Question-1

Where would you find gliding joints?

Solution:

The bones in the palm or in the sole of the foot, we find gliding joints.

Question-2

How does a muscle receive a stimulus to contract?

Solution:

The contraction of a muscle is brought about by the nervous system in response to a stimulus. The muscle tissues are supplied with motor nerves. Each motor nerve fibre divides into a number of branches. Each branch terminates into a flattened muscle fibre, which is the motor end plate. When the motor neuron impulse arrives at the motor end plate, it causes contraction of the muscle fibre.

Question-3

What are the ligaments?

Solution:

Ligaments are the flexible connective tissue which binds the articulating bones together.

Question-4

Define joints and classify various types of joints on the basis of mobility.

Solution:

The place of articulation between two or more bones is called a joint. At the joint, the surface of the two bones is opposite to each other. These joints facilitate the movement of bones in different ways.

On the basis of mobility, the joints are classified into,

(i) Fixed or fibrous joints,

(ii) Slightly movable or cartilaginous joints and

(iii) Freely movable or synovial joint.

(i) Fixed or fibrous joints: In these joints, the articulating bones are firmly fixed together by dense bands of tough, inextensible white fibrous tissues. These joints allow no movements between them. e.g. Sutures of the skull bones.

(ii) Slightly movable or cartilaginous joints: These joints show limited movements due to the presence of white fibro cartilage tissues at the opposing end of articulating bones. e.g. between the vertebrae and at the symphysis pubis.

(iii) Free movable or synovial joints: These types of joints are freely movable. The presence of synovial fluid in the synovial cavity make these joints move freely. This fluid lubricates the joint for free and easy movement. The articulating bones provide considerable movement between them without any danger of friction. The articulating surfaces are kept in close contact by a fibrous capsule. e.g. shoulder joint, knee and ankle joints, etc.

Question-5

Write the difference between skeletal and smooth muscles.

Solution:

Differences between skeletal and smooth muscle are tabulated below:

Skeletal muscle	Smooth muscle
(i) It is attached to bones and tendons.	(i) It is found in the wall of hollow organs like alimentary canal and blood vessels.
(ii) It is under the control of our will. So it is called voluntary muscle.	(ii) It is involuntary in action. It helps in movement of materials by tubular organs.
(iii) It has transverse stripes. Hence, it is called striated muscle.	(iii) It is a non-striated muscle.

Question-6

What are the antagonistic muscles?

Solution:

The antagonistic muscles are the muscles which contract to produce opposite movement at the same joint, e.g., biceps and triceps muscles.

Question-7

What is the function of pectoral girdle and pelvic girdle?

Solution:

Pectoral girdle: It provides a surface to the soft organs of the body in the pectoral region. It also provides a surface for the articulation of forelimbs. In the glenoid cavity of the pectoral girdle fits the head of the humerus bone.

Pelvic girdle: It protects the organs of the pelvic region and provides a surface for the articulation of the hind limbs.

Question-8

Name the antagonistic muscle of biceps.

Solution:

The antagonistic muscle of biceps are the muscles of triceps.

Question-9

List any two functions of ribs in our body.

Solution:

The two functions of ribs in our body are as follows:

(i) Thoracic rib cage protects the heart and lungs.

(ii) The ribs allow the chest cavity to expand and contract during breathing movements.

Question-10

Name the type of cartilage present between vertebrae to allow limited movement

Solution:

Invertebral disc is the fibrocartilage present between vertebrae to allow limited movement.

Question-11

What is contractibility of muscle fibres?

Solution:

The contractibility is the property of shortening of muscle fibres and their return to relaxed state based on relative position of different intracellular filaments.

Question-12

Discuss the three types of synovial joints.

Solution:

The three types of synovial joints are,

(i) Ball and socket joint

(ii) Hinge joint

(iii) Gliding joint

(i) Ball and socket joint: In this type of joint, one bone forms a cup-like socket in which the ball-like structure fits. The head or ball can move freely in the joint in any direction. e.g. Shoulder joint and hip joint.

(ii) Hinge joint: Movement is performed only in one direction. E.g. Elbow joint, knee joint, etc.

Question-13

Explain any two disorders of bones.

Solution:

Arthritis and osteoporosis are the two disorders of bones in humans.

