although matter and light can escape from it. In this sense, it is the reverse of a black hole, which can only be entered from the outside and from which matter and light cannot escape. White holes appear in the theory of eternal black holes. In addition to a black hole region in the future, such a solution of the Einstein field equations has a white hole region in its past. However, this region does not exist for black holes that have formed through gravitational collapse, nor are there any known physical processes through which a white hole could be formed. Although information and evidence regarding white holes remains inconclusive, the 2006 GRB 060614 has been proposed as the first documented occurrence of a white hole.

Q.2) One of the cure of loss of power is seen in superconductivity. Which of the following statements are correct regarding Superconductivity?

1. It is achieved when electric resistance in a medium becomes zero.
2. A superconductor can carry a current indefinitely without losing any energy.
3. 10 times more magnetic field is generated in a superconductor as compared to a normal conductor.

Select the code from following:

a) 1 and 2

b) 2 and 3
c) 1 and 3
d) All of the above

Q.2) Solution (a)

Superconductors are materials that conduct electricity with no resistance. This means that, unlike the more familiar conductors such as copper or steel, a superconductor can carry a current indefinitely without losing any energy. They also have several other very important properties, such as the fact that no magnetic field can exist within a superconductor.

Superconductors already have drastically changed the world of medicine with the advent of MRI machines, which have meant a reduction in exploratory surgery. Power utilities, electronics companies, the military, transportation, and theoretical physics have all benefited strongly from the discovery of these materials.

Q.3) **Which of the following statements correctly defines superfluidity?**

a) It is a state of liquid to flow without any friction at absolute Zero temperature.
b) It is a state of liquid to flow without friction at its boiling point.
c) It is a property of liquid to retain its state at higher temperature than its boiling point.
d) It is a property of liquid to retain its state below its freezing point.

Q.3) Solution (a)

Superfluidity is the characteristic property of a fluid with zero viscosity which therefore flows without loss of kinetic energy. When stirred, a superfluid forms cellular vortices that continue to rotate indefinitely. Superfluidity occurs in two isotopes of **helium** (helium-3 and helium-4) when they are liquified by cooling to cryogenic temperatures. It is also a property of various other exotic states of matter theorized to exist in astrophysics, high-energy physics, and theories of quantum gravity.

Q.4) Dark matter is a hypothetical form of matter that is thought to account for approximately 85% of the matter in the universe and about a quarter of its total energy density. Consider the following statements regarding this:

1. It does not appear to interact with observable electromagnetic radiation, such as light, and is thus invisible to the entire electromagnetic spectrum.
2. Dark energy is believed to be responsible for expansion of Universe.

Which of the above statements is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.4) Solution (c)

Dark matter is a hypothetical form of matter that is thought to account for approximately 85% of the matter in the universe and about a quarter of its total energy density. The majority of dark matter is thought to be non-baryonic in nature, possibly being composed of some as-yet undiscovered subatomic particles. ts presence is implied in a variety of astrophysical observations, including gravitational effects that cannot be explained by accepted theories of gravity unless more matter is present than can be seen. For this reason, most experts think dark matter to be ubiquitous in the universe and to have had a strong influence on its structure and evolution. Dark matter is called dark because it does not appear to interact with observable electromagnetic radiation, such as light, and is thus invisible to the entire electromagnetic spectrum, making it extremely difficult to detect using usual astronomical equipment.

Dark Energy:

It is a theoretical form of energy postulated to act in opposition to gravity and to occupy the entire universe, accounting for most of the energy in it and causing its expansion to accelerate.

Q.5) One of the most fundamental research going on at CERN in France is that on Anti – Matter. Which of the following statements are correct regarding Anti – Matter?

1. Antimatter particles share the same mass as their matter counterparts, but qualities such as electric charge are opposite.
2. A collision between any particle and its anti-particle partner leads to their mutual annihilation releasing energy.

Select the code from following:

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.5) Solution (c)

In modern physics, antimatter is defined as a material composed of the antiparticles (or "partners") of the corresponding particles of ordinary matter. Minuscule numbers of antiparticles are generated daily at particle accelerators – total production has been only a few nanograms – and in natural processes like cosmic ray collisions and some types of radioactive decay, but only a tiny fraction of these have successfully been bound together in experiments to form anti-atoms. No macroscopic amount of antimatter has ever been assembled due to the extreme cost and difficulty of production and handling.

In theory, a particle and its anti-particle (for example, proton and antiproton) have the same mass, but opposite electric charge and other differences in quantum numbers. For example, a proton has positive charge while an antiproton has negative charge.

A collision between any particle and its anti-particle partner leads to their mutual annihilation, giving rise to various proportions of intense photons (gamma rays), neutrinos, and sometimes less-massive particle-antiparticle pairs. Annihilation usually results in a release of energy that becomes available for heat or work. The amount of the released energy is usually proportional to the total mass of the collided matter and antimatter, in accordance with the mass–energy equivalence equation, $E=mc^2$.

Q.6) Presence of hypothetical sub atomic particle Higgs Boson was confirmed by CERN in 2012 in its experiment ATLAS. Which of the following physical attributes are believed to be imparted by Higgs boson to matter?

a) Energy
b) Spin
c) Electric Charge
d) Mass

Q.6) Solution (d)

Higgs Boson, also known as the God particle, is believed to impart mass to matter.

It is worth noting that the Higgs field does not "create" mass out of nothing (which would violate the law of conservation of energy), nor is the Higgs field responsible for the mass of all particles. For example, approximately 99% of the mass of baryons (composite particles such as the proton and neutron), is due instead to quantum chromodynamic binding energy, which is the sum of the kinetic energies of quarks and the energies of the mass less gluons mediating the strong interaction inside the baryons. In Higgs-based theories, the property of "mass" is a manifestation of potential energy transferred to fundamental particles when they interact ("couple") with the Higgs field, which had contained that mass in the form of energy.

Q.7) A light year is unit of –

a) Time
b) Distance
c) Luminosity
d) Speed

Q.7) Solution (b)

A unit of astronomical distance equivalent to the distance that light travels in one year, which is 9.4607 × 1012 km (nearly 6 million million miles).

Q.8) In a pressure cooker, the food is cooked early. The reason behind this is?

a) Water boils at a higher temperature
b) Increased pressure breaks the molecular bonds in raw food
c) Increased pressure crushes the food item and makes it easier to cook
d) Water boils at a lower temperature in pressure cooker

Q.8) Solution (a)

The cooker works by trapping the steam produced from boiling the cooking liquid inside the vessel. This causes internal pressure and temperature to rise quickly. After use, the steam is slowly released so that the vessel can be opened safely.

