WINTER– 2022 EXAMINATION

MODEL ANSWER

Subject Title: HUMAN ANATOMY & PHYSIOLOGY- THEORY Subject Code: **20114**

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by the candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.)
4) While assessing figures, the examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step-wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions, credit may be given by judgement on part of the examiner of relevant answer based on the candidate's understanding.
7) For programming language papers, credit may be given to any other program based on an equivalent concept.
8) As per the policy decision of Maharashtra State Government, teaching in English/Marathi and Bilingual (English + Marathi) medium is introduced at first year of AICTE diploma Programme from academic year 2021-2022. Hence if the students in first year (first and second semesters) write answers in Marathi or bilingual language (English +Marathi), the Examiner shall consider the same and assess the answer based on matching of concepts with model answer.

Q. No.	Sub No.	Answers	Marking Scheme
1		**Answer any SIX of the following:**	**30M**
1	a	**What is CSF? Give composition and functions of CSF.** **Marking Scheme: Definition:1M; Composition:2M, Functions: 2M** **Answer:** **Cerebrospinal fluid:** CSF, cerebrospinal fluid is fluid secreted by choroid plexuses within the four ventricles and moves around the brain and spinal cord. **Composition of CSF**: • Water, • Mineral salts, • Glucose, • Plasma proteins: small amounts of albumin and globulin, c • Urea in small amounts • Few leukocytes. **Functions**: • It supports and protects the brain and spinal cord. • It maintains a uniform pressure around these delicate structures.	**5M** **1M** **2M** **2M**

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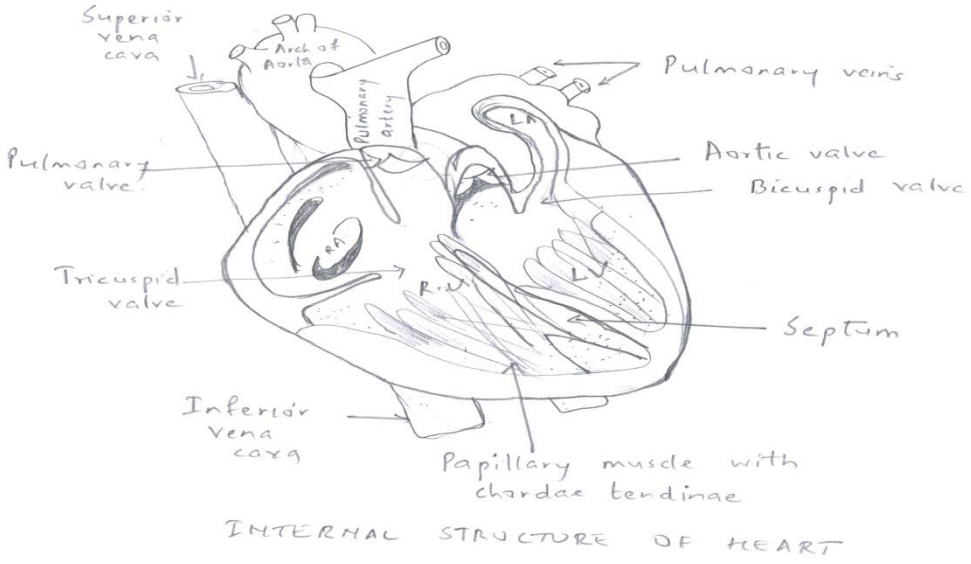
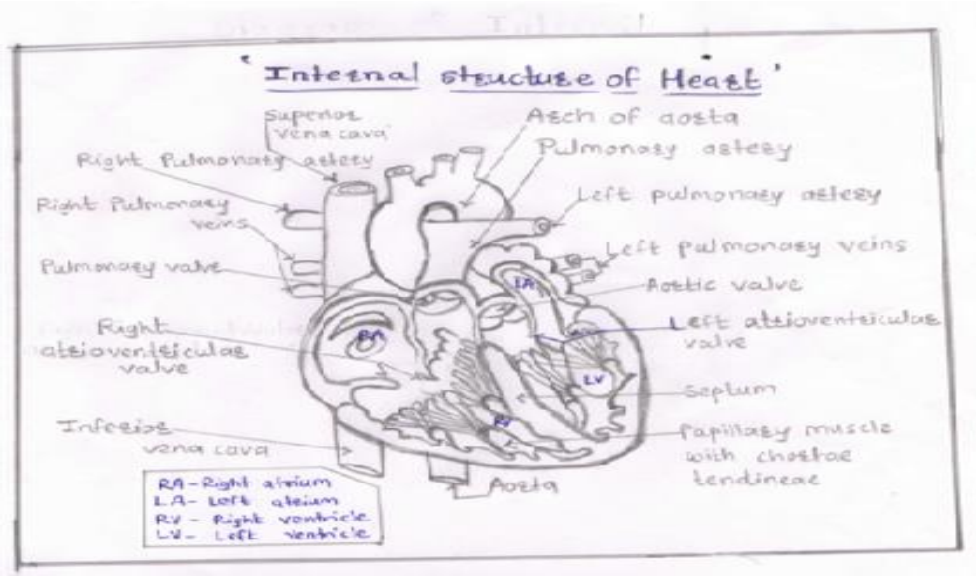
Q. No.	Sub No.	Answers	Marking Scheme
		• It acts as a cushion and shock absorber between the brain & the skull. • It keeps the brain and spinal cord moist and there may be interchange of substances between CSF and nerve cells, such as nutrients and waste products.	
1	**b**	**Describe internal structure of heart with a well labelled diagram.** **Marking Scheme: Description: 2.5M; Diagram 2.5M**  INTERNAL STRUCTURE OF HEART **OR**  • The heart is a four-chambered organ consisting of two upper chambers called right atrium and left atrium and two lower chambers consisting of right ventricle and left ventricle. The two thin-walled atria are separated by inter-atrial septum and ventricles are separated by inter-ventricular septum.	**5M** **2.5M** **2.5M**

