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NURSING

PB BSc

Solved Question Papers for 1st Year

2023-2019

7th Edition

Elakkuvana Bhaskara Raj D

Co-authors
Anbu T
Venkatesan B

JAYPEE

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BIOCHEMISTRY AND BIOPHYSICS

Paper 2023 February

BIOCHEMISTRY

LONG ESSAYS

1. Explain the digestion and absorption of proteins.
2. Explain the role of liver in fat metabolism.

SHORT ESSAYS

1. Write a note on Gout.
2. Write any five diagnostic application of enzymes.
3. Explain the classification of polysaccharides with examples.
4. Explain the classification of proteins.
5. Mention the sources and disposal methods of biomedical waste.

SHORT ANSWERS

1. Name the two essential amino acids.
2. Mention any two functions of cholesterol.
3. Mention the normal levels of i. Fasting blood glucose ii. Blood creatinine.
4. Rickets.

BIOPHYSICS

LONG ESSAYS

1. What is a machine? Explain different types of simple machines.
2. State Newton's laws of gravitation. Write a note on center of gravity and specific gravity.

SHORT ESSAYS

1. Explain medicinal uses of gamma rays.
2. Write a note on regulation of body temperature.
3. Use of body mechanics in patient care.
4. Noise pollution and its prevention.
5. Draw normal ECG, label its parts.

SHORT ANSWERS

1. Explain voltage. Mention its SI unit.
2. Intracranial pressure.
3. SI and CGS units of length and time.
4. Write audible frequency range of human ear.

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BIOCHEMISTRY

LONG ESSAYS

1. Explain the digestion and absorption of proteins.

Proteins are high molecular weight, nitrogen containing organic macromolecules, which are present in all cells of the body. They are made up of alpha-amino acids, which are linked by peptide linkages.

Digestion of Protein

Digestion and absorption takes place in gastrointernal tract (GI tract) at different levels with proteolytic enzymes aided by GI hormones.

Digestion in Stomach

- HCL secreted by parietal cells of stomach denatures proteins and makes it susceptible to hydrolysis by protease enzymes.
- **Pepsin:** It is secreted as inactive zymogen—pepsinogen by chief cells of stomach.
- Pepsinogen is converted into pepsin by HCl.

$$\text{Pepsinogen} \xrightarrow{\text{HCl}} \text{Pepsin}$$

- Later, pepsin itself causes activation of pepsinogen to pepsin (autocatalysis).
- It is an endopeptidase with an optimum pH of 1 to 2. Its end products are protease and peptones.
- It hydrolyses peptide bonds of phenylalanine, tyrosine, tryptophan, glutamate.

Digestion in Duodenum

- Proteolytic enzymes of pancreatic juice carry on further digestion
- **Trypsin:** It is secreted as inactive trypsinogen. The activation is brought about by an enzyme enterokinase of intestinal juice. It is an endopeptidase, hydrolyses peptide bonds formed by basic amino acids, agrinine, histidine and lysine.
- It acts on proteins, proteoses, peptones converting them to polypeptides. Optimum pH is 8 to 9.

$$\text{Trypsinogen} \xrightarrow{\text{Enterokinase}} \text{Trypsin}$$

- **Chymotrypsin:** It is secreted as activative chymotrypsinogen. It is an endopeptidase specific for peptide bonds of aromatic amino acids. Optimum pH is 7 to 8.

$$\text{Chymotrypsinogen} \xrightarrow{\text{Trypsin}} \text{Chymotrypsin}$$

- **Proelastase:** It is an endopeptidase, hydrolyses peptide bonds next to small amino acids residues such as glycine, alanine and serine.

$$\text{Proelastase} \xrightarrow{\text{Trypsin}} \text{Elastase}$$

- **Carboxypeptidase:** It is an exopeptidase. It hydrolyses peptide bonds adjacent to carboxy terminal, liberating amino acids.

$$\text{Procarboxypeptidase} \xrightarrow{\text{Trypsin}} \text{Carboxypeptidase}$$

In Small Intestine

- **Aminopeptidase:** Present in intestinal juice, it is an exopeptidase. It hydrolyses peptide bonds adjustment to amino terminal, liberating amino acids.