Q.9) Nobel prize for Physics in 2018 was given for the invention of optical tweezers. Which of the following statements regarding this is/are correct?

1. It can grab particles, atoms, viruses and other living cells with their laser beam fingers.
2. The radiation pressure of light is used to move physical objects.

Select the code from following:

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.9) Solution (c)

The inventions being honoured this year have revolutionised laser physics. Extremely small objects and incredibly rapid processes are now being seen in a new light. Advanced precision instruments are opening up unexplored areas of research and a multitude of industrial and medical applications.

Arthur Ashkin invented optical tweezers that grab particles, atoms, viruses and other living cells with their laser beam fingers. This new tool allowed Ashkin to realise an old dream of science fiction – using the radiation pressure of light to move physical objects. He succeeded in getting laser light to push small particles towards the centre of the beam and to hold them there. Optical tweezers had been invented.

A major breakthrough came in 1987, when Ashkin used the tweezers to capture living bacteria without harming them. He immediately began studying biological systems and optical tweezers are now widely used to investigate the machinery of life.

Gérard Mourou and Donna Strickland paved the way towards the shortest and most intense laser pulses ever created by mankind. Their revolutionary article was published in 1985 and was the foundation of Strickland's doctoral thesis.

Using an ingenious approach, they succeeded in creating ultrashort high-intensity laser pulses without destroying the amplifying material. First they stretched the laser pulses in time to reduce their peak power, then amplified them, and finally compressed them. If a pulse is

compressed in time and becomes shorter, then more light is packed together in the same tiny space – the intensity of the pulse increases dramatically.

Strickland and Mourou's newly invented technique, called chirped pulse amplification, CPA, soon became standard for subsequent high-intensity lasers. Its uses include the millions of corrective eye surgeries that are conducted every year using the sharpest of laser beams.

Q.10) Consider the following statements regarding Gravitational Waves:

1. They are 'ripples' in the fabric of space-time caused by some of the most violent and energetic processes in the Universe.
2. It was hypothesized by Isaac Newton in his theory of Gravitation.
3. Continuous Gravitational Waves are produced by a single spinning massive object, like an extremely dense star called a neutron star

Which of the above statements are correct?

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.10) Solution (c)

GRAVITATIONAL WAVES

- Gravitational waves are 'ripples' in the fabric of space-time caused by some of the most violent and energetic processes in the Universe.
- The strongest gravitational waves are produced by catastrophic events such as colliding black holes, the collapse of stellar cores (supernovae) etc.
- Hypothesised by Albert Einstein a century ago

TYPES OF GRAVITATIONAL WAVES

Continuous Gravitational Waves: Produced by a single spinning massive object, like an extremely dense star called a neutron star

Compact Binary Inspiral Gravitational Waves: Produced by orbiting pairs of massive and dense (hence "compact") objects like white dwarf stars, black holes, and neutron stars

Q.11) Consider the following statements regarding Earth's Mini – Moons:

1. These are small asteroids temporarily captured in earth's orbit.
2. The Large Synoptic Survey Telescope (LSST), which is currently under construction will verify their existence and track their paths around our planet.

Which of the above statements are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.11) Solution (c)

MINI-MOON

- Earth's mini-moons – small asteroids temporarily captured in the planet's orbit – could be used as test-beds for research and commercial space activities in the future.
- These small and fast-moving visitors have so-far evaded detection by existing technology, with only one confirmed mini-moon discovery to date.
- The Large Synoptic Survey Telescope (LSST), which is currently under construction will verify their existence and track their paths around our planet, presenting exciting scientific and commercial opportunities.
- Mini-moons can provide interesting science and technology testbeds in near-Earth space.
- These asteroids are delivered towards Earth from the main asteroid belt between Mars and Jupiter via gravitational interactions with the Sun and planets in our solar system

Q.12) Which of the following statements correctly defines a 'Positron':

a) This is a particle with same mass as electron but positive charge.
b) This is a particle with same mass as proton but negatively charged.
c) This is a particle showing same properties as electron but without any charge.
d) This is a subatomic particle which is a building unit of Proton.

Q.12) Solution (a)

Anti-electrons (called positrons) behave like electrons but have a positive charge. Antiprotons, as the name implies, are protons with a negative charge.

These antimatter particles (which are called "antiparticles") have been generated and studied at huge particle accelerators such as the Large Hadron Collider operated by CERN

Q.13) Consider the following statements regarding Heliosphere:

1. It is a space around sun which is filled with plasma originating from the sun.
2. The extent of heliosphere extends beyond the region of Pluto.

Which of the above statements is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.13) Solution (c)

The heliosphere is the vast, bubble-like region of space which surrounds and is created by the Sun. In plasma physics terms, this is the cavity formed by the Sun in the surrounding interstellar medium. The "bubble" of the heliosphere is continuously "inflated" by plasma originating from the Sun, known as the solar wind. Outside the heliosphere, this solar plasma gives way to the interstellar plasma permeating our galaxy. Radiation levels inside and outside the heliosphere differ; in particular, the galactic cosmic rays are less abundant inside the heliosphere, so that the planets inside (including Earth) are partly shielded from their impact.