Q. No.	Sub No.	Answers	Marking Scheme
		• The ventricles are thick walled because they have to pump the blood with force. The left ventricle is the chamber of the heart with the thickest wall. • The valves between atria and ventricles ensure that the flow of blood is in one direction only. The valve separating the right atrium from right ventricle is called right atrioventricular valve or tricuspid valve and consists of three cusps or flaps. The left atrioventricular valve is called bicuspid or mitral valve and consists of two cusps or flaps. • Thick thread-like cords of fibrous tissue which connects the valve flaps to the walls of ventricles with papillary muscles are called chordae tendinae. These prevents valves from opening during ventricular contraction. • The pulmonary artery arises from the right ventricle and the aorta arises from the left ventricle. The place where pulmonary artery and aorta leave the ventricles is guarded by semi-lunar valves (pulmonary valve and aortic valve). These valves prevent the backflow of blood.	
1	**c**	**What is anaemia? Give its type & write its causes.** **Marking Scheme:** **Definition:1M; Types and Causes: 4M** **Anaemia:** In anaemia, there is not enough haemoglobin available to carry sufficient O_2 from lungs to the tissues. **Types (Classification) based on the cause:** **1. Iron deficiency anaemia** – due to deficiency of iron **2. Megaloblastic anaemia** – Due to deficiency of Vitamin B_{12} or folic acid **3. Hypo plastic/ aplastic anaemia** – Due to reduced/ no bone marrow function. **4. Haemolytic anaemia** – May be either congenital or acquired. **a. Congenital** includes sickle cell anaemia or Thalassemia-Major & Minor **b. Acquired:** This is due to chemicals, drugs, autoimmunity or mismatched blood transfusion, malaria, ionising radiation, burns etc. **5. Normocytic (Haemorrhagic) anaemia**- Due to blood loss	**5M** **1M** **2M** **2M**

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Q. No.	Sub No.	Answers	Marking Scheme
1	d	**Define and classify joints with suitable examples. Explain any two joint disorders.**	**5M**

Marking Scheme:

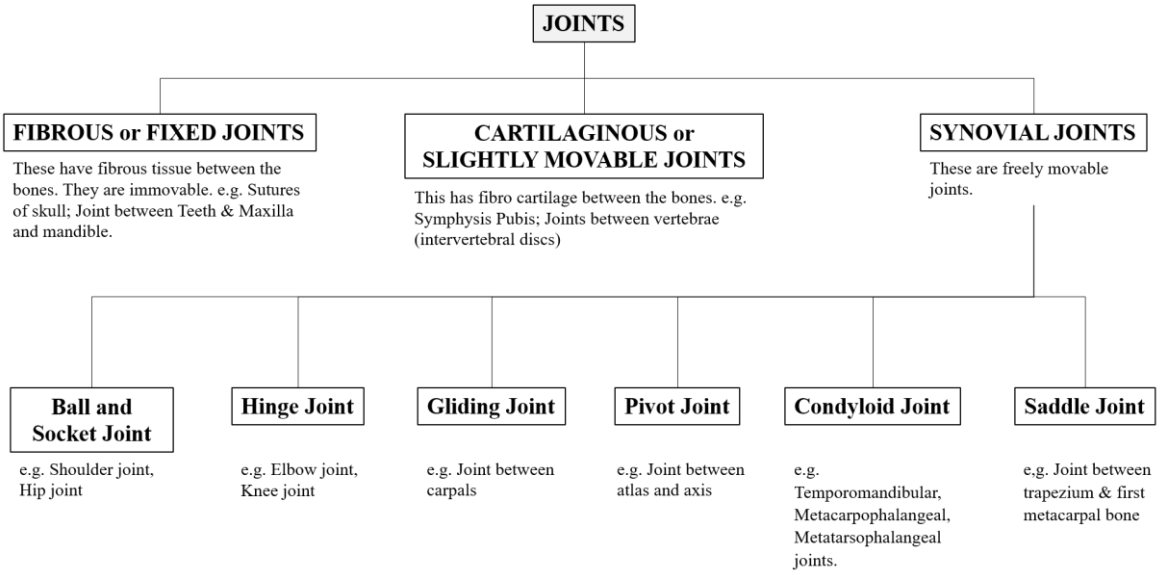
Definition:1M; Classification with examples:2M (explanation of each type is not required); Joint disorders: 2M (Explanation of any two disorders)