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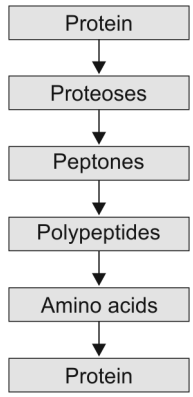
- **Dipeptidase:** Present in intestinal juice. It hydrolyses dipeptides to liberate amino acids.
- Dipeptide → Amino acid + Amino acid
- End product of protein digestion is amino acids.



Absorption of Protein

Amino acids are absorbed in small intestine by active transport, which is Na + dependent. There are six different carrier proteins for different groups of amino acids. L-amino acids are preferentially absorbed compared to D-amino acids.

Amino acids are carried to liver and further metabolized. Gamma-glutamyl cycle (Meister's cycle) takes place in kidney tubules and brain. Amino acids enter into the cell with help of glutathione.

The transport of one amino acid with regeneration of glutathione requires 3 molecules of adenosine triphosphate (ATP).

2. Explain the role of liver in fat metabolism.

- Secretion of bile salts
- Synthesis of fatty acid, triacylglycerol and phospholipids
- Oxidation of fatty acid
- Production of lipoproteins for transportation of lipids
- Production of ketone bodies
- Synthesis and excretion of cholesterol

SHORT ESSAYS

1. Write a note on Gout.

Gout is caused by an increase in uric acid production, underexcretion of uric acid by the kidneys or increased intake of food containing purines, which are metabolized to uric acids by the body, characteristic deposits of sodium urate crystals occur in articular, periarticular and subcutaneous tissue.

Causes

- Acidosis or ketosis
- Alcoholism
- Atherosclerosis
- Chemotherapeutic drugs
- Diabetes mellitus
- Drug-induced renal impairment

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- Hyperlipidemia
- Hypertension
- Malignant disease
- Myeloproliferative disorder
- Obesity
- Renal disease
- Sickle cell disease
- Use of certain drugs (salicylates)

2. Write any five diagnostic application of enzymes.

Some important enzyme estimation include:

a. Creatine kinase/creatine phosphokinase (CPK and CK-MB)
   Creatine kinase starts increasing by 3–4 hours after myocardial infarction, reaches peak value by 24 hours and declines by about 72 hours.
   Normal values of CPK&CK-MB
   CPK—Male 15–105 U/L**, Female** 10–80 U/L
   Ck-MB- 0–9 U/L
b. Aspirate amino transaminase (SGOT)
   it is increased in myocardial infraction
c. Alanine transaminase (SGPT) increase in liver disorder
d. Acid phosphatise is increase in carcinoma of prostate
e. Alkaline phosphatise is increase in obstructive jaundice
f. Serum amylase is increase in acute pancreatitis

Serum enzymes used to identify the certain disease condition such as:

Enzyme	***Application***
Trypsin	Acute thrombophlebitis
Pepsin, rennin	Gastric achylia
Streptokinase	Dissolution of clot in myocardial infarction
Thromboplastin	Blood coagulation
Urokinase	Myocardial infarction
Asparagines	Leukemia
Lysozyme	Eye infections
Lysozyme	Cystic fibrosis

Certain enzymes are used for treatment purpose and they are:

- Streptokinase—increase conversion of plasminogen to plasmin and thus dissolves clot; it used in myocardial infarction
- Pepsin and trypsin are proteolytic enzymes present in digestive tonics
- Chymotrypsin is used to reduce inflammatory edema

3. Explain the classification of polysaccharides with examples.

Polysaccharides

They are those yield more than 8 monosaccharides units on hydrolysis.
The general formula $[C_6H_{10}O_5]_n$