(i) Arthritis disorder: The inflammation of joints is the main cause of arthritis. It is of many types - they are rheumatoid arthritis, osteoarthritis and gouty arthritis. The rheumatoid arthritis is diagnosed by the presence of rheumatoid factor. This factor is a type of immunoglobin. There is inflammation of synovial membrane. This membrane secretes abnormal granules called pannus. Erosion is caused on the surface of the cartilage due to pannus. As a result of this, the joints become immovable. It is cured by heat treatment and physiotherapy. Osteoarthritis is a degenerative joint disorder. It is characterized by the degeneration of the articular cartilage and proliferation of new bones. Gouty arthritis is also called gout. This is caused due to excessive formation of uric acid, which is deposited at the joint.

(ii) Osteoporosis disorder: It is an age dependent systemic disorder. It is characterized by low bone mass and is the micro architectural deterioration of bones. It makes bones brittle and prone to fracture. It can also occur in pregnant women. Thyrocalcitonin, parathyroid and sex-hormone's imbalance is the main cause of this disease. The major causative factors are the deficiency of vitamin D and calcium deficiency in body.

Question-14

What are the terms used for the plasma membrane and cytoplasm of muscle cells?

Solution:

The terms used for the plasma membrane and cytoplasm of muscle cells are sarcolemma and sarcoplasm respectively.

Question-15

What are cross bridges, actin and myosin? Also state their importance.

Solution:

Myosin and actin are special kinds of proteins. Myosin and actin are special kinds of proteins. Myosin forms the thick filaments while the actin forms the thin filaments of the muscles. The actin and myosin help in the contraction of shortening of muscles by the formation of cross bridges. A cross bridges is the portion of the myosin filament which is overlapped by actin filament.

Question-16

Why does a red muscle fibre work for a prolonged period while a white muscle fibre suffers from fatigue after a shorter period of work?

Solution:

Red muscle fibres are rich in myoglobin and contain large number of mitochondria. The function of myoglobin is to bind and store oxygen and oxyhaemoglobin. During muscle contraction, oxygen is released from the oxymyoglobin. Red muscle fibres produce energy only under aerobic conditions. So very little amount of lactic acid gets accumulated in the muscle. Hence these muscles can work for a prolonged period. On the other hand, in white muscle fibres, myoglobin is absent and there are very less number of mitochondria. So they depend on aerobic glycolysis for their energy production. As a result, lactic acid gets accumulated in the muscle and they soon get fatigued.

Question-17

What are skeletal and cardiac muscles?

Solution:

Skeletal muscles - These muscles are found attached with the skeleton of the organism. They are under the control of the will of an individual.

Cardiac muscles - They form the wall of the heart only.

Question-18

What is the threshold stimulus?

Solution:

Threshold stimulus is the minimum stimulus that is required to bring about the contraction of muscles.

Question-19

Which kind of muscle fibres are richly found in the extensor muscles present on the back of human body? What characteristics enable these fibres to serve their purpose?

Solution:

Red muscles fibres are found in the extensor muscles. They are rich in mitochondria, myoglobin, slow aching, no lactic acid, aerobic respiration takes place. These characteristics enable these fibres to serve their purpose.

Question-20

What is muscle twitch?

Solution:

The single isolated contraction of a muscle fibre is known as muscle twitch.

Question-21

What happens to the leg muscle of an athlete who runs a marathon race.

Solution:

Athletes usually develop cramps due to vigorous exercise or after running a marathon race. Cramp is a condition when a muscles contracts and it does not relaxes again. This is because of the fact that sufficient supply of energy by the oxidation of food is not available. Due to this lactic acid gets accumulated, which is not be converted into glycogen or oxidized due to the insufficient supply of oxygen.

Question-22

White muscle fibres become fatigued quickly. Give reasons.

Solution:

White muscle fibres are thicker, lighter in colour and poor in mitochondria. They are free of myoglobin. Their concentration rate is faster. Energy is produced in them by anaerobic glycolysis. Lactic acid is accumulated in them in sufficient amount during strenuous work. So white muscle fibres become fatigued quickly. when the muscle stop contracting.

Question-23

What is the role of Ca^{++} and ATP in muscle contraction?

Solution:

The chemical changes occurring during muscle contraction were worked out by Albert Sxent Gyorgi and his co-workers. The sequence of chemical events in muscle contraction may occur under the following steps:

(i) Motor nerve endings release acetylcholine from the end plate or neuromuscular synaptic junction. Acetylcholine caused release of calcium ions from the sarcoplasmic reticulum inside the muscle fibre.