Answer:

Joints: **1M**

A joint is a site at which any two or more bones articulate or come together.

Classifications of Joints: **2M**



Disorders of joint: **2M (For Any two Disorders)**

1. **Inflammatory joint diseases**:

   a) **Rheumatoid arthritis:** It is a chronic progressive autoimmune disease mainly affecting synovial joints. It is a disease which affects heart, blood vessels & skin. it is more common in females, may be post viral infection.

   b) **Other types of poly arthritis:** Polyarthritis means inflammation of more than one joint.it is also autoimmune disease like *Rheumatoid arthritis*, but the RA factor is absent. Here joints of axial skeleton are involved.

   c) **Infective arthritis**- joint infection due to septicemia or injury.

2. **Traumatic injury to the joints** - sprains, strains & dislocations. If a ligament is stretched or torn, the injury is called a sprain. A strain occurs when the muscle tendon unit is stretched or torn. Joint dislocation occurs when bones in a joint are displaced.

Q. No.	Sub No.	Answers	Marking Scheme
		3. **Osteo arthritis**: It is a degenerative non inflammatory disease that results in pain & restricted movement of affected joints. It is due to age, obesity, hereditary or female gender. 4. **Gout** This is more common in males. it is caused by deposition of sodium urate crystals in joints & tendons which causes inflammation.	
1	e	**What is oedema. Describe the physiology of urine formation.** **Marking Scheme: Definition:1M; Physiology: 4M** **Oedema:** Oedema is excessive accumulation of tissue fluid causing swelling. **Urine Formation:** There are three processes in urine formation: 1. **Glomerular ultrafiltration** 2. **Selective reabsorption** 3. **Tubular secretion** 1. **Ultrafiltration/ glomerular filtration**: Filtration takes place through the semi permeable walls of the glomerulus & glomerular capsule or Bowman's capsule. Water and small molecules pass through it. The afferent renal artery brings blood to the glomerulus and the efferent artery carries the blood away from it. As the diameter of afferent artery is more than the efferent artery, a hydrostatic pressure is generated in the glomerulus (55mm Hg). This pressure is opposed by osmotic (30 mmHg) and filtrate hydrostatic pressure in capsule (15mm Hg). The net filtration pressure is 55-(30+15) = 10 mm of Hg. All constituents of blood are filtered except blood cells and plasma proteins. 2. **Selective reabsorption:** This is the process by which composition and volume of filtrate are changed during its passage through the tubule. The constituents required by the body are reabsorbed. Components like glucose, vitamins, amino acids get completely re-absorbed into the blood. These are called high threshold substances. Low threshold substances like urea, uric acid are absorbed slightly. Some substances like creatinine are not reabsorbed at all.	**5M** **1M** **4M**

