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Paper - 3
Part - A

Exam date - 23/03/2020
Submission date - 30th April - 2020

Ans 1(a) QR Code
→ Quick response code, trademark for a type of matrix barcode
→ A machine readable two dimensional barcode consisting of an array of black and white
→ system used for storing URLs or other information
→ First designed in 1994 for automobile industry in Japan

Ans 1(b) Nitrogen fixing bacteria - Micro-organisms capable of transforming atmospheric nitrogen (molecular nitrogen) into fixed nitrogen (inorganic compounds usable for plants)
→ Play important role in nitrogen cycle
→ Example - Rhizobium

Ans 1(c) Fullerenes
→ Molecules of carbon atoms with hollow shapes, their structure are based on hexagonal rings of carbon atom joined by covalent bond.
eg Buckminister of fullerenes, nanotube. etc

Ans 1(d) Electric charge
→ Force experienced per unit electric field
→ $q = \frac{F}{E}$ q = electric charge Columb
F = Force (Newton), E = electric field
→ Discovered by Benjamin Franklin.

Ans 1(e) Wi-max -
Worldwide interoperability of microwaves access.
→ Point to multipoint wireless networking

→ It is a wireless broadband communication technology based around the IEEE 802.16 standard providing high speed over wide area
→ Range (30-40 miles) speed - (50-70 mbps)

Ans 1(g) Bombay Natural history society
→ Funded on 15 september 1883
→ Headquarter - Mumbai
→ It is an NGO in India engaged in conservation and biodiversity research

Ans ~~fast breeder reactor~~

Ans (h) Itai-Itai disease
→ Also called 'it hurt, it hurt', given by locals in japan in 1912
→ Symptoms - Due to cadmium poisioning, weak and brittle bones, spinal and leg pain.
→ Treatment - Detoxification of Cadmium with EDTA and other chelators.

Ans 1(i) Spleen
→ It is the largest organ in the lymphatic system
→ It is Commonly fist shaped, purple colour and abut 4 inches long acts as blood filter
→ Old RBCs are recycled and WBCs are stored here.

Ans 1(j) Vector units - Those units which depend on magnitude as well as direction are known as vector unit
e.g velocity, acceleration. etc.

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Ans 1(k) Cruise Missile
→ It is low flying guided missile against terrestrial target by an on-board computer
→ Example - Brahmos (India), Harpoon (USA) Exocet (France)

Ans 1(l) Spamming -
→ It is the use of messaging system to send an unsolicited messages (spam) especially advertisements

Ans 1(m) Neutron bomb
→ It is a low yield thermonuclear weapon designed to maximize lethal neutron radiation
→ Discovered by Samuel T. Cohen in 1958

Ans 2(b) Whole numbers and integers

→ whole numbers -
They start from 0 and end to ∞
i.e 0, 1, 2, 3 — ∞
They are always positive

→ Integers
They are non-fractional, non decimal number between -∞ to ∞ i.e -∞ — -3, -2, -1, 0, 1, 2 - ∞.
They can be +ve or -ve

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INS2(G) Ways of Separating mixtures

→ Solid-Solid - Mechanical picking, magnetic separation etc
→ Solid-liquid - Solvent extraction
→ Liquid-liquid - Separation of iron and sulpher
→ Gas-Gas - Gravity separation
→ Liquid-Gas - fractional crystallization

a) Solid-liquid
→ Filtration of water
→ Sedimentation and decantation of muddy water
→ Evaporation - salt from water.
→ Distillation
→ Centrifugation - Blood plasma from its solid constant

b) Liquid-liquid
→ Separating funnel - kerosene from water
→ Fractional distillation - Separation of different petroleum products from crude oil

c) Gas-Gas
→ Diffusion - separation of hydrogen from methane
→ Fractional evaporation - Liquified air is allowed to evaporate nitrogen
→ Preferential liquification - Ammonia get liquified at high pressure in a mixture ammonia & hydrogen
→ Dissolution in suitable solvent - Co_2 and Co dissolved in KOH then Co remain in gas state.