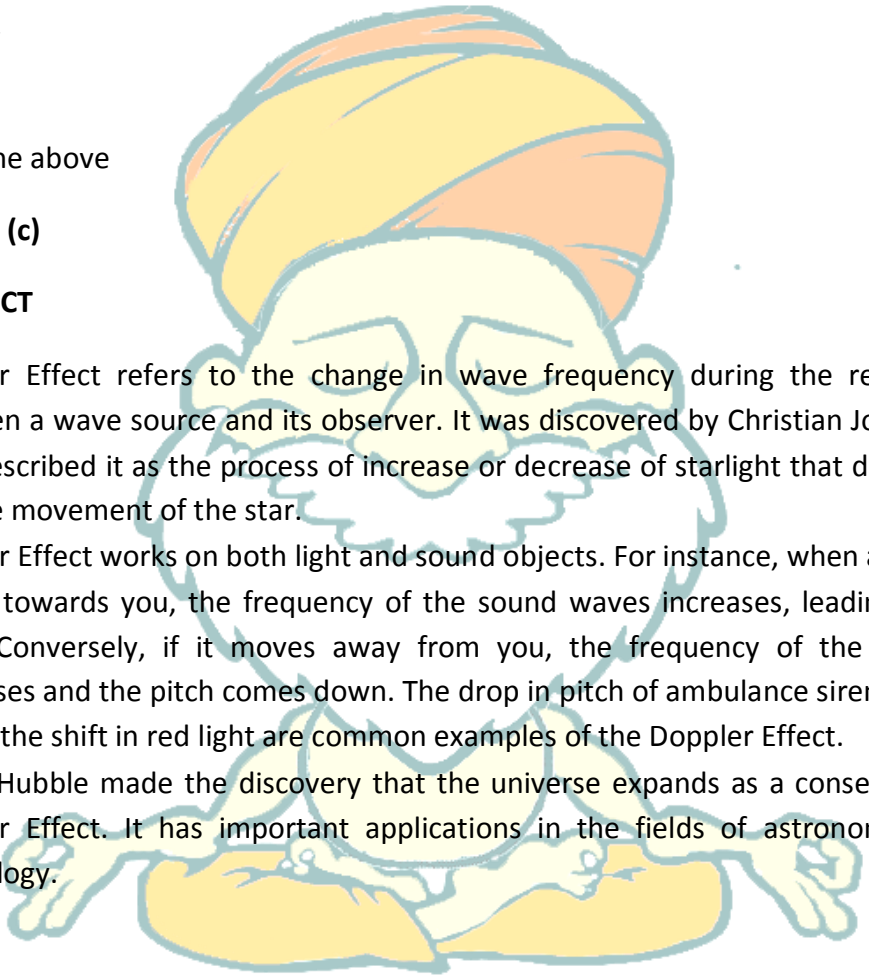
Flowing unimpeded through the Solar System for billions of kilometres, the solar wind extends far beyond even the region of Pluto, until it encounters the termination shock, where its motion slows abruptly due to the outside pressure of the interstellar medium. Beyond the shock lies the heliosheath, a broad transitional region between the inner heliosphere and the external environment. The outermost edge of the heliosphere is called the heliopause. The overall shape of the heliosphere resembles that of a comet – being approximately spherical on one side, with a long trailing tail opposite, known as the heliotail.

Q.14) Which of the following statements are correct regarding Doppler Effect?

1. Doppler Effect refers to the change in wave frequency during the relative motion between a wave source and its observer.
2. Doppler Effect is true for sound waves but not for light waves.
3. The discovery that universe is expanding was made as a consequence of Doppler Effect.

Select the code from following:

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above



Q.14) Solution (c)

DOPPLER EFFECT

- Doppler Effect refers to the change in wave frequency during the relative motion between a wave source and its observer. It was discovered by Christian Johann Doppler who described it as the process of increase or decrease of starlight that depends on the relative movement of the star.
- Doppler Effect works on both light and sound objects. For instance, when a sound object moves towards you, the frequency of the sound waves increases, leading to a higher pitch. Conversely, if it moves away from you, the frequency of the sound waves decreases and the pitch comes down. The drop in pitch of ambulance sirens as they pass by and the shift in red light are common examples of the Doppler Effect.
- Edwin Hubble made the discovery that the universe expands as a consequence of the Doppler Effect. It has important applications in the fields of astronomy and space technology.

Q.15) Which of the following is NOT an example of application of Force?

a) When a body at rest starts moving
b) When a moving body comes to rest
c) When a moving body changes its direction
d) When a body is moving at constant speed

Q.15) Solution (d)

If a body is at rest or is moving with constant speed, it means that net force acting on it is zero.

All other are the effects of application of force.

Q.16) An object weighing 100 kg on earth will weigh 38 kg on mars. The main reason behind this is

a) High atmospheric pressure on mars
b) Lower gravitational pull on mars
c) An object shrinks on mars
d) The weight of an object does not change

Q.16) Solution (b)

The surface gravity on *Mars* is only about 38% of the surface gravity on Earth, so if you *weigh* 100 Kgs on Earth, you would *weigh* only 38 Kgs on *Mars*.

Q.17) The property of matter through which it regains its shape once a deforming force is removed, is called

a) Plasticity
b) Malleability
c) Ductility
d) Elasticity

Q.17) Solution (d)

Elasticity is the ability of a body to resist a distorting influence and to return to its original size and shape when that influence or force is removed. Solid objects will deform when adequate forces are applied to them. If the material is elastic, the object will return to its initial shape and size when these forces are removed.

Q.18) Athena is a fleet of internet beaming satellite to provide internet access across the world. Which of the following organizations have launched this project?

a) Facebook
b) Google
c) NASA
d) Microsoft

Q.18) Solution (a)

Facebook is working on an internet satellite project called Athena to beam internet connectivity down to Earth. The company aims to launch satellite in 2019.

The project, dubbed Athena, would eventually launch a fleet of small satellites into low-Earth orbit, somewhere between 100 and 1,250 miles above sea level, and beam Internet access down to rural areas.

Q.19) Which of the following is not a natural magnate?

a) Lodestone
b) Bauxite
c) Pyrrholite
d) Columbite

Q.19) Solution (b)

A lodestone is a naturally magnetized piece of the mineral magnetite. They are naturally occurring magnets, which can attract iron. The property of magnetism was first discovered in antiquity through lodestones.

Pyrrhotite is an iron sulfide mineral with the formula $Fe_{(1-x)}S$. It is a nonstoichiometric variant of FeS, the mineral known as troilite. Pyrrhotite is also called magnetic pyrite, because the color is similar to pyrite and it is weakly magnetic.

Columbite, hard, black (often iridescent), heavy oxide mineral of iron, manganese, and niobium, (Fe, Mn)Nb2O6. It is mildly magnetic.

Q.20) Clouds are condensed liquid water droplets suspended in air. They float in air because they have

a) High density

b) Low temperature
c) High Pressure
d) Low density

Q.20) Solution (d)

Clouds contain a large amount of water, but that water is dispersed due to low density.

Consider a hypothetical but typical small cloud at an altitude of 10,000 feet, comprising one cubic kilometer and having a liquid water content of 1.0 gram per cubic meter. The total mass of the cloud particles is about 1 million kilograms, which is roughly equivalent to the weight of 500 automobiles. But the total mass of the air in that same cubic kilometer is about 1 billion kilograms--1,000 times heavier than the liquid!

So, even though typical clouds do contain a lot of water, this water is spread out for miles in the form of tiny water droplets or crystals, which are so small that the effect of gravity on them is negligible. Thus, from our vantage on the ground, clouds seem to float in the sky.

Q.21) Consider the following statements regarding Electronic Nicotine Delivery Systems (ENDS)?

1. ENDS creates an aerosol which frequently contains flavours dissolved into propylene glycol and Glycerin.
2. It contains powdered tobacco which is heated by a coil to add nicotine to the mixture.