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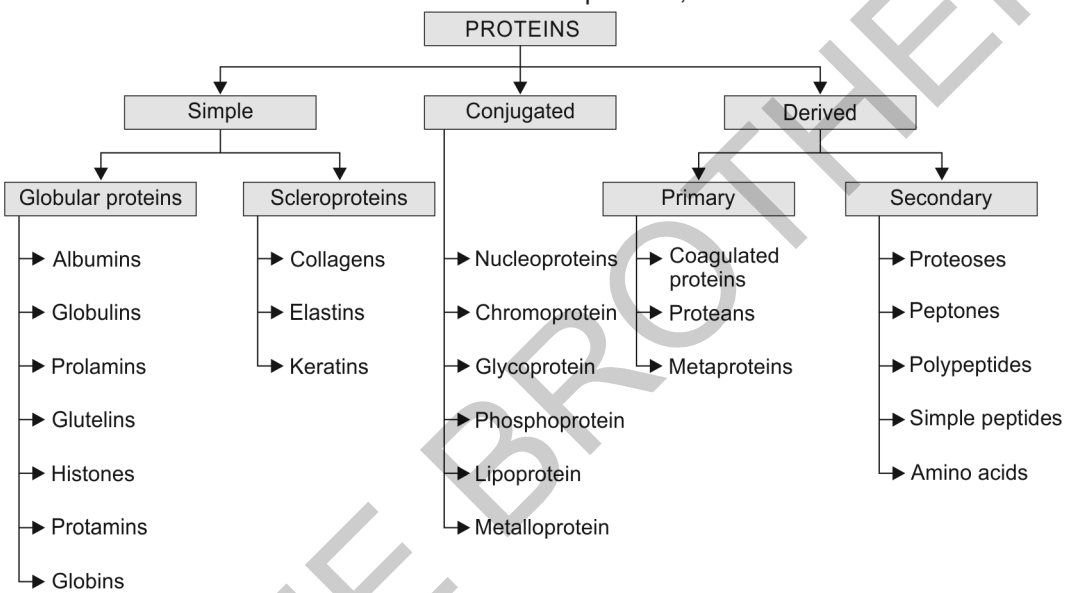
- They are further divided into:
  - **Homopolysaccharides:** They are polymer of same monosaccharides units, e.g., starch, glycogen, insulin, cellulose, dextrin, dextran, etc.
  - **Heteropolysaccharides:** Polymer of different monosaccharides units their derivates, e.g., muco polysaccharides.

4. Explain the classification of proteins.

Protein is derived from a Greek word PROTOS which means "the first or the supreme". Protein are extremely complicated and nitrogenous molecule made up of variable number of amino acid residue joined to each other by a specific covalent bond called peptide bond. 20 amino acid which have been found to occur in all proteins, known as standard amino acid.



Functions of Proteins

- Transport substances in blood of different tissues, e.g., hemoglobin is a oxygen transport protein.
- Contraction of muscle and cells, e.g., myosin.
- Prevents blood loss, e.g., fibrinogen.

Albumin

i. Albumin is the most abundant plasma protein with molecular weight 69,000 Da and isoelectric pH 5.4.
ii. It migrates fastest in electrophoresis. It precipitates on full saturation with ammonium sulfate. It is a simple protein, which is synthesized in liver. Half-life of albumin is 20 days.

Functions of Albumin

i. **Albumin:** Contributes to the colloidal osmotic pressure. Maintenance of blood volume is dependent on this effective osmotic pressure. It plays an important role in exchange of water between tissue fluid and blood.
ii. Transport substances like free fatty acids, unconjugated bilirubin, calcium. Drugs like sulfate and aspirin bind albumin.
iii. It has got a buffering capacity.

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Alpha Globulins

Alpha-globulins are glycoproteins classified into alpha-1 and alpha-2 depending on their electrophoretic mobility.

Alpha-1 Globulin

a. **Alpha-1-fetoglobulin**
   - It present high concentration in fetal blood and during pregnancy
   - Increased in hepatocellular carcinoma.

b. **Alpha-2-antitrypsin**
   - Synthesized by liver protease inhibitor of human plasma
   - It inhibits trypsin, elastase and certain other protease by forming complexes with them. Increase in alpha-1 AT—occurs in inflammation, trauma, burns, infarction, malignancy and liver disease.

Alpha-2 Globulin

Ceruloplasmin: It is a copper containing alpha-globulin, a glycoprotein. It contains 8 copper atoms per molecule. It is synthesized in the liver. Ninety percent of Cu in plasma is bound to ceruloplasmin. Ten percent of Cu is bound to albumin.

Functions

Alpha-globulins mainly functions to help ferroxidase conversion of Fe^{2+} to Fe^{3+}, which is incorporated into transferring.

5. Mention the sources and disposal methods of biomedical waste.

Refer Paper 2022 February, short essay question number 4.

SHORT ANSWERS

1. Name the two essential amino acids.

An essential amino acids is an amino acids that cannot be synthesised itself by the organism (usually referring to human) and the fore must be supplied in the diet.

Essential amino acids helps the body function and regulate neurotransmitters. Chemical in the brain control mood and behavior.