d) Liquid-gas
→ Heating - O_2 from water
→ Lowering of pressure - soda water

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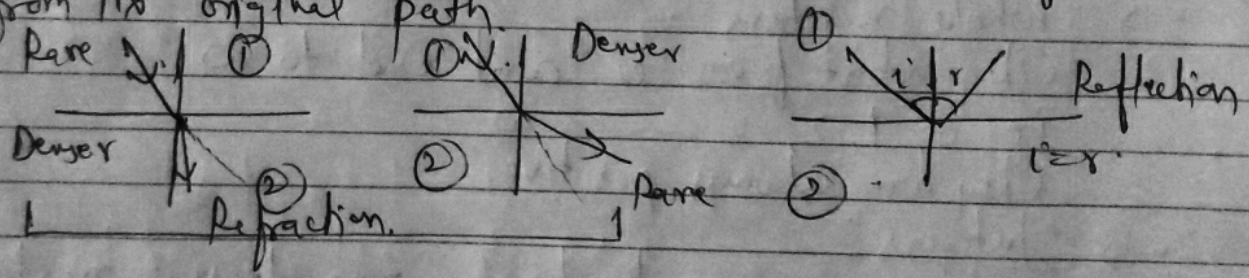
→ Chromatography –
Different rate of adsorption of different Compositions.
Discovered by Michael Tswett in 1906
Types –
a) Liquid c) Thin-layer
b) Gas d) Paper.

Ans 2(a) Light is an electromagnetic radiation within a certain portion of electromagnetic spectrum. It lies between the infrared and the UV rays.

Properties of light

→ It travels in straight line
→ It wavelength ranges from 3900 Å to 7000 Å
→ Speed of light = 3×10^8 m/sec
→ It can travel through vacuum
→ It has dual nature - Particle and wave nature
→ It has different speed in different medium highest in vacuum.
→ Reflection of light - If the surface is smooth and shiny like glass, water or polished metal and when the light is incident on the surface it bounce back in the same medium.
→ Refraction of light - when a light travels from one medium to another medium then it deflects from its original path.



→ Dispersion - The separation of white light (mixture of 7 different colour) into its different colours is known as dispersion e.g Rainbow
→ Scattering - Beam of light is redirected in many different directions when it interacts with a particle of matter.
e.g - Colour of sky appears to blue

Aug 2(a) The crucial difference dif between hormones and enzymes are chemical compositions. Almost all enzymes are protein.
Hormones on the other hand can either made of protein, amino acid or even steriod.

Enzymes	Hormones
→ Acts as a Catalyst	Acts as a messenger.
→ Made of protein	Protein, amino acids and steriods
→ Retain chemical make up after reuse hence can be reused	Chemical composition changes after use, Can't be reused
→ Form and act at the site of production	Act at different site
→ Produced by Exocrine gland	By Endocrine gland
→ Can't diffuse through a cell membrane	Can be diffused
→ External factors acutely affect regulation of enzyme such as temperature, PH level etc	
→ Examples - Protease, Amylase, Lipase for digestion	Examples - Insulin, regulate blood sugar, melatonine regulate sleep cycle.

Conclusion - Hormones and enzymes play vital role in our body by controlling and regulation many functions. Hormones are known as chemical messengers while enzymes are Catalyst.

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technologies can become billion time faster and

Ans 2(d) In blood transfusion there two most important blood group system named ABO and Rhesus system. ABO blood group system consist of 4 types blood group A, B, AB, O and is mainly based on the presence and Absence of antibodies and inherited antigens present in RBC and plasma.
On the other hand Rh blood group system consist of 50 defined blood group antigens. Most important are D, C, c, E, e.
Blood group was discovered by Landsteiner in 1900 and categorized into 4 groups.

Chart of blood group

Blood group	Antigen	Antibody	Remarks
A	A	b	—
B	B	a	—
AB	A, B	—	Universal recipient
O	—	a, b	Universal donal.