(ii) Ca^{++} binds the troponin which results in interaction of myosin and actin to form actomyosin in the presence of ATP and Ca^{++} ions.

(iii) Breakdown of ATP into ATP and energy takes place in the presence of Mg^{++}, Ca^{++} and myosin ATPase.

(iv) ATPase is activated in the presence of Ca^{++} ions.

(v) The above energy is used in the contraction of muscle.

(vi) Creatine phosphate reacts with ADP to give rise to ATP and creatine. In this way regular supply of ATP is maintained from the creatine stored in muscles.

Question-24

What is the utility of ribs in the body?

Solution:

Ribs form the side of the chest cavity. There are 12 pairs of ribs in man. The first seven pairs of ribs are attached to the thoracic vertebra at the back and to the sternum in front. The next three pairs are connected to the rib above each. These are vertebrochondral ribs. Rib cage is formed by ribs, sternum and thoracic vertebrae. The last two pairs are free and hence called floating ribs. The rib cage formed by the ribs encloses and protects the heart and lungs. The ribs also allow the chest cavity to expand and contract during breathing movements.

Question-25

What do you understand by denervation atrophy?

Solution:

If any damage occurs to the nerve cell or its axon in a particular muscle, a condition called paralysis of the muscle occurs. The denervated muscle decreases in size. This decrease in size of the muscle is termed as denervation atrophy.

Question-26

Give one example each of the striped and unstriped muscles in human body. Mention any one main characteristic of cardiac muscles.

Solution:

Voluntary muscle, is found in the forearm and hind arm are skeletal muscle. Involuntary muscle is found on the wall of urinary bladder and gastro-intestinal tract. Main characteristic of cardiac muscle is presence of intercalated discs.

Question-27

Describe briefly the structure of striated muscle.

Solution:

In a striated muscle, each fibre is long and unbranched. They measure about 40mm in length and 20 micrometers in thickness. Each fibre is enclosed in a membrane called sarcolemma and its cytoplasm is called sarcoplasm. The sarcoplasm contains many myofibrils that are long, thin unbranched and cross striated. Each myofibril consists of alternating thick A and light I- band. A-band is formed of protein myosin and I-band with actin protein. The thick filament bands lie parallel to one another. The thin filaments extend between them upto a considerable distance in an orderly manner. At the centre of the I-band is a fine, dense dark band, the Z-line. Each segment of myofibril forms one Z-band which functions as a contractile unit and is called a sarcomere.

Question-28

Eagles fly slowly but continuously for long time while sparrows fly too fast bit only for a short time. Give the scientific reason for this difference in the nature of muscles evolved.

Solution:

Flight muscles of eagle are red muscles having abundant mitochondria and myoglobin. More oxygen is required to carry out more oxidation for energy hence prolonged flight.

The flight muscles of sparrow are white having less mitochondria and mygoglobin. Less oxygen is required and hence strenuous work for short time followed by fatigue.

Question-29

What are cross bridges?

Solution:

A cross bridge is the portion of the myosin filament which is overlapped by the actin filament

Question-30

Differentiate between muscle twitch and muscle tetanus.

Solution:

Muscle twitch	Muscle tetanus
Muscle twitch is known as the single isolated contraction of the muscle fibre.	If the muscle fibre is stimulated by many nerve impulses or electric shocks, it will remain in the state of contraction till the stimulation continues. The continued state of contraction is called muscle tetanus.

Question-31

Which kind of muscle fibres are richly found in the extensor muscles present on the back of human body? What characteristics enable these fibres to serve their purpose?

Solution:

Red muscle fibres are richly found in the extensor muscles. They are rich in mitochondria and myoglobin. Aerobic respiration is seen in the cells. There is no lactic acid in it.

Question-32

What are antagonistic muscles? Give one example.

Solution:

The muscles which contract to produce opposite movement at the same joint are known as anatagonostic muscles. The antagonistic muscle is triceps in the upper arm of man.

Question-33

List the functions of the skeletal system.

Solution:

The functions of the skeletal system:

(i) The skeletal system forms the framework for the body.

(ii) The bone of the skeletal system protects delicate internal organs of the body.

(iii) The skeletal system provides attachment surface for the body muscles, tendons and other similar structures and thus helps in movement.