They are cannot be synthesized in the body and have to taken through the diet, e.g. Methionine, Threonine, Tryptophan, Valine, Leucine, Lysine, Phenylalanine, Arginine and Histidine.

2. Mention any two functions of cholesterol.

Functions of Cholesterol

- Cholesterol is an important tissue component. It has a modulating effect on the fluid of the membrane.
- Because of its conductivity, cholesterol plays an important role in insulating nerves brain structure.
- For the transport of fatty acids in the body through the formation of esters of fatty acids.
- Cholesterol neutralize the hemolytic action of a number of agents, such as snake venous, bacterial toxins, etc.
- Cholesterol gives rise to provitamin D.
- It is precursor of cholic acid in the body.
- It gives rise to sex hormones.

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3. Mention the normal levels of i. Fasting blood glucose ii. Blood creatinine.

Fasting blood glucose = 70–110 mg/dL
Creatinine = 0.2–1.0 mg/dL

4. Rickets.

The deficiency vitamin D causes rickets in children and osteomalacia.

Clinical Features of Rickets

- Bone deformity
- Bow legs

BIOPHYSICS

LONG ESSAYS

1. What is a machine? Explain different types of simple machines.

The lever is perhaps the most basic of all the simple machines. It is described as a rigid bar that moves about a fixed axis called the fulcrum (F). The bar may be straight or bent.

An operating lever, in addition to a ful resistance force. Neglecting friction, the law of the machine (Ede = Rdr) holds true for all levers.

The distance from the effort to the fulcrum (de) is called 'the effort arm', and the distance from the resistance to this fulcrum (dr) is called 'the resistance arm'. Using these terms, the law of the machine (Ede =Rdr) may be restated for application to the lever as follows:

Effort × Effort = Resistance × Resistance arm

Levers are grouped into three classes, according to the relative position of the three components—the fulcrum, the effort and the resistance.

- **First class levers:** In a lever of the first class the fulcrum is situated somewhere between the effort and the resistance. Scissors hemostats and other instrument are examples of such a machine.
  Many of the muscle of the body are attached to points on the skeleton in such a way that they function as the effort force of a lever. In the human body, a first—class lever is represented by the triceps brachia muscle when it acts without the aid of other muscles. The muscles supplies the efforts, the elbow joints acts as the fulcrum and the resistance is an object held in the hand. As the fibers of the triceps brachia contract, the forward extends and the objects is lowered. The forward and backward movement of the skull as it pivots on the axis to drop and rise the head are also examples of the action of first class lever.
- **Second class lever:** In a second class lever, the resistance is situated between the fulcrum and the effort examples are the wheelbarrow and oxygen tank carrier. The acts of turning a firm mattress and lifting the front end of a bed also illustrate second class levers.
- **Third class lever:** In a third class lever, the effort is situated between the resistance and the fulcrum. Some of the muscles of the body acting at the joints and forceps are examples. In the body, the action of the biceps lever. The elbow joint is the fulcrum, the biceps brachia provides the efforts and the fibers of the biceps brachia contract, the object is raised.
- **Bent levers:** The hammer and machines that operate like the hammer by producing torques are called 'bent levers'. In the bent lever, the resistance arm and the effort arm are the perpendicular distance from the line of action to the fulcrum. Retractors, used in surgery to enlarge the opening of operative incision, acts as bent levers.

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A simple machine is a device in which a force is applied at one point in one direction is made available at some other point in some other direction. The simple machines are levers, pulley, screw, gears, wheel, axe and inclined machine. The force applied on the simple machine is called effort or power. The force overcome by the machine is called load or weight.

2. State Newton's laws of gravitation. Write a note on center of gravity and specific gravity.

Sir Isaac Newton observed an apple falling toward the ground and formulated the law of gravitation. According to him, "Every body in this universe attracts every other body with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers.

Let us consider two bodies of mass m_1 and m_2, separated by distance d, and then the force of attraction is given by:

$$F\ m_1\ m_2/d^2$$

$$F = G.m_1.\ m_2/d^2$$

Where G is the constant of gravitation = $6.670 \times 10^{-11}\ Nm^2\ kg^{-2}$

Relation between g and G

If M is the mass of earth and R is the radius of the earth, force of gravity of a mass m on the surface of the earth:

$$F = GMm/R^2$$

Where G is the gravitational constant. We also know that F = mg, where g is the acceleration due to gravity, from these two equations we get:

$$Mg = GMm/R^2$$

$$GM = gR^2$$

From this mass of the earth can be calculated as 5.98×10^{24}kg

$$(g = 9.8,\ R = 6.38 \times 10^6,\ G = 6.67 \times 10^{-11})$$

Variation of g

The acceleration due to gravity is inversely proportional to the square of the earth's radius R. But earth is not a perfect sphere, it is flattened at the poles and bulged at the equator and R is not a constant at all points on the earth surface. The radius is greatest at the equator and least at the poles. The value of g is least at the equator and greatest at the poles.