Blood transfusion chart

Blood group (Donar)	Recipient Group			
	A	B	AB	O
A	✓	✗	✓	✗
B	✗	✓	✓	✗
AB	✗	✗	✓	✗
O	✓	✓	✓	✓

Ans 2(f) Earth Summit

In 1992, more than 100 heads of states met in Rio De Janeiro Brazil for 1st international summit focusing on the problems of the environment protection and socio-economic development. It gave result to following legally binding agreements

→ Rio declaration on environment and development
→ Agend 21
→ Forest principles
→ Convention on biological diversity
→ Frame convention for climate change
→ United nations Convention to combat desertification

Kyoto Protocol

→ It was adopted in kyoto Japan on 11 dec 1997 and came into force on 16 feb 2005
→ It helps industrialized countries to stablise the green house gas emissions.
→ It had two Commitment periods, first one was (2008-2012) and second one runs from (2013-2020)
→ It was not ratified by the US and also denounced by Canada in 2012.

Paris agreement

→ It was signed in 2015 and came into effect in 2016.
→ There are 189 parties to the Paris agreement
→ It focuses to keep the increase in the global temperature levels to below 2°C and to put efforts to make it to 1.5°C by initiating projects leading to less emission of GHG.

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India's National action plan on climate change

→ National Solar mission.
→ National mission for a green India.
→ Clean air initiatives
→ Indian network on climate change assessment
→ Fame India Programme

Ans 2(b) Introduction

FBR (fast breeder reactors) use fast i.e (unmoderated) neutrons to breed fissile plutonium and possibly higher transuranics from fertile $_{92}U^{238}$.

Features of FBR

Fuel -
Power generation - Bulk capacity
Base load plant
moderator - Not used
Coolant - Gas (Helium)
Startup time - little less than thermal.

In 2006 all large scale FBR power station were liquid metal fast breeder reactor (LMFBR) cooled by sodium

Design

a) Loop type - Primary coolant is circulated through primary heat exchanger outside the reactor tank.

b) Pool type - Primary heat exchanger and pumps are immersed in the reactor tank.

Proposed generation IV reactor types
→ Gas-cooled fast reactor
→ Sodium cooled fast reactor
→ Lead cooled fast reactor.

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India's Indigenously developed Pool fast breeder reactor

→ India's first indigenously 500 mw PFBR developed at kalpakkam in Tamil nadu.

→ It is a pool type reactor with 1750 tonnes of sodium as coolant

→ Designed to generate 500 mw (mega watt) of electrical power

→ Operational life of 40 years

→ Fuel - mixture of PuO_2 and UO_2

→ India is planning to build such 21 reactors by 2030

Ans 2(i) Introduction

It is GPS-aided GEO augmented navigation and an implementation of a regional satellite based augmentation system of the government of India.

Developed by – AAI and ISRO collaboration started in 2004

Goal – To provide a navigation system to assist aircraft in accurate landing over the Indian airspace and in the adjoining area and applicable to safety to life in civil operations.

Satellites Carrying – GSAT-15, GSAT-10

Payload of Gagan system – GSAT-8

Coverage – It Cover area from Africa to Australia and has expansion capability for seamless navigation services across the region.

Other details –

→ It is the first Satellite based Augmentation navigation system in the world which has been certified for approach with vertical guidance operation in the equatorial ionospheric region.