Which of the above statements is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.21) Solution (a)

Electronic Nicotine Delivery Systems and Electronic Non-Nicotine Delivery Systems (ENDS/ENNDS) heat a solution (e-liquid) to create an aerosol which frequently contains flavourants, usually dissolved into Propylene Glycol or/and Glycerin. All ENDS (but not ENNDS) contain nicotine. Electronic cigarettes, the most common prototype, are devices that do not

burn or use tobacco leaves but instead vaporise a solution the user then inhales. The main constituents of the solution, in addition to nicotine when nicotine is present, are propylene glycol, with or without glycerol and flavouring agents. ENDS solutions and emissions contain other chemicals, some of them considered to be toxicants.

Q.22) Germany has recently launched world's first hydrogen powered commuter trains. Which of the following statements regarding these trains is/are correct?

1. They use hydrogen cells which combine Hydrogen and oxygen to release water vapour as a by – product.
2. They are high speed trains and will have an operation speed of 300 km/hr.

Select the code from following:

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.22) Solution (a)

The World's First Hydrogen-Powered Commuter Train Is Now in Service in Germany.

While hydrogen is often touted as a clean fuel, it's more accurate to describe it as a clean energy-storage technology. In the idealized vision of the clean hydrogen economy, the hydrogen itself is generated by the electrolysis of water. Hydrogen fuel cells, such as those used by Alstom's train, can then combine the hydrogen with oxygen, "burning" it into water and steam as the waste products. These fuel cells allow the trains to hit a top speed of 140km/hr (87mph). Not the fastest trains around, but capable of keeping up with the average speed in the UK.

The advocates of hydrogen as the solution to replacing fossil fuels, particularly in transportation, have some compelling arguments. The fuel can be made with entirely renewable electricity, the internal combustion engine need not be abandoned, and the only waste product from burning it is water.

Q.23) Which of the following statements correctly defines the 'hydrogen wall'?

a) It is the outer boundary of our Atmosphere.
b) It is the outer boundary of Sun's atmosphere.
c) It is the outer boundary of our solar system.
d) It is the outer boundary of Milky Way.

Q.23) Solution (c)

That hydrogen wall is the outer boundary of our home system, the place where our sun's bubble of solar wind ends and where a mass of interstellar matter too small to bust through that wind builds up, pressing inward. Our host star's powerful jets of matter and energy flow outward for a long stretch after leaving the sun — far beyond the orbit of Pluto. But at a certain point, they peter out, and their ability to push back the bits of dust and other matter — the thin, mysterious stuff floating within our galaxy's walls — wanes. A visible boundary forms. On one side are the last vestiges of solar wind. And on the other side, in the direction of the Sun's movement through the galaxy, there's a buildup of interstellar matter, including hydrogen.

Q.24) Which of the following glasses are correctly matched with their functions?

1. Laminated Glass – Bullet Proof glass
2. Flint Glass – Optical lenses
3. Pyrex Glass – Ovenware
4. Lead Crystal Glass – Decorative reflective glass

Select the code from following:

a) 1, 2 and 3
b) 2, 3 and 4
c) 1, 3 and 4
d) All of the above

Q.24) Solution (d)

Laminated glass

It can also be called bulletproof glass. Several layers of safety glass are bound together with a transparent adhesive.

Flint Glass

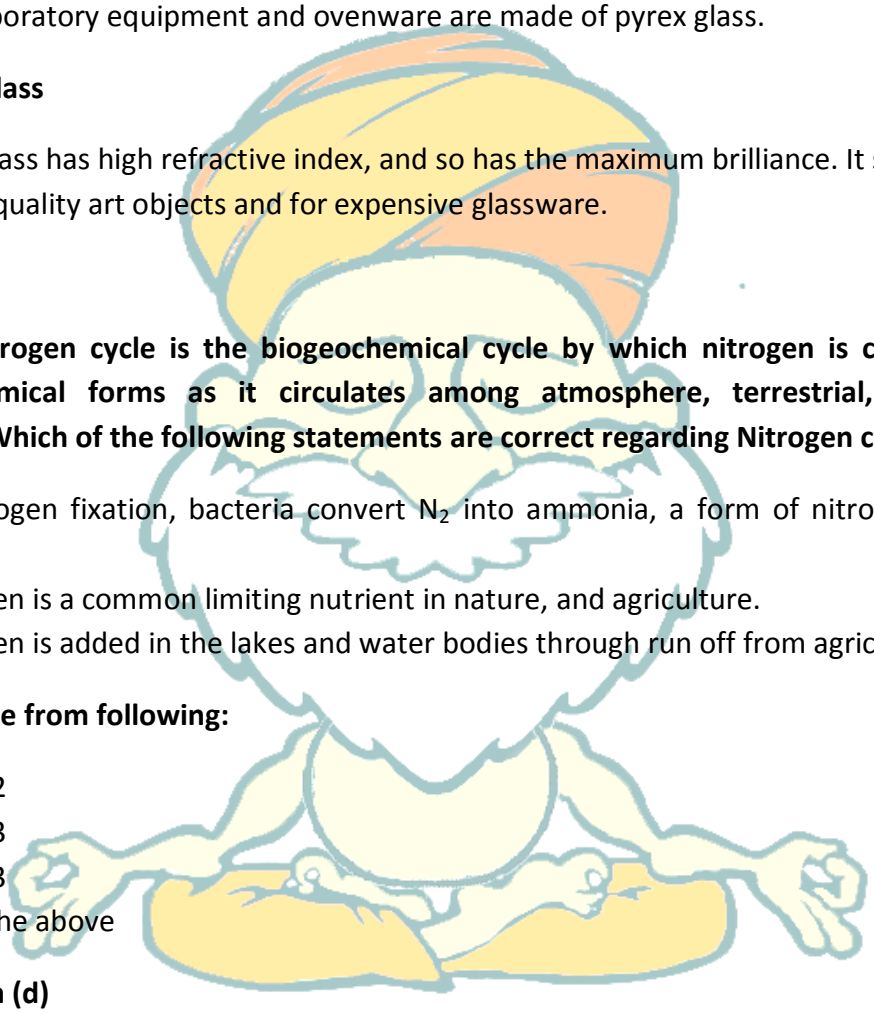
Optical glass is softer than any other glass. It is clear and transparent. Potassium and lead silicates are used in making optical glass. It is also called flint glass. The main use of flint glass is in the manufacture of lenses, prisms and other optical instruments.

Pyrex glass

Pyrex glass is highly heat resistant. In ordinary glass, silica is the main constituent. In pyrex glass some of the silica is replaced by boron oxide. It has a high melting point and is resistant to many chemicals. Laboratory equipment and ovenware are made of pyrex glass.

Lead crystal glass

Lead crystal glass has high refractive index, and so has the maximum brilliance. It sparkles and is used for high quality art objects and for expensive glassware.