The value of g is also varies with altitudes. As the altitude increase, the value of the acceleration due to gravity decreases. The value of g decreases with depth and becomes zero at the center of the earth.

Effect of Gravitational Force on Human Body

- When a man is standing erect the CG passes through a midpoint between two legs. When one leg is injured, the center of gravity shifts toward the side of the uninjured leg. When a man is in lying position, he is in stable equilibrium. The CG is lowered and it is passing through a vertical line.
- A man carrying a load on his back has to bend forward. In this case, the CG passes through a vertical line, along with the body. The man carry the load and walk easily, if he wants to walk straight and carries the load on his back, the CG passes through a vertical line, which falls outside the base. It is difficult to carry the load

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- A lady carrying a water bucket in her right hand leans toward her left hand. This is to keep the vertical line through the CG within the base.
- When a man is climbing up a hill, he bends forward to keep the CG through a vertical line with in the base. While coming down, he leans backwards, so that the vertical line through the CG falls within the base.
- A rope dancer holds an umbrella to keep the vertical line through the CG passing through the rope. He adjusts the position of the CG by balancing the umbrella.

The centre of gravity (CG) of a body is defined as the point thorough which the weight of the body acts irrespective of the position of the body. For given it is fixed, provided the size and shape do not undergone a change.

a. The centre of gravity of a body depends on the shape and size of the body. In a sphere the CG is at its centre. In a ring it lies at its geometric centre.
b. The position of the centre of gravity (CG) changes with the change in shape of the body.

Applications of Gravity in Nursing

i. Gravity exerts an effect on the blood circulation in the body. Changes in body position alter the blood pressure (BP) in various parts of the body. During fainting the brain is temporarily deprived of blood so nurse can understand patient condition she changes the patient position.
ii. People who stand their legs for long periods of time may have edema of the legs and feet based on patient condition she educates to avoid longstanding.
iii. Nurse should aware about following the brain operation the head of the bed may be elevated to facilitate draining the blood from the brain.
iv. Procedure like irrigation, intravenous infusion and transfusions would be impossible in the absence of gravity as there be no pressure without gravity.
v. Nurse can teach patient or position in after operation on the throat or mouth the head of the patient.
Is usually lowered and placed to one side so that mucus and fluids will drain out of the mouth by gravity.
vi. She should know the gravity based on that she can place chest tube bottles.
vii. Shifting of orthopaedic applinces and artificial limbs have to learn the shifting of the centre of gravity without falling.
viii. Nurse should know to prevent back pain with body gravity and balance she/can shift patient.
ix. Good posture is an asset to all individuals in esthetic sense.

SHORT ESSAYS

1. Explain medicinal uses of gamma rays.

Gamma rays are produced, due to isomeric transition of radionuclei from excited state to ground state.

- It is used in radiographic techniques, it is shooting inside an object. The captured were recorded in the X-ray.
- It used in medicine, namely CT scanner.
- It is used to cure cancer with gamma knife surgery.
- It is used in the sterilization process for biological tissue products.
- It is used to process plant breeding with mutations techniques in BATAN.
- It is used in nuclear weapons.
- It is used create sterile insists.

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2. Write a note on regulation of body temperature.

The human body has the remarkable capacity for regulating its core temperature somewhere between 98°F and 100°F when the ambient temperature is between approximately 68°F and 130°F according to Guyton. This presumes a nude body and dry air.

The external heat transfer mechanisms are radiation, conduction and convection and evaporation of perspiration. The process is far more than the passive operation of these heat transfer mechanisms, however. The body takes a very active role in temperature regulation.