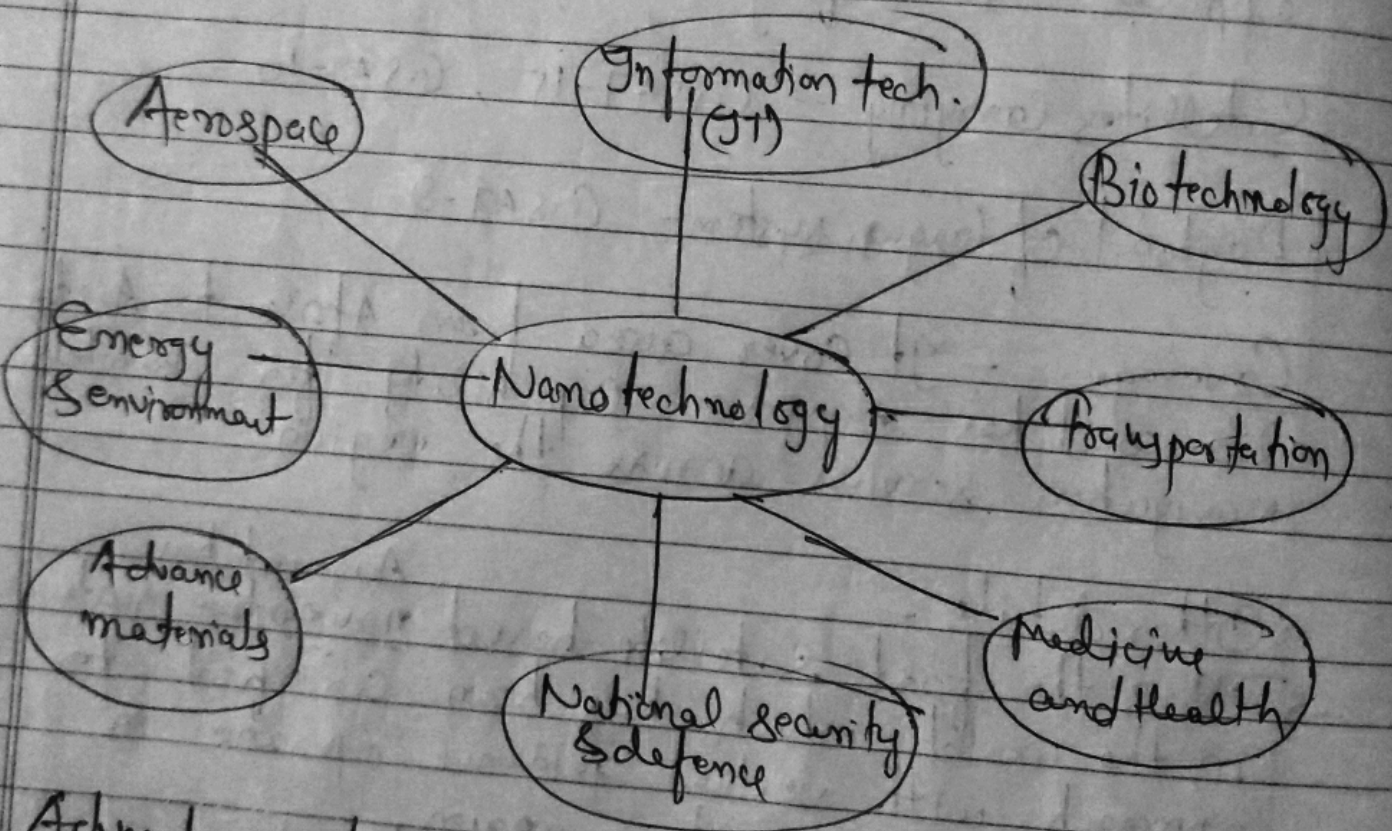
→ Interoperable with other international SBAS

→ While GAGAN will redefine navigation over Indian air space IRNSS (Indian regional navigation satellite system) will provide independent and self reliant satellite based navigation system over Indian region.

Aug 2019 Nanotechnology

The study of controlling of matter on an atomic and molecular scale. Generally nanotechnology deals with structure sized between (1 to 100 nano meters (nm)) in atleast one dimension and involves developing or modifying materials or devices with that size. A human hair is about 100,000 μm wide compare to nano fibre.

Applications



Advantages of nanotechnology

→ With nanotechnologies, we can create unique materials, products which are stronger, lighter cheaper, durable and precise.
→ Environmental friendly
→ Manufacturing cost is low.
→ Mass production
→ Industrial machines and computers with nano

Q3(a) Introduction

Developments which meets the needs of the present without compromising the ability of future generations to meet their own needs.
Most widely accepted definition of sustainable developent was given by Brundtland in its own report 'Our Common future' 1987.
SD (sustainable developments) calls for concerted effort towards building an inclusive, sustainable and resilient future for people and planet".

Need

a) Climate change
→ Increase in atmospheric temperature and extreme weather events
→ Rising sea level extinction threat to small island nations due to climate changes

b) Over exploitation of natural resources
→ Decline of more than 60% of the worlds marine fisheries
→ 1 million species on track for extinction

c) Scarcity of resources
→ Food production needs to double over the next 40 years at a time when almost 23% of the world's agricultural land has been degraded.

→ Nearly 2/3rd of the world's population will

be living in water-scarce and water stressed areas by 2025.