Q.25) The nitrogen cycle is the biogeochemical cycle by which nitrogen is converted into multiple chemical forms as it circulates among atmosphere, terrestrial, and marine ecosystems. Which of the following statements are correct regarding Nitrogen cycle?

1. In nitrogen fixation, bacteria convert N_2 into ammonia, a form of nitrogen usable by plants.
2. Nitrogen is a common limiting nutrient in nature, and agriculture.
3. Nitrogen is added in the lakes and water bodies through run off from agricultural fields.

Select the code from following:

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

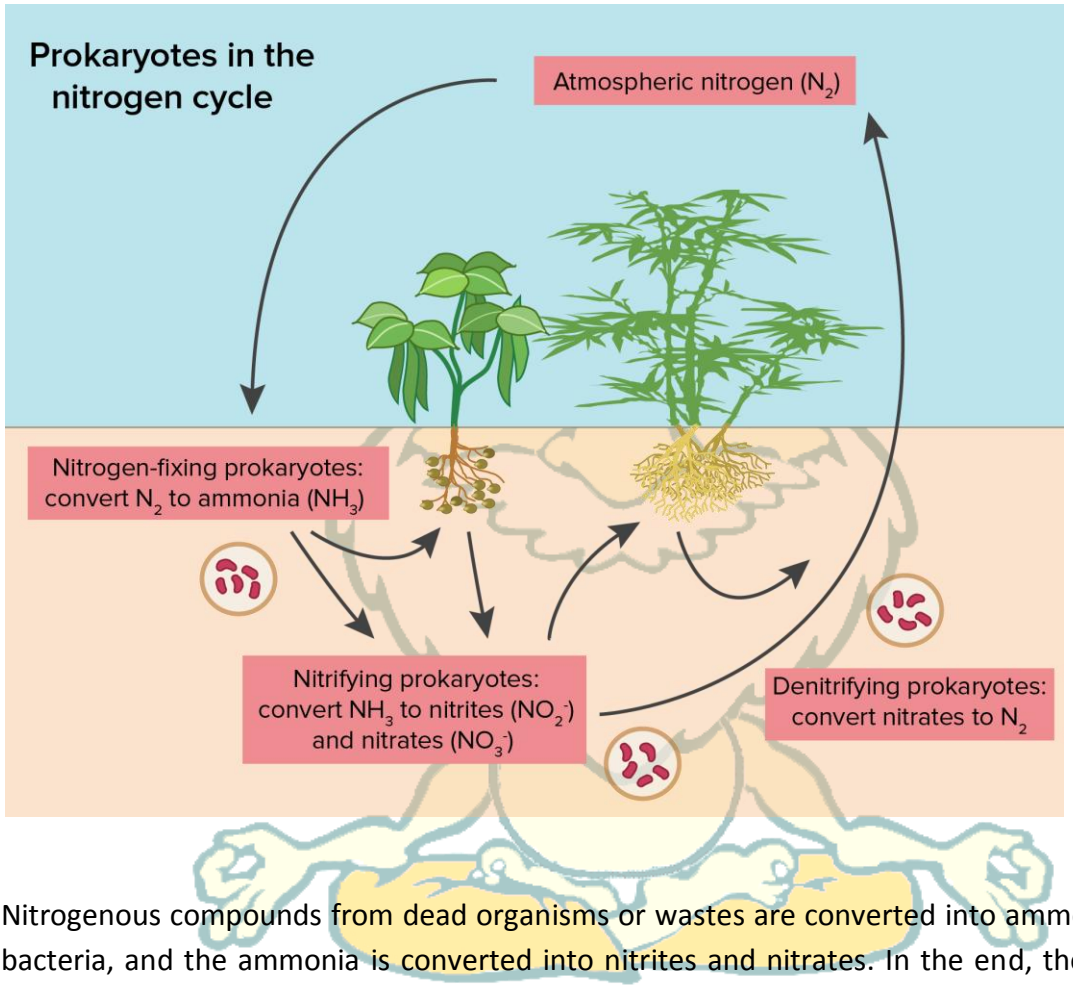
Q.25) Solution (d)

The nitrogen cycle is the biogeochemical cycle by which nitrogen is converted into multiple chemical forms as it circulates among atmosphere, terrestrial, and marine ecosystems.

Nitrogen enters the living world by way of bacteria and other single-celled prokaryotes, which convert atmospheric nitrogen—N2\text N_2N2N, start subscript, 2, end subscript—into biologically usable forms in a process called nitrogen fixation. Some species of nitrogen-fixing

bacteria are free-living in soil or water, while others are beneficial symbionts that live inside of plants.

Nitrogen-fixing microorganisms capture atmospheric nitrogen by converting it to ammonia—NH3\text {NH}_3NH3N, H, start subscript, 3, end subscript—which can be taken up by plants and used to make organic molecules. The nitrogen-containing molecules are passed to animals when the plants are eaten. They may be incorporated into the animal's body or broken down and excreted as waste, such as the urea found in urine.



Nitrogenous compounds from dead organisms or wastes are converted into ammonia—NH_3 by bacteria, and the ammonia is converted into nitrites and nitrates. In the end, the nitrates are made into N_2 gas by denitrifying prokaryotes.

In natural ecosystems, many processes, such as primary production and decomposition, are limited by the available supply of nitrogen. In other words, nitrogen is often the limiting nutrient, the nutrient that's in shortest supply and thus limits the growth of organisms or populations.

Nitrogen and phosphorus are the two most common limiting nutrients in both natural ecosystems and agriculture.

Q.26) Consider the following statements:

1. It is one of the most abundant naturally occurring non-essential amino acids.
2. It is a flavor enhancer commonly added to Chinese food, canned vegetables, soups and processed meats.
3. It is produced with a commercial name of Aji no moto.

The above statements are correct about which of the following substances?

a) Iodized Salt
b) Mono Sodium Glutamate
c) Tartaric acid
d) Fruit salt

Q.26) Solution (b)

Monosodium glutamate is the sodium salt of the naturally occurring amino acid glutamic acid. This amino acid is one of the most abundant in nature, being an important component of all proteins. Monosodium glutamate, has been used as a seasoning or flavour enhancer, since it was first isolated from seaweed more than a century ago and is now recognised as the most pure example of umami or savoury taste. The body treats glutamate in exactly the same way whether it comes from the food we eat or from seasoning.

MSG not only adds a umami character to food but can also be used to reduce the salt content. For the latest information about the science about glutamate and umami taste. It was suspected by some people of being the cause of 'Chinese restaurant syndrome', where people suffer a hot flushing reaction after eating food containing MSG. However, tests on people who claim to be susceptible have never been able to confirm that there is a link, as this scientific review explains.