The temperature of the body is regulated by neural feedback mechanisms which operate primarily through the hypothlamus. The hypothlamus contains not only the control mechanisms, but also the key temperature sensors. Under control of these mechanisms, sweating begins almost precisely at a skin temperature of 37°C and increases rapidly as the skin temperature rises above this value. The heat production of the body under these conditions remains almost constant as the skin temperature rises. If the skin temperature drops below 37°C a variety of responses are initiated to conserve the heat in the body and to increase heat production. These include:

- Vasoconstriction to decrease the flow of heat to the skin.
- Cessation of sweating.
- Shivering to increase heat production in the muscles.
- Secretion of norepinephrine, epinephrine, and thyroxine increase heat production.
- In lower animals, the rection of the hairs and fur to increase insulation

Application of Heat Transfer in the Body

This is an active graphic. Click on one of the heat transfer mechanisms for a discussion of its role in cooling the human body.

This is a simplified model of the process by which the human body gives off heat. Even when inactive, an adult male must lose heat at a rate of about 90 watts as a result of his basal metabolism. One implication of the model is that radiation is the most important heat transfer mechanism at ordinary room temperatures. This model indicates that an unclothed person at rest in a room temperature of 23 Celsius or 73 Fahrenheit would be uncomfortably cool. Select one of the cooling mechanisms for further details about how the model numbers were obtained. The skin temperature of 34°C is a typical skin temperature taken from physiology texts, compared to the normal core body temperature of 37°.

3. Use of body mechanics in patient care.

- It is used mainly the patient while shifting and transferring from wheel chair to bed or bed to starchier and wheel chair.
- Administration of IV medication to the patient nurse need to maintain the proper body posture.
- It is mainly used in drainage tube patency while taking care of surgical patient.
- It helps in placing the patient in proper position.
- Body mechanism helps in prevention of injury of muscle and joints while taking care of patient.

4. Noise pollution and its prevention.

The term noise is derived from Latin word `nausea' meaning seasickness.

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It can defined as unwanted or offensive sound that unreasonably intrude into our daily activities.

Noise pollution is excessive, displeasing human, animal or machine-created environmental noise that disrupts the activity or balance of human life.

Prevention

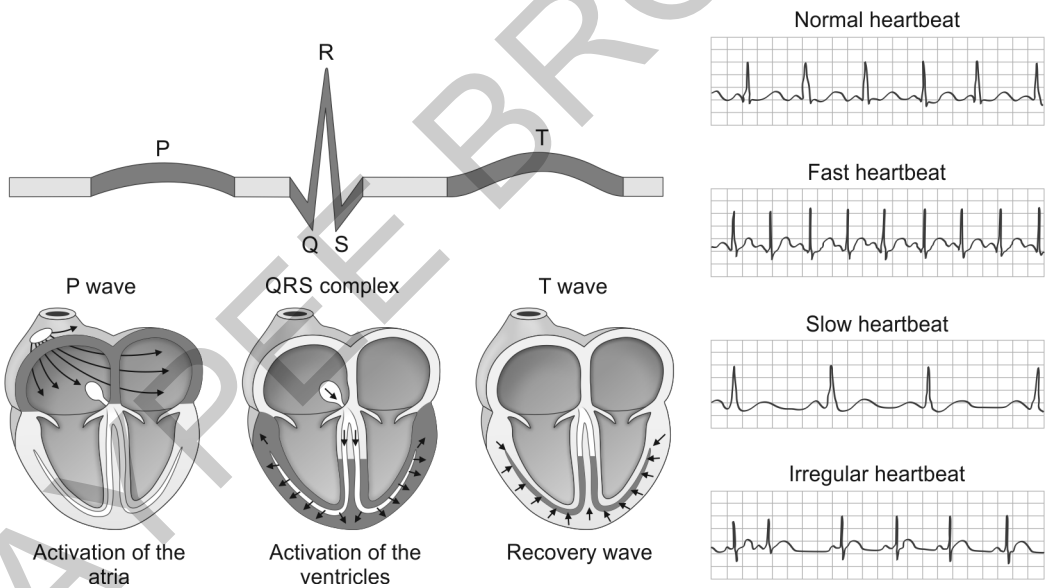
The noise can be controlled by following methods:

- Keeping away—the sources
- By reducing the intensity of source of sound
- Putting car plugs
- Designing the structure of the building to reduce sound
- Getting treatment by the physician
- Having double walls/doors with air space between them
- By putting suitable sound absorbing materials like curtains, carpets, material made of cork and soon.

5. Draw normal ECG, label its parts.

An ECG is a series of waves and deflections recording the heart's electrical activity from a certain "view."