Q. No.	Sub No.	Answers	Marking Scheme
		3. Tubular secretion: Substances not required & the foreign material which have not got cleared during filtration due to short time, are secreted into the distal convoluted tubule & excreted in the urine. Tubular secretion of Hydrogen ions is imp. for maintaining PH.H ions are secreted in combination with bicarbonate as carbonic acid, with ammonia as ammonium chloride & with hydrogen phosphate as dihydrogen phosphate.	
1	**f**	**Give and explain the functions of liver.** **Marking Scheme: Functions: 5M** **Answer:** **Functions of liver**: 1) Secretion of bile: Bile salts are helpful in digestion and absorption of fats by its emulsification. 2) Glycogenic function: The hepatic cells by the action of enzymes convert glucose into glycogen and it is then stored in the liver. 3) Formation of urea: Hepatic cells by the action of the enzyme cause deamination of amino acid, i.e., amine group is set free which forms urea. 4) Metabolism of fat: Whenever energy is needed, the saturated stored fat is converted to a form in which it can be used to provide energy. 5) Formation of RBCs in foetal life. 6) Destruction of RBCs forming bile pigments and iron. 7) Formation of plasma protein. 8) Formation of heparin, a natural anticoagulant in the blood. 9) Storage of iron and vitamin B_{12}. 10) Maintenance of body temperature: As several chemical reactions occur in the liver, heat is generated which is helpful in maintaining body temperature. 11) Excretion of toxic substances: The toxic substances entering the body through alimentary canal are destroyed in liver. **OR** 1) Carbohydrate metabolism: It helps in maintaining plasma glucose level with the help of insulin & glucagon. 2) Fat metabolism: Stored fat can be converted to a form in which it can be used by the tissue to provide energy. 3) Protein metabolism: Deamination of amino acids-removes nitrogenous portion from amino acid not required for formation of new protein. Urea is formed from the nitrogenous portion which is excreted in urine. Breakdown of nucleic acids to form uric acid which is excreted in urine. Transamination: Removes the nitrogenous	**5M**

Q. No.	Sub No.	Answers	Marking Scheme
		portion of amino acid & attaches it to carbohydrate molecule forming new non-essential amino acid. 4) Synthesis of plasma protein & most blood clotting factors from amino acid. 5) Breakdown of RBCs & defence against microbes. This is carried out by Kupffer cells. 6) Detoxification of drugs & noxious sub. 7) Inactivation of hormones 8) Production of heat 9) Secretion of bile 10) Storage of glycogen, iron, copper, & fat-soluble vitamin-A, D, E, K, water soluble vitamin like vit. B_{12}.	
1	**g**	**Discuss physiology of hearing. What are auditory ossicles?** **Marking Scheme:** Physiology:4M; Definition: 1M. **Answer** **Physiology of hearing-** The auricle collects the sound waves & through external acoustic meatus directs them to tympanic membrane. Tympanic membrane vibrations are transmitted & amplified through middle ear by movement of auditory ossicles. The foot plate of stapes rocks to & fro into the oval window, setting the fluid wave in perilymph of scala vestibuli. Most of the pressure of this wave is transmitted to cochlear duct. This causes wave in endolymph resulting in stimulation of the auditory receptors in the hair cells in spiral organ in cochlear duct. The nerve impulses generated pass to the brain through the cochlear portion of the eighth cranial nerves. **Auditory ossicles:** Auditory ossicles are three very small bones present in tympanic cavity of the ear. They are named according to their shape, namely- a. Malleus (hammer) b. Incus (anvil) c. Stapes (stirrup).	**5M**

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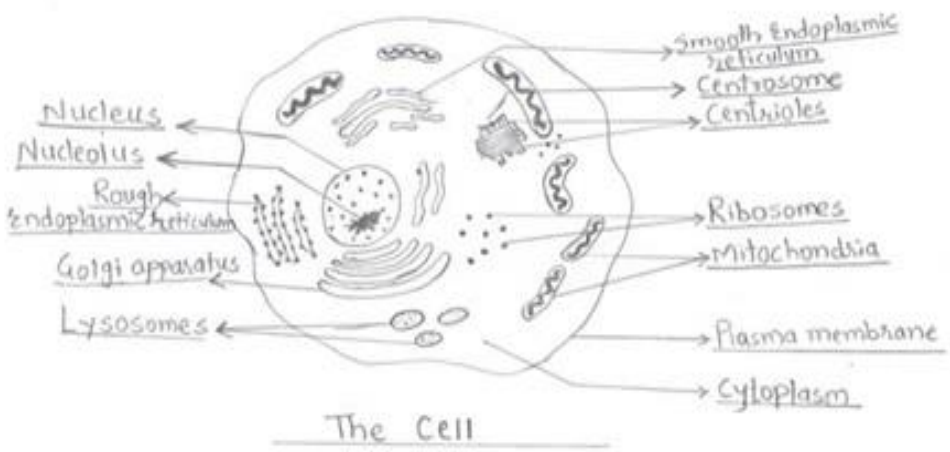
Q. No.	Sub No.	Answers	Marking Scheme
2		**Answer any TEN of the following:**	**30 M**
2	a	**Define cell. Draw a well labelled diagram of the cell.** **Marking Scheme: Definition: 1M, Diagram: 2M** **Answer:** **Definition:** The cell is defined as the structural and functional unit of body.  	**3M** **1M** **2M**
2	b	**What is spleen? Describe its structure and functions.** **Marking Scheme: Spleen:1M; Structure:1M; Functions:1M** **Answer:** **Spleen:** Spleen is the largest lymph organ. It is dark purple in colour and located in the abdominal cavity between the stomach and diaphragm. **Structure** • It is purplish in colour & weighs about 200 gms. • It is oval in shape and has hilum through which passes the splenic artery, splenic vein & efferent lymph vessels. • It has fibrous tissue capsule which dips inside forming trabeculae. • It has two different types of tissues known as red pulp which has blood & white pulp which has lymphatic tissue containing lymphocytes and macrophages. **Functions of spleen** • Phagocytosis: Destruction of old & abnormal RBCs, WBCs, platelets, and microbes. • Storage of blood- It stores up to 350 ml of blood. • Immunity- It contains T & B lymphocytes which are activated by presence of antigens i.e., infections. • Spleen produces lymphocytes, some specific antibodies, and antitoxins. • Erythropoiesis- It is an important site of foetal blood cell production & can do this in adults at the time of need.	**3M** **1M** **1M** **1M**