Core elements of Sustainable development (SD)

a) Environment Sustainability

→ It prevent nature from being used as an inexhaustible sources of resources and ensures its protection and rational use

→ Aspect such as environmental conservative, investment in renewable energy, saving water, support sustainable mobility, innovation in sustainable construction and architecture contribute to achieve environmental sustainability on several fronts

b) Social sustainability

It can foster gender equality, development of people, communities and culture to help achieve a reasonable and fairly distributed quality of life, healthcare and education across the globe.

c) Economic sustainability

→ Equal economic growth that generate wealth for all without harming environment

→ Investment and equal distribution of economic resources

→ Eradication poverty.

Sustainable development Goals (SDGs)

→ To bring sustainable development in the mainstream United nations (UN) launched 2030 agenda for SDGs

→ There are 17 goals and 169 targets, specific targets to be achieved by 2030.

→ Reaching the goals requires action on all fronts like government business, civil society and people everywhere, all have to role to play.

→ SDGs are not legally binding.

There 17 Goals which are as follows:-

→ No poverty
→ Zero hunger
→ Good health and well being
→ Quality education
→ Gender equality
→ Clean water & sanitation
→ Affordable and clean energy
→ Decent work and economic growth
→ Industry innovation and infrastructure
→ Reduced inequalities
→ Sustainable cities and communities
→ Responsible Consumption and production
→ Climate action
→ Life below water
→ Life on land

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→ Peace, justice and strong institutions
→ Partnership for the goals.

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Metals

Metals are opaque, lustrous elements that are good conductor of heat and electricity. Majority elements in the periodic table are metals. This include alkali metals, transition metals, lanthanides, actinides and alkaline earth metals. Metals are separated from non-metals in a periodic table through a zig-zag line starting from carbon till radon.

Examples- Copper, Al etc.

Non-metals

Non-metals are the elements that does not posses the properties of metals i.e bad conductor of heat and electricity. Very few elements in periodic table are non-metals. They are present on right hand side in the periodic table.

Example - Sulphur, carbon, all halogens, phosphorus, oxygen, noble gas etc.

Properties of metals

Physical properties

→ Shiny (lustrous) in nature
→ Good conductors of heat and electricity
→ High density
→ Melting point is high
→ Malleable and ductile
→ At room temperature metals are solid except mercury

→ Opaque.

Chemical properties

→ Corrosion
→ Good reducing agents
→ Can louse electrons
→ Low electronegativity

Properties of non-metals

→ Poor conductor of heat and electricity
→ Non-ductile
→ Non-malleable
→ Brittle
→ Solid liquid or gaseous at room temperature
→ Not sonorous
→ Transparent

Chemical properties of non-metals

→ Number of electron in outer shell 4 to 8
→ Easily gain or loose valence electron
→ Form acidic oxides whenever they come in contact with O_2
→ High electronegativity
→ Great oxidising agents

3(d) Central Nervous system

CNS is often called the central processing unit of the body. It is a part of human nervous system. It Consist of the brain and the Spinal Card

a) Brain

(i) The Brain is one of the important, largest and central organ of the human nervous system.

(ii) It is the Control unit of the nervous system, which helps us in discovering new things, remembering and understanding, making decision and a lot more

(iii) It is enclosed within the skull, which provides frontal, lateral and dorsal protection. The human brain Composed of 3 major parts:-

1) Forebrain

It is made up of:

- Cerebrum :- Associated with memory, wisdom knowledge, will power and thinking
- Thalamus :- It regulates cold, heat and pain
- Hypothalamus :- It controls the sweat, blood pressure, secretion of hormones, thirst, hunger etc.

2) Midbrain:- It is the smaller and central part of brain, Consist of tectum and Tegmentum Midbrain manages the main function of hearing and vision.

3) Hindbrain

It Consist of:

- → Cerebellum — Posture of human body managed by it.
- → Pons — It acts as a bridge between brain and spinal cord
- → Medulla — It regulates important functions like respiration, heart rate, sneezing and coughing etc

5) Spinal Cord

(i) The spinal cord starts from the medulla oblongata and extends towards towards the neural canal of the backbone / vertebral Column

(ii) There are 31 pair of spinal nerves that arises from the side of the spinal cord.