Q.27) Which of the following can be the effects of Ozone pollution?

1. Ozone can cause the muscles in the airways to constrict, trapping air in the alveoli.
2. Ozone can provide more oxygen to the cells making them work more efficiently.

3. It can increase the frequency of asthma attacks
4. It can cause mutation of cell and cause DNA degeneration.

Select the code from following:

a) 1,2 and 3
b) 1 and 3
c) 2,3 and 4
d) 3 only

Q.27) Solution (b)

Ozone can cause the muscles in the airways to constrict, trapping air in the alveoli. This leads to wheezing and shortness of breath.

Ozone can:

- Make it more difficult to breathe deeply and vigorously.
- Cause shortness of breath, and pain when taking a deep breath.
- Cause coughing and sore or scratchy throat.
- Inflame and damage the airways.
- Aggravate lung diseases such as asthma, emphysema, and chronic bronchitis.
- Increase the frequency of asthma attacks.
- Make the lungs more susceptible to infection.
- Continue to damage the lungs even when the symptoms have disappeared.
- Cause chronic obstructive pulmonary disease (COPD).

These effects have been found even in healthy people, but can be more serious in people with lung diseases such as asthma.

Q.28) Recently Spicejet operated India's first Bio fuel propelled flight. Which of the following statements regarding Bio Jet Fuels are correct?

1. They can be made from vegetable oil, sugar, animal fat and waste biomass.
2. It can directly be used in aircraft without any modifications.
3. It will be helpful in lowering the flight costs and decreasing the carbon emissions.

Select the code from following:

a) 1 and 2

b) 2 and 3
c) 1 and 3
d) All of the above

Q.28) Solution (d)

India's first biofuel flight is operated by SpiceJet. It is a 78-seater aircraft Bombardier Q400 aircraft. With an aim to lower the costs and help reduce the carbon emissions by around 15 percent, SpiceJet is planning to blend in a quarter of its energy requirement with biofuel for flight operations.

- The fuel is developed by the Council of Scientific and Industrial Research (CSIR) - Indian Institute of Petroleum (IIP), Dehradun.
- It contains 75 percent aviation turbine fuel and 25 percent bio jet fuel and has been made out of Jatropha crop
- It is made of vegetable oil, sugar, animal fat and waste biomass, and it can directly be used in aircraft without any modifications.

Q.29) Which of the following are correct uses of Formalin?

1. It is used to preserve biological tissues, cells and specimens.
2. It is used as a disinfectant to kill bacteria and fungi.
3. It is used in drug testing to identify several compounds.
4. It is consumed as an anti – carcinogenic substance.

Select the code from following:

a) 1,2 and 3
b) 2,3 and 4
c) 1,3 and 4
d) All of the above

Q.29) Solution (a)

Formaldehyde (systematic name methanal) is a naturally occurring organic compound with the formula CH_2O (H-CHO). It is the simplest of the aldehydes (R-CHO). The common name of this substance comes from its similarity and relation to formic acid.

Formaldehyde is an important precursor to many other materials and chemical compounds. In 1996, the installed capacity for the production of formaldehyde was estimated at 8.7 million tons per year. It is mainly used in the production of industrial resins, e.g., for particle board and coatings.

In view of its widespread use, toxicity, and volatility, formaldehyde poses a significant danger to human health. In 2011, the US National Toxicology Program described formaldehyde as "known to be a human carcinogen".

- Formaldehyde is a common precursor to more complex compounds and materials. In approximate order of decreasing consumption, products generated from formaldehyde include urea formaldehyde resin, melamine resin, phenol formaldehyde resin, polyoxymethylene plastics, 1,4-butanediol, and methylene diphenyl diisocyanate. The textile industry uses formaldehyde-based resins as finishers to make fabrics crease-resistant.
- An aqueous solution of formaldehyde can be useful as a disinfectant as it kills most bacteria and fungi (including their spores). It is used to produce killed vaccines.
- Formaldehyde preserves or fixes tissue or cells. The process involves cross-linking of primary amino groups.
- Formaldehyde and an 18 M (concentrated) sulfuric acid makes Marquis reagent—which can identify alkaloids and other compounds.
- In photography, formaldehyde is used in low concentrations for process C-41 (color negative film) stabilizer in the final wash step, as well as in the process E-6 pre-bleach step, to make it unnecessary in the final wash.

Q.30) Which of the following statements is correct regarding 'Kerogen' Oil?

a) It is oil obtained by heating Kerogen which is solid insoluble organic matter found in rocks.
b) It is oil obtained by destructive distillation of Wooden tissue.
c) It is oil obtained by hydrogenation of Keratin protein found in animals.
d) It is a rarely found vegetable oil obtained by cold pressing of watery vegetables.

Q.30) Solution (a)

The naturally occurring, solid, insoluble organic matter that occurs in source rocks and can yield oil upon heating. Kerogen is the portion of naturally occurring organic matter that is

nonextractable using organic solvents. Typical organic constituents of kerogen are algae and woody plant material. Kerogens have a high molecular weight relative to bitumen, or soluble organic matter. Bitumen forms from kerogen during petroleum generation. Kerogens are described as Type I, consisting of mainly algal and amorphous (but presumably algal) kerogen and highly likely to generate oil; Type II, mixed terrestrial and marine source material that can generate waxy oil; and Type III, woody terrestrial source material that typically generates gas.