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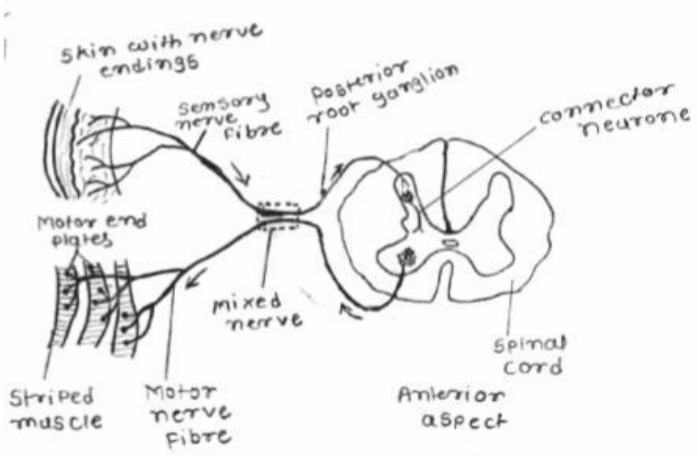
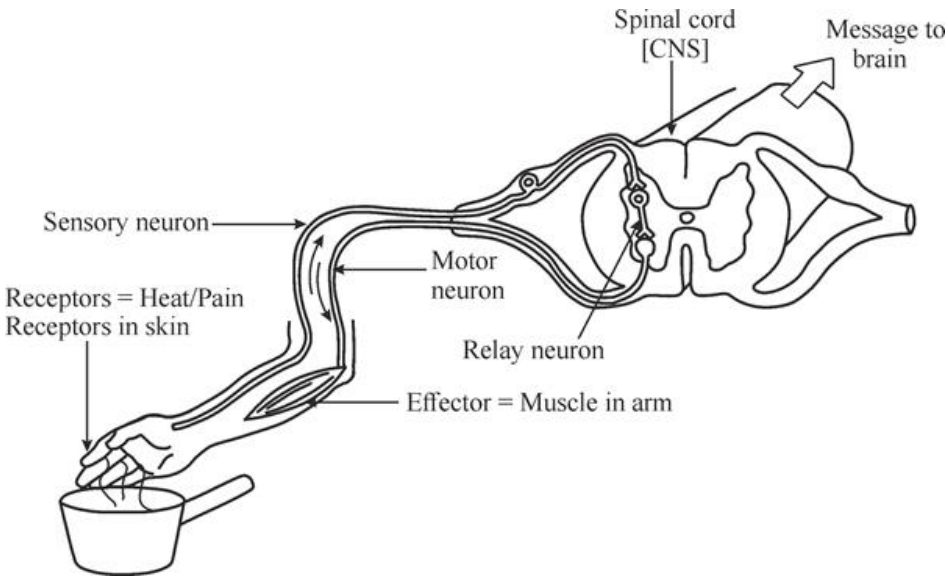
Q. No.	Sub No.	Answers	Marking Scheme
2	c	**What is reflex action? Give structure of reflex arc.**	**3M**
		Marking Scheme: Reflex action:1M, Structure:2M OR Diagram:2M	
		Explanation of structure or well labelled diagram should be considered for 2M.	
		Answer:	
		Reflex action:	**1M**
		It is an involuntary and immediate motor response given by spinal cord to a sensory stimulus. Examples -the sudden withdrawal of hand if fingers touch something hot	
		Structure of reflex arc	
		A simple reflex arc has following points:	**2M**
		1) Sense organ 2) Sensory neurons which pass from sensory organ to the spinal cord 3) Connector neuron in the spinal cord 4) Motor neuron in the spinal cord 5) Effector organ like the muscle.	
			**OR 2M**
		OR	
			