(iv) It gives shape and posture to the body.

Question-34

What is sternum?

Solution:

The thorax is supported by sternum on the ventral side and the thoracic vertebrae on dorsal side. It is called breast bone. It is a flat bone of about 15 in length. It is a narrow bone. It lies in midline of thorax.

Question-35

Why are muscle cells usually called muscle fibres?

Solution:

The muscle cells are usually called muscle fibres because of their thread like structure. These cells are thin and elongated. They do not have the shape of a cell but they do have more of a fibre shape, hence, it is called as muscle fibres.

Question-36

What is the function of a myoglobin?

Solution:

The myoglobin binds and stores oxygen as oxymyoglobin in the red fibres.

Question-37

Describe isotonic and isometric contractions.

Solution:

Isometric contractions – When any force is exerted by a contracting muscle on an object, it is known as the muscle tension. The force exerted on a muscle by lift and load, the muscle contraction is said to be isotonic, since the load remains constant throughout the period of shortening of muscle. But when shortening prevented by maintaining the muscle at a fixed length, the development of tension occurs at the constant muscle length. This type of contraction is said to be in isometric contraction. When two successive stimuli are applied, the muscle response to the second stimulus is added on that of the first, giving a greater total response called summation. This response to the repetitive stimulation is known as tetanus.

Question-38

Write the difference between pronator and supinator.

Solution:

Pronator	Supinator
Contraction of pronator results in the rotation of the forearm to turn the palm downward or backward.	Contraction of supinator results in the rotation of the forearm to turn the palm upward or forward.

Question-39

Differentiate between striated, smooth and cardiac muscles.

Solution:

Characteristics	Striated muscles	Smooth muscles	Cardiac muscles
Position	These are present in the limbs, pharynx, beginning of oesophagus.	These are present in wall of visceral organs and also in hair muscle.	They form Myocardium of heart.
Arrangement	These are arranged in bundles.	They act as sheets in visceral organs.	They form continuous network in the body.
Size and shape	There are long cylindrical with blunt ends.	They are short, spindle shaped with pointed ends.	The form continuous network in the body.
Surface membrane	Sarcolemma is the surface membrane	Plasma membrane.	Plasma membrane.
Nucleus	These are multinucleate. Nuclei are peripheral.	They are uninucleate. Nucleus central.	They uninucleate. Nucleus central.
Myofibrils	Presence of dark and light bands.	No bands are absent.	Bands present in them.
Blood supply	They are highly vascular.	They are less vascular.	They are highly vascular.
Mitochondria and glycogen granules	They are numerous.	They are less in number.	They are very numerous.
Innervation	They are from CNS	They are from ANS.	Both CNS and ANS.
Branching	These are unbranched.	They are unbranched.	They are branched.
Mode of contraction	Contract rapidly for short period as soon as they get fatigued.	They contract slowly for long period and do not get fatigued.	They contract rapidly, rhythmically and never get fatigued.

Question-40

How does the muscle shorten during its contraction and lengthen during its relaxation?

Solution:

Sarcomeres are small units of myofibrils. The sarcomere consists of A-band in the center with halves of two I-bands on its two sides, the distance between two Z-membranes. When stimulus is given to muscles, the thin filaments slide in the space between the thick ones but neither of them change its length. Due to sliding of I filaments, there is breakage and rearrangement of the cross linkage between acting and myosin filaments. The ATP is broken by the enzyme ATPase myosin which provides energy for interaction between actin and myosin filaments. Consequently, the thin actin filaments slide deeper into the A bands and Z lines are drawn closer with each other by the disappearance of H zone. Finally the sarcomeres becomes shortened due to shortening of the I band. But in relaxation, the cross linkage between the filaments are rearranged. The cross bridges disappear due to pulling of the filaments by the active sites on the actin filaments. The actin filaments slide out from the A-band. Consequently, this elongates the I band, pushing the Z-line away from each other. Thus the contraction and relaxation of muscle occurs due to repetitive formation and breakage of cross bridges between the thick filament of A-band and the thin filament of I band.

Question-41

Briefly explain the appendicular skeleton of humans.

Solution:

Appendicular skeleton consists of two parts, they are,

(i) the griddles and

(ii) limbs.

(i) Pectoral girdle – It is called shoulder girdle. It is formed of two bones

(i) Clavicle and

(ii) Scapula.