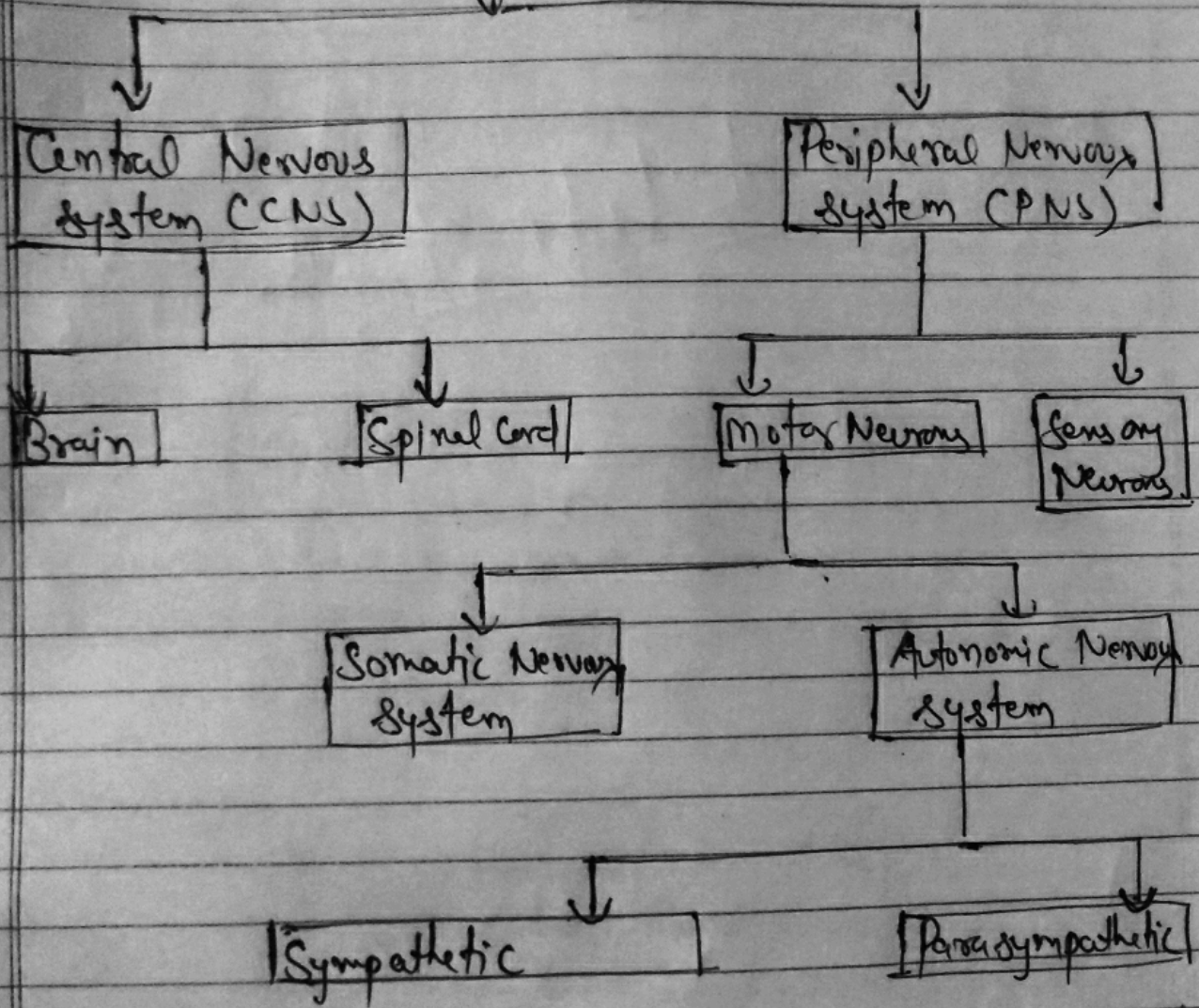
(iii) The function of the spinal cord is to control all the reflexes that take place below the neck.

(iv) Furthermore, the spinal cord conducts the sensory impulses arising from the muscles and skin to the brain.

(v) Vertebrae protect the spinal cord from any kind of injuries

(vi) The spinal cord also conducts the motor responses from the brain to the muscles present in the limbs and trunk area

Classification of Human Nervous System



Neurons are the structural and functional unit of nervous system