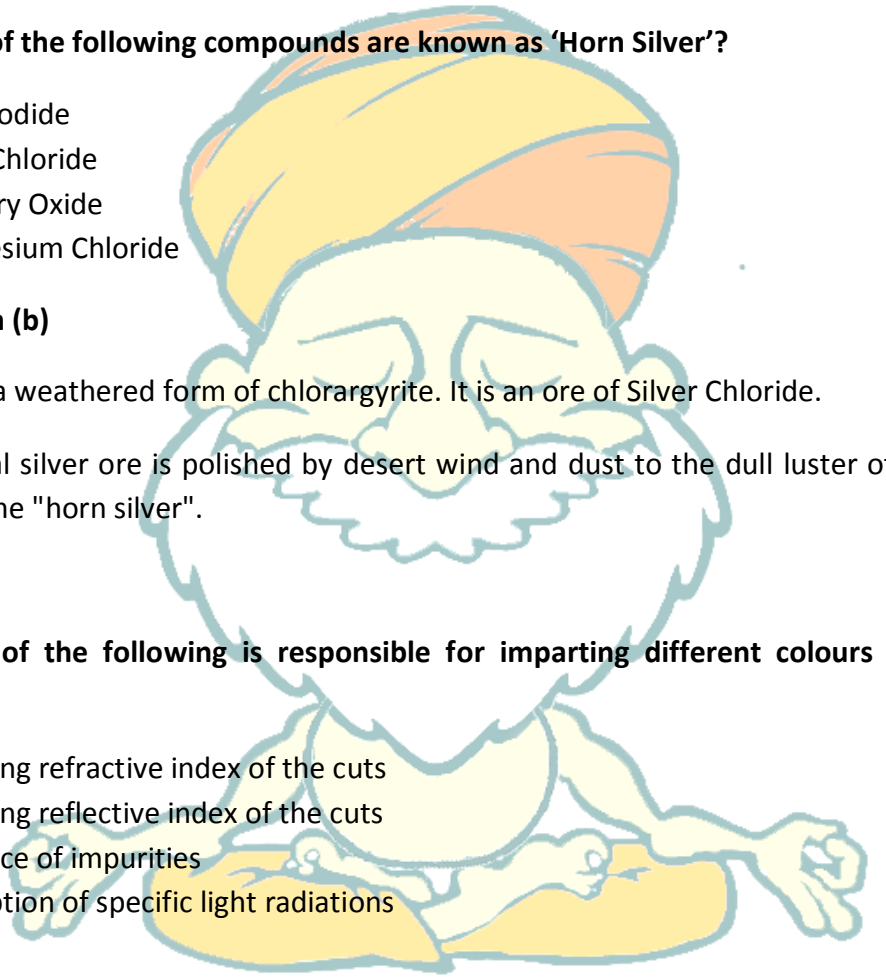
Q.31) Which of the following compounds are known as 'Horn Silver'?

a) Silver Iodide
b) Silver Chloride
c) Mercury Oxide
d) Magnesium Chloride

Q.31) Solution (b)

Horn Silver is a weathered form of chlorargyrite. It is an ore of Silver Chloride.

This superficial silver ore is polished by desert wind and dust to the dull luster of a cow horn, hence the name "horn silver".



Q.32) Which of the following is responsible for imparting different colours to finely cut diamonds?

a) Changing refractive index of the cuts
b) Changing reflective index of the cuts
c) Presence of impurities
d) Absorption of specific light radiations

Q.32) Solution (c)

Diamonds occur in a variety of colors—steel **gray**, **white**, **blue**, **yellow**, **orange**, **red**, **green**, **pink** to **purple**, **brown**, and **black**. Colored diamonds contain interstitial impurities or structural defects that cause the coloration, pure diamonds are perfectly **transparent** and colorless.

Q.33) Acephate, Atrazine, Captan, Endosulphan and Dicofol are common type of

a) Antibiotics
b) Fertilisers
c) TB vaccines
d) Pesticides

Q.33) Solution (d)

There are 234 pesticides registered in India. Out of these, 4 are WHO Class Ia pesticides, 15 are WHO Class Ib pesticides and 76 are WHO Class II pesticides, together constituting 40% of the registered pesticides in India. In terms of consumption too, the greatest volumes consumed are of these poisons.

The following is a list of 24 pesticides registered and used in India, classified as Potential Carcinogens by the US EPA: Acephate (C), Alachlor (B2), Atrazine (C), Benomyl (C), Bifenthrin (C), Captan (B2), Chlorothalonil (B2), Cypermethrin (C), Dichlorvos (C), Diclofop-Methyl (C), Dicofol (C), Mancozeb (B2), Methomyl (C), Metolachlor (C), Oxadiazon (C), Oxyflourfen (C), Permethrin (C), Phosphamidon (C), Propiconazole (C), Propoxur (B2), Thiodicarb (C), Thiophanate Methyl (C), Triadimefon (C), Trifluralin (C).

As per the EPA classification of carcinogenic pesticides, B indicates Probable Human Carcinogen (B2 indicating sufficient evidence of carcinogenicity from animal studies and C indicates Possible Human Carcinogen (limited evidence of carcinogenicity in animals, in the absence of human data).

Q.34) Nobel Prize in 2018 for Chemistry was given for

a) Harnessing power of sun to develop biomolecules that can convert solar energy to electrical energy.
b) Harnessing power of evolution to develop enzymes and antibodies that have led to new pharmaceuticals and biofuels.
c) Discovering the structure of atomic nucleus and its use for quantum computing.
d) Trapping the transition compounds in an organic chemical reaction

Q.34) Solution (b)

The Royal Swedish Academy of Sciences has selected US scientists Frances Arnold and George Smith and British researcher Gregory Winter for the 2018 Nobel Prize in Chemistry. They were selected for harnessing power of evolution to develop enzymes and antibodies that have led to new pharmaceuticals and biofuels. Chemistry was third of this year's Nobel Prizes. Frances Arnold shared the half price and George Smith and Gregory Winter share other half of the prize.

Q.35) In many products that we buy these day, we find small packets of silica gel. Which of the following statements is correct regarding silica gel?

a) It has tiny pores increasing its surface area helping it absorb a large amount of moisture.
b) It is hydrophobic and repels any moisture around it.
c) It acts as a catalyst and prevents reaction of material with ambient air.
d) Prevents the article from breakage during packing and shipping

Q.35) Solution (a)

Little packets of silica gel are found in all sorts of products because silica gel is a desiccant -- it adsorbs and holds water vapor. In leather products and foods like pepperoni, the lack of moisture can limit the growth of mold and reduce spoilage. In electronics it prevents condensation, which might damage the electronics. If a bottle of vitamins contained any moisture vapor and were cooled rapidly, the condensing moisture would ruin the pills. You will find little silica gel packets in anything that would be affected by excess moisture or condensation.

Silica gel is nearly harmless, which is why you find it in food products. Silica, or silicon dioxide (SiO_2), is the same material found in quartz. The gel form contains millions of tiny pores that can adsorb and hold moisture. Silica gel is essentially porous sand.

Silica gel can adsorb about 40 percent of its weight in moisture and can take the relative humidity in a closed container down to about 40 percent. Once saturated, you can drive the moisture off and reuse silica gel by heating it above 300 degrees F (150 C).

Q.36) Scuba and deep sea divers use compressed air cylinders to breathe under water. Which of the following mixture of gases are correctly matched with their names?

1. Trimix – Nitrogen, Oxygen and Argon

2. Nitrox – Nitrogen and Oxygen
3. Heliox – Helium and Oxygen

Select the code from following:

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.36) Solution (b)

Nitrox, also known as 'Enriched Air', is a blended gas consisting of pure nitrogen and oxygen. The air we breathe normally is ~21% oxygen and ~79% nitrogen (with other trace gasses mixed in); Nitrox (generally) has an oxygen percentage between 22 and 40%.