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Q. No.	Sub No.	Answers	Marking Scheme
2	**d**	**Define the following terms and give the normal values-** **i) Lung capacity** **ii) Vital capacity** **iii) Tidal volume** **Marking Scheme: Each definition 0.5 M, Normal value 0.5 M** **Answer:** 1) **Lung capacity:** It is the total amount of air that lungs can hold and equals vital capacity + residual volume. The normal value is 4.5 to 6 lit or 4500 - 6000 ml. 2) **Vital capacity:** This is the maximum volume of air which can be moved into & out of the lungs during forceful breathing. Normal value is about 3-5 lit. 3) **Tidal volume:** It is the volume of air moved in & out of lungs during normal breathing. Normal value is 500 ml.	**3M** **1M** **1M** **1M**
2	**e**	**Describe the composition of blood.** **Marking Scheme: Plasma 1.5 M, Blood cells 1.5 M** **Answer:** **Composition of blood**: It is composed of liquid matrix plasma (55%) & different cells suspended in it (45%). 1) Plasma consists of water-90-92%, plasma proteins, inorganic salts, nutrients, waste material, hormones & gases. 2) Blood cells are of 3 types: a. Red Blood Cells: (Erythrocytes) b. White Blood Cells: (Leukocytes) – These are of 2 types i. Granulocytes: 1. Neutrophils 2. Eosinophils 3. Basophils ii. Agranulocytes 1. Monocytes 2. Lymphocytes c. Platelets (Thrombocytes)	**3M** **1.5M** **1.5M**

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Q. No.	Sub No.	Answers	Marking Scheme
2	f	**What is blood pressure? How it is recorded clinically?** **Marking Scheme: Definition: 1M, BP measurement: 2M** **Answer:** **Blood pressure:** It is defined as the force or pressure exerted by blood on the artery walls. The normal value of blood pressure is 120/ 80 mm of Hg **Clinical recording -** The blood pressure is measured clinically by auscultatory method using an instrument called sphygmomanometer. The sphygmomanometer consists of cuff, mercury column, air pump and release button for it. The inflatable cuff of sphygmomanometer is wrapped around the arm. A stethoscope is placed at the anti-cubital fossa over the brachial artery. The cuff is inflated until the pressure is above the expected systolic blood pressure. The brachial artery is occluded by the cuff, no sound is heard by the stethoscope. The pressure in the cuff is then released slowly. The point at which systolic pressure in the artery exceeds the cuff pressure, a spurt of blood passes through. This is heard as a tapping sound. The pressure at which the sound is first heard is called systolic blood pressure. As the cuff pressure is further lowered, the sounds become louder then dull and finally stop. The last sound corresponds to the diastolic pressure. The sounds are heard due to the turbulent blood flow in the brachial artery.	**3M** **1M** **2M**
2	g	**What is menstrual cycle? Describe phases of menstrual cycle.** **Marking Scheme: Definition: 1M, Phases: 2M** **Answer:** **Menstrual Cycle:** Series of events occurring regularly in endometrium of females every 26-30 days, during reproductive years. Consists of series of changes that take place simultaneously in ovaries & uterine walls, stimulated by changes in blood level of hormones. Days of cycle are numbered from beginning of menstruation. **Phases of menstrual cycle**: 1) Proliferative phase (10 days) 2) Secretory phase (14 days). 3) Menstruation (4 days) 1) **Proliferative phase:** One of the follicles from both ovaries, develop and become dominant follicle, starts secreting estrogens. This follicle matures into Graafian follicle (diameter more than 20 mm). Estrogens stimulate repair of endometrium. Cells of stratum basalis undergo	**3M** **1M** **2M**

Q. No.	Sub No.	Answers	Marking Scheme
		mitosis & produce new stratum functionalis Thickness of endometrium doubles:5-10mm LH causes rupture of mature follicle & ovulation. That is end of this phase. 2) **Secretory phase** Under influence of LH ruptured follicle transforms into corpus luteum that secretes progesterone, estrogens. Promotes growth and coiling of endometrial glands, vascularisation of superficial endometrium & thickening of endometrium to 12 -18 mm. Under influence of progesterone, secretory glands produce large amount of mucus There is similar increase in secretion of watery mucus by glands of uterine tubes & cervical glands of vagina. If oocyte is not fertilised, degeneration of corpus luteum within 2 weeks into corpus albicans. Levels of progesterone & estrogens decrease, that causes menstruation & cycle continues. This phase lasts for 14 days i.e. from 15 to 28 days. 3) **Menstrual phase:** It is characterised by periodic discharge of 25 – 65 ml of blood, mucus, tissue fluid and epithelial cells. This is caused by sudden reduction in estrogen and progesterone. This phase lasts for 4- 5 days.	
2	**h**	**Name any two endocrine glands and their location. Why is pituitary gland known as "Master gland"?** **Marking Scheme: Any two endocrine glands with location: 2M, Reason: 1M** **Answer:**	**3M**