Many views, each called a lead, monitor voltage changes between electrodes placed in different positions on the body.



- P wave—indicating atrial depolarization(and contraction)
- PR interval—Measures time during which a depolarization wave travels from the atria to the ventricles
- QRS interval—Indicates ventricular depolarization (and contraction)
- ST segment—Measures time between ventricular depolarization and beginning of repolarization
- T wave—Represents ventricular repolarization

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SHORT ANSWERS

1. Explain voltage. Mention its SI unit.

Voltage is the potential difference between two points in an electric field.
Symbol of voltage is " V"
SI units of voltage if Volt
Its formula is V= W/q

2. Intracranial pressure.

ICP is a measure of the pressure in the cranial cavity; 0 to 15 mm Hg is normal.

3. SI and CGS units of length and time.

Physical quantity	*SI Units*	*CGS*
Length	Meter	Cm
Time	Second	S

4. Write audible frequency range of human ear.

The human ear is more sensitive to 50–5000 Hz range.

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Elakkuvana Bhaskara Raj D MSN MPhil (Psy) PGDHM PGD (Biostat) PhD (Nursing) RN RP is Professor and Principal, College of Nursing, Government Medical college, Ambedkar Nagar, Uttar Pradesh, India. He is a triple graduate, a double postgraduate, and obtained MPhil degree in 2007. He is a PhD student under the national consortium in nursing by Indian Nursing Council (INC). He is a life member in various national professional organizations and alumnae associations. He has about 10 years of teaching experience in undergraduate and postgraduate nursing programs. He has published several articles in various national and state journals. He has participated and presented several research papers in various national and international workshops and conferences. He is actively associated in the eld of nursing management, psychiatric nursing, research and biostatistics. He bagged many books to his credit such as *Nursing Research and Biostatistics, Nursing Theories, Psychiatric Dictionary, Nursing Management Services and Education, Nursing Informatics, Practical Book for PC BSc, BSc and GNM* and *Solved Question Papers of GNM and PC BSc Nursing*

Anbu T MSN PGDED RN RP is Professor and Principal, Sri Vishnu College of Nursing, Bengaluru, Karnataka, India. He did MSc (Nursing) from The Tamil Nadu Dr MGR Medical University, Chennai, Tamil Nadu and has been awarded Post Basic Diploma in Emergency and Disaster Nursing by the Karnataka State Diploma in Nursing Examination Board. He is a life member in various national professional organizations like TNAI, ISPA, etc. He has about 20 years of teaching experience. He participated in many national and international conferences and presented scientific papers; and published many articles in various journals. He was appointed as an Examiner for nursing program in Rajiv Gandhi University of Health Sciences, Bengaluru. He has authored many books entitled: *Textbook of Psychiatric Nursing, Nursing Informatics* and *Management of Nursing Service and Education*.

Venkatesan B MSc (N) PhD (N) MSc (Psychology) PG Diploma in Diabetic Educator is presently working as Vice-Principal and Head, Department of Medical Surgical Nursing in Padmashree Institute of Nursing, Bengaluru, Karnataka, India. He has been awarded Doctorate in Nursing in year 2021 in Sri Ramachandra Institute of Higher Education and Research (SRIHER), Chennai, Tamil Nadu, India. He has been lecturing to the students of nursing undergraduate and postgraduate for the past 15 years. He also completed Master in Medical Surgical Nursing, Sri Ramachandra Institute of Higher Education and Research, Chennai. He published 25 research articles in various national and international journals.

He has completed Research Methodology and Biostatistics course work, Research Ethics Education, and Ethics and Responsible conduct of research: Basis and Beyond conducted by SRIHER. He presented five research papers in international nurse's conferences. He published five case reports in national and international journals. He is a Review Board Member in national and international journals. He has guided more than 50 dissertations for postgraduate students. He is PhD Co-guide in Sri Balaji Vidyapeeth University, Puducheery, India. He authored many books such as *Nursing Management Services and Education, Medical Surgical Nursing, PB BSc Solved Question Bank for I and II Year, PCBSc Nursing Foundation, Cardiothoracic Nursing, Nursing Foundation for BSc Nursing and GNM, Casebook for BSc II Year and BSc III Year, Medical Surgical Nursing for BSc Nursing* and *Adult Health Nursing Practical Record Book for BSc Nursing.*

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