Clavicle is a small 'S' shaped collar bone. It lies on the anterior-lateral side of the thoracic basket. On one side it articulates with the sternum and on the other side it articulates with the scapula. It is called collar bone.

Scapula is a large dorso-ventrally flattened triangular bone having club-shaped spine is called shoulder blade. A glenoid cavity fits the head of humerus. There is an acromian process articulating with the clavicle.

Forelimb – It consists of thirty bones. The upper arm has humerus. It is a straight bone with long shaft. Head articulates with the glenoid cavity of the scapula. The lower end of humerous articulates with the radius –ulna. Deltoid ridge is the characteristic feature of this bone. The largest bone of the forearm is ulna. Lower end of ulna articulates with wrist bones.

Radius is slightly shorter than ulna. The lower end of it articulates with the carpal of wrist. Carpals are eight. They lie in two rows. Metacarpels are five. Phalanges are three bones in each finger. There are two in thumb.

Digital formula of phalanges: 2,3,3,3,4.

(ii) Pelvic girdle – It consists of two halves. Each is called innomiate v has three bones. They are (i) ilium, (ii) ischium, and (iii) pubis. They unite in the center to form acetabulum. In its head the femur bone is fitted. Two hip bones make arch behind by uniting with the sacrum and the coccyx make pelvis.

Hind limb – It consists of 30 bones.

Femur is thigh bone. It is longest bone of the body. Its upper end is called head. The head fits into the acetabulum of pelvic girdle. The patella is a small, seasmoid bone found on the anterior surface of the knee forming knee cap.
Two bones lie in the shank region of the leg, (i) tibia and (ii) fibula. Seven tarsal bones make the ankle. The foot possesses 7 tarsals.

Metatarsals phalanges are five in number. There are only two phalanges in first digit called hallux and three in each of the rest toes.

Question-42

Why does a red muscle fibre work for a prolonged period while a white muscle fibre suffers from fatigue after shorter work?

Solution:
Red muscle fibres are rich in myoglobin and contain large number of mitochondria. Function of myoglobin is to bind and store oxygen and Oxyhaemoglobin. During muscle contraction oxygen is released from the oxymyoglobin. Red muscle fibres produce energy only under aerobic conditions, so very less amount of lactic acid gets accumulated in the muscle. Hence these muscles can work for a prolonged period. While in white muscle fibre myoglobin is absent and there are very less number of mitochondria and so they depend on aerobic glycolysis for their energy production. As a result of this large amount of lactic acid gets accumulated in the muscle and hence this muscle soon gets fatigued.

Question-43

Where from the muscle gets energy for its contraction?

Solution:

ATP is the immediate source of energy for muscle contraction. Energy released due to break down of ATP molecule is used up in the contraction of muscle. This breaking down of ATP takes place in the presence of myosin ATPase.

There is another high energy compound called creatinine phosphate, present in the muscle. This creatinine phosphate maintains the regular supply of ATP. Creatinine phosphate reacts with ADP to give rise to ATP and creatinine. When the contraction is completed creatine is again reconverted into creatinine phosphate by reacting with ATP to produce creatinine phosphate.

Question-44

Differentiate between exoskeleton and endoskeleton.

Solution:

Exoskeleton	Endoskeleton
Made up of hard parts on the surface of the body.	Made up of hard parts found inside the body.
Examples – Scales, feather, hair, claws, hooves, nails and horns in invertebrates.	Examples – Cartilage and bones form endoskeleton in vertebrates.
Formed by ectoderm.	Formed by mesoderm.

Question-45

Where do we find hyaline cartilage?

Solution:

At the extremity of long bones, larynx, trachea we find hyaline cartilage.

Question-46

What is muscle tetanus?

Solution:

Muscle tetanus is the prolonged state of muscle contraction.

Question-47

Name the fluid that is present between two joints ex: knee joint?

Solution:

synovial fluid

Question-48

Name the type of cartilage present between vertebrae to allow limited movement?

Solution:

Intervertebral disc is a fibrocartilage present between the vertebrae that allows movement.

Question-49

Why do muscles become stiff after death?

Solution:

The muscles become stiff due to non-availability of ATP, enzymes and oxygen. After death, the muscles cannot synthesis ATP and actomyosin - ADP bonds are not broken due to lack of ATP and finally the muscles go into a state of stiffness.