Trimix is a mixture of 3 gases (nitrogen, oxygen and helium) used to increase depth limits and/or dive times.

Heliox is a mixture of helium and oxygen used by technical divers on very deep/long decompression dives. It is not used by recreational divers.

Q.37) Consider the following statements:

1. Bhut Jolokia is India's hottest chilli pepper grown in North Eastern India.
2. The hotness of chilli is measure in a unit called Scoville Heat Unit.

Which of the above statements are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.37) Solution (c)

The Bhut jolokia, also known as ghost pepper, ghost chili and ghost jolokia, is an interspecific hybrid chili pepper cultivated in the Northeast Indian states of Arunachal Pradesh, Assam, Nagaland and Manipur. It is a hybrid of Capsicum chinense and Capsicum frutescens and is closely related to the Naga Morich of Nagaland and Bangladesh.

In 2007, Guinness World Records certified that the ghost pepper was the world's hottest chili pepper, 400 times hotter than Tabasco sauce. The ghost chili is rated at more than 1 million Scoville heat units (SHUs). However, the ghost chili was shortly superseded by the Infinity chili in 2011, followed by the Naga Viper, the Trinidad moruga scorpion in 2012 and the Carolina Reaper on August 7, 2013.

Q.38) UNESCO has declared 2019 as the International Year of the Period Table of Chemical Elements to commemorate the 150th birthday of the periodic table of chemical elements. Which of the following questions regarding Periodic Table is/are correct?

1. The periodic table was published by Russian scientist Dmitry Mendeleev.
2. Only naturally occurring elements are placed in the Periodic Table.
3. Elements have been arranged in the periodic table according to their Atomic Mass.

Select the code from following:

a) 1 only
b) 2 and 3
c) 1 and 3
d) All of the above

Q.38) Solution (a)

The Periodic Table of Chemical Elements is the tabular arrangement of the chemical elements, arranged by atomic number, electron configuration, and recurring chemical properties.

Features:

- The seven rows of the table are called as periods and generally accommodate metals on the left and non-metals on the right.
- The columns of the table are called groups and contain elements with similar chemical behaviour.
- The elements from atomic numbers 1 (hydrogen) to 118 (oganesson) have been discovered in nature or synthesized in laboratories.
- The first 98 elements listed in the periodic table occur naturally, though some are found only in trace amounts and a few were discovered in nature only after having first been synthesized.
- Elements from 99 to 118 have only been synthesized in laboratories or nuclear reactors.

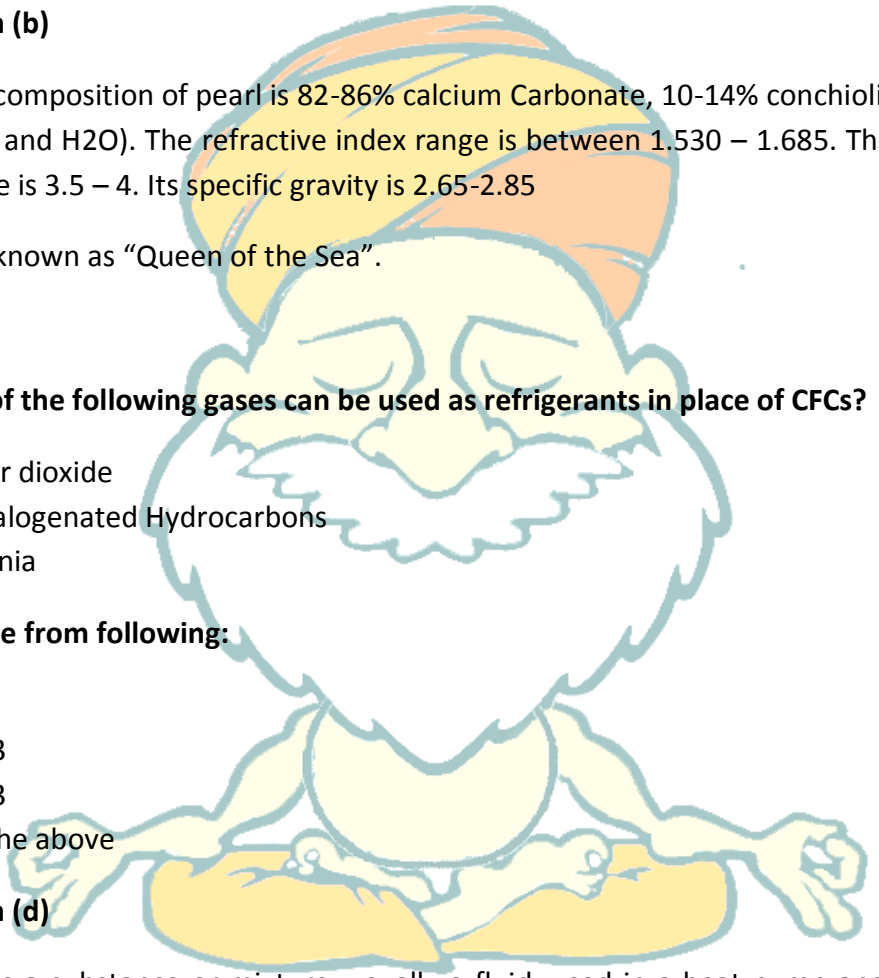
Q.39) Pearl is one of the costliest organic materials found in Nature. It is large composed of

a) Iron oxide
b) Calcium carbonate
c) Amino acids
d) Proteins

Q.39) Solution (b)

The chemical composition of pearl is 82-86% calcium Carbonate, 10-14% conchiolin and 2-4% of water (CaCO3 and H2O). The refractive index range is between 1.530 – 1.685. The hardness on the Mohs scale is 3.5 – 4. Its specific gravity is 2.65-2.85

Pearl is often known as "Queen of the Sea".



Q.40) Which of the following gases can be used as refrigerants in place of CFCs?

1. Sulphur dioxide
2. Non Halogenated Hydrocarbons
3. Ammonia

Select the code from following:

a) 1 only
b) 2 and 3
c) 1 and 3
d) All of the above

Q.40) Solution (d)

A refrigerant is a substance or mixture, usually a fluid, used in a heat pump and refrigeration cycle. In most cycles it undergoes phase transitions from a liquid to a gas and back again. Many working fluids have been used for such purposes. Fluorocarbons, especially chlorofluorocarbons, became commonplace in the 20th century, but they are being phased out because of their ozone depletion effects. Other common refrigerants used in various applications are ammonia, sulfur dioxide, and non-halogenated hydrocarbons such as propane.