SR.NO	GLANDS	LOCATION
1	Pituitary Gland	Situated in hypophyseal fossa of sphenoid bone at the base of brain.
2	Thyroid Gland	Situated in the neck in front of larynx and trachea and beside the thyroid cartilage
3	Parathyroid Glands	Two on each side of the thyroid gland in the neck on the posterior side.
4	Pancreas (Islets of Langerhans)	In the curvature of duodenum in the abdominal cavity.
5	Adrenal glands	They are situated on upper pole of each kidney
6	Pineal glands	Situated near corpus callosum in the brain
7	Testes in male	Present in scrotum
8	Ovaries in female	One on each side of the uterus

	2M
Pituitary gland known as "Master gland": The secretions from all endocrine glands are controlled by hormones of the pituitary gland, hence pituitary gland called as master gland.	**1M**

2	i	**Draw and explain the structure of neuron.**	3M

Marking Scheme: Diagram: 1M, Explanation 2M

Answer:

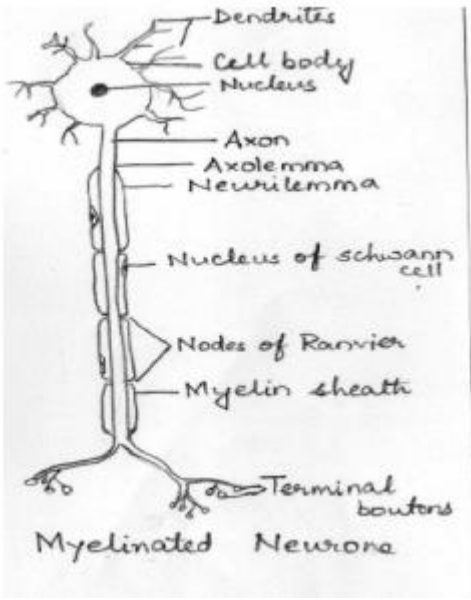
Depending on the structure, neurons are of two types:

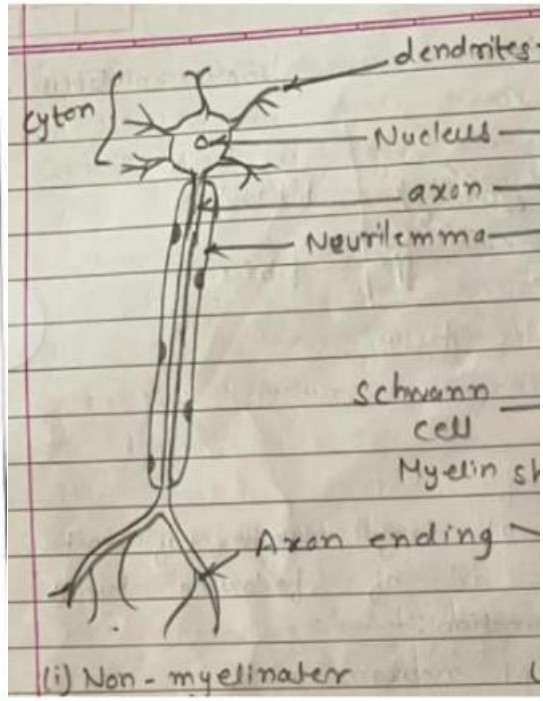
1. Myelinated or medullated.
2. Non-myelinated or non-medullated

Structure of Neuron –

A typical neuron consists of:

1) **Dendrites**: These are the processes which are short, and they carry impulses towards the nerve cell. Each neuron contains several dendrites. **2M**
2) **Axon**: The axon is a long process of nerve cell which carries impulse away from neuron. The axon consists of:
   a. Axolemma or Neurilemma: It maintains the shape of axons.
   b. Myelin sheath: It is a sheath of fatty material which surrounds most axons and gives white appearance. The myelin sheath is absent at intervals along the length of the axon and near its branched end, these intervals are called 'nodes of Ranvier'. They help in rapid transmission of nerve impulse in the myelinated neuron.





1M

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<table>
<tr><th>Q. No.</th><th>Sub No.</th><th>Answers</th><th>Marking Scheme</th></tr>
<tr><td>2</td><td>j</td><td>

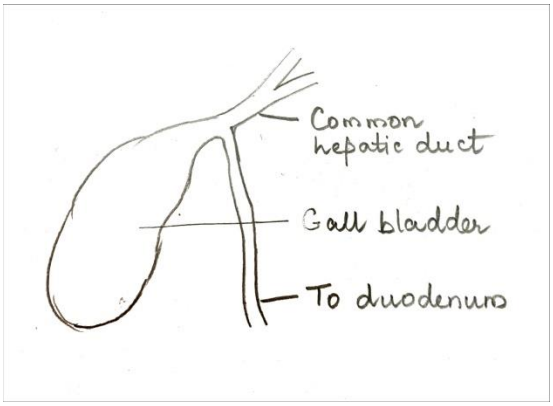
Draw a well labelled diagram of gall bladder. Give its functions.

