

chapter-16	120	Support and movement
------------	-----	----------------------

chapter NO-16	Support and Movement
---------------	----------------------

Q1 what is skeleton. Explain the type of tissues that consistute the skeleton of Human.

Answer : skeleton :

Definition :- The skeleton is tough and rigid farmework of the body of animals which provides protection, shape and Support to the body organs.

Explanation :- Support is necessary to uphold and sustain the body against external forces .In animals such support is provided by the skeleton. The human skeletal -system consists of bone and cartilage of various types. Bones and cartilages are supporting connective tissues.

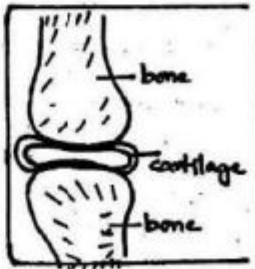
Function of skeleton :-

The skeleton performs the following functions in the body.

- 1: Support :-** Skeleton provides support to soft-tissues of the body. It provides attachment sites for muscles.
- 2: Shape :-** Skeleton gives proper shape to the body.
- 3: protection :-** Skeleton protects various sensitive internal organs. e.g- brain, spinal-cord, lungs and heart.
- 4: Movement :-** Skeleton helps in movement of organs and Locomotion of organisms due to muscles and joints.

Human skeleton:

Endoskeleton:- Like other vertebrates, the human -

chapter-16	121	Support and movement
Skeleton is inside the body called endoskeleton. It contains living cells (i.e.-Bones and cartilages) and also has - nerves and blood vessels. It can also grow and repair - itself. <u>Components of human skeleton:</u> Human endoskeleton consists of cartilages and bones. i.e- <u>1: Cartilage:</u> (ETEA-2006) <u>Introduction:-</u> cartilage is a softer type of connecting tissue, consists of tough, elastic, homogenous materials or matrix. In early embryonic life, the whole skeleton is made of cartilage which then gradually turns into bones. Some of our body parts are still provided with — cartilagenous skeleton. <u>Composition of cartilage:-</u> Cartilage mostly contains organic-substances and may or may not have calcium or inorganic-substances. <u>Function of cartilage:-</u> 1: cartilage covers the ends of large bones at the joint which helps in motion and reduce friction between bones. 2: It also support and maintain the shape of the flexible portion of nose and external ears. <u>Structure of cartilage:</u> A cartilage consists of the following parts. - i: <u>Ground substance: (matrix)-</u> it is amorphous (shapeless) gel like -		
		

chapter-16	122	Support and movement
substance, which is tough, flexible, non-vascular and homogenous mass, present in extracellular spaces.		
ii: <u>collagen fibres</u> :- The ground substances of cartilage contains collagen-fibres (Type-II) in parallel arrangement. It gives tensile strength and elasticity to cartilage.		
iii: <u>Chondrocytes</u>: (ETEA-2016)		
The cells of cartilage is called chondrocytes which are present in the ground-substance within space called - lacunae. The number of chondrocytes found in cartilage determines how flexible or elastic the cartilage is.		
iv: <u>Blood Vessels</u>:		
There are no blood vessels present in the ground substance of cartilage. so cartilage is nourished by lymphatic vessels (lymph) through diffusion, because of this, cartilage heals very slowly.		
<u>Types of cartilage</u> :- There are 3-types of cartilage. i.e-		
a: <u>Elastic cartilage</u> :- In elastic cartilage the cells are closer together and there is less ground-substance.		
<u>Location</u> :- Elastic cartilage is found in the external ear flaps and in epiglottis.		
b: <u>Hyaline cartilage</u> :- Hyaline cartilage has less number of cells and more ground-substance		
<u>Location</u> :- Hyaline cartilage is found at the ends of the long bones, in the nose, ears, Trachea, Larynx and bronchi.		

chapter-16	123	support and movement
<u>c: Fibrous cartilage :-</u> Fibrous cartilage has the least - Number of cells, so it has maximum ground substance.		
<u>2: Bone: (ETEA-2014)</u>		
<u>Definition :-</u> Bone is a rigid form of connective tissue which is living, hard and strong structure, which cannot be - compressed and bent.		
<u>Body mass :-</u> Bones make up less than 20% of the body mass.		
<u>Function :-</u> 1:- Bones provide a rigid framework which give shape and structure to the body, and support and protect delicate internal organs—such as lungs, heart, brain.		
2: Bones serve as a storage place for some minerals, such as calcium and phosphorus.		
<u>Composition of Bone :-</u> Bone is composed of matrix and cells i.e-		
<u>i: Matrix :-</u> It is hard ground-substance which consists of organic and inorganic substances. i.e-		
<u>a: organic matrix :-</u> about 35 percent matrix is composed of organic materials, chiefly of collagen fibers (Type-I) (about 90%) and glycoprotein.		
<u>b: inorganic matrix :-</u> about 65 percent matrix is composed of inorganic materials, chiefly of calcium-phosphate, sodium, magnesium, potassium, chloride, fluoride, — bicarbonate and citrate ions.		
<u>ii: Bone cells :-</u> These are embedded in the matrix.		
<u>Structure of Bone: (components) :-</u> Bone has following comp:-		

chapter-16	124	Support and movement
------------	-----	----------------------

1- periosteum :- Bone is surrounded by a membrane called periosteum. This membrane has blood vessels and nerves. These keep the membrane alive and allow growth.

2- layer of osteoblast :- Below the periosteum is a layer of bone forming cells called osteoblast. These osteoblasts secrete bone materials (collagen proteins) which helps in increasing thickness of bone and also help in repair of broken or damage bones.

3- Haversian canal :- Bone contains many circular called Haversian

4- Haversian lamellae :- Each haversian canal is surrounded by concentrically arranged boney plates called haversian lamellae. Haversian lamellae contains matrix which is calcified and have collagen fibres.

5- Lacunae :- There are spaces between the adjacent haversian lamellae called lacunae. These lacunae contain mature bone cells.... (osteocytes)