Marking Scheme: Diagram:2M, Functions: 1M

Answer:

The gall bladder is a pear- shaped sac attached to the posterior surface of liver by connective tissue.

It consists of a fundus, body and a neck which is continuous with the cystic duct. Its structure is similar to the GIT with additional oblique muscles. The mucus membrane shows small rugae when empty.



Functions:

1. It is reservoir of bile.
2. It concentrates the bile by absorption of water through the wall of gallbladder.
3. Secretion of mucus into the bile
4. Release of the stored bile

</td><td>3M

2M

1M</td></tr>
<tr><td>2</td><td>k</td><td>

Give the differences between endocrine and exocrine glands with examples.

Marking Scheme: 0.5 M for each difference, 0.5 M for example

Answer:

S. No.	ENDOCRINE GLAND	EXOCRINE GLAND
1	These glands are ductless glands	These glands have ducts
2	These glands pour their secretions. directly into the blood.	These glands pour their secretions into the lumen of the organs or to the outer surface of the body.
3	Secretion of endocrine gland is called hormone.	Secretion of exocrine gland is called juice or enzyme.
4	They produce their effect on distant. organs.	They produce their effect where they secrete their secretion.
5	Their glands are mostly involved in. homeostatic activity.	Their glands are mostly involved in metabolic activities.
6	E.g: adrenal glands, testes, thyroid	E.g: sweat glands, gastric glands, sebceous glands.

</td><td>3M</td></tr>
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Q. No.	Sub No.	Answers	Marking Scheme
3		**Answer all questions**	**20M**
		:: *Important Instructions* :: ***In case, multiple answer options are observed for the same sub-question of question No. 3, the option (Answer) appearing first in the answer book shall be treated as answer and assessed accordingly.***	
3	**a**	**Name the muscles of respiration.** Answer: The respiratory muscles categorized into following type: • Diaphragm • Intercostal muscles (External & Internal)	**1M**
3	**b**	**Cerebrum** is the largest part of brain.	**1M**
3	**c**	The collar bone is called as **Clavicle**	**1M**
3	**d**	**Define micturition.** Micturition is the process of expelling or excreting urine from the urinary bladder of human body to the exterior. Micturition is also known as Urination.	**1M**
3	**e**	The cell produced by fusion of male and female gametes is called as **diploid zygote**	**1M**
3	**f**	**Names the bones in the shoulder joint.** Clavicle, Scapula, Humerus	**1M**
3	**g**	**Define systole and diastole.** **Marking Scheme**: **0.5M for each definition** **Systole**: Contraction of the heart muscle. **Diastole**: Relaxation of the heart muscle.	**1M**
3	**h**	**Write the effect sympathetic stimulation on salivary gland.** Sympathetic stimulation is the secretion of noradrenaline which is responsible for inhibition of secretion of the saliva. OR Inhibition of secretions from the salivary gland.	**1M**
3	**i**	**Define Menopause** **Menopause:** It is the natural decline in oestrogen and progesterone in women and marks the end of childbearing period. It occurs between the age of 45 to 55 years.	**1M**

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Q. No.	Sub No.	Answers	Marking Scheme
3	j	Trachea is also called as **windpipe.**	1M
3	k	**Name the enzyme which is present in tears.** Answer: **Lysozyme**	1M
3	l	**Name the arteries supplying blood to kidney and spleen.** **Answer:** Right and left renal arteries, splenic artery.	1M
3	m	**Acetylcholine (Ach)** Neurotransmitter causes skeletal muscle contraction	1M
3	n	**Name the enzyme which converts fats to fatty acid and glycerol.** Answer: **Lipases**	1M
3	o	**Keratinised epithelium is found on dry surfaces like_____** **Answer: ii) Hair**	1M
3	p	Human body is divided in to _____cavities. **Answer: iii) Four**	1M
3	q	_____is essential for the synthesis of pigment Rhodopsin. **Answer:** **ii. Vitamin A**	1M
3	r	**Superior Means_____** Answer: iii). **Nearer to the head**	1M
3	s	Colour pigmentation of the skin is due to_____ **Answer:** **iv) Melanin**	1M
3	t	_____is responsible for muscle contraction. Answer: i) **Calcium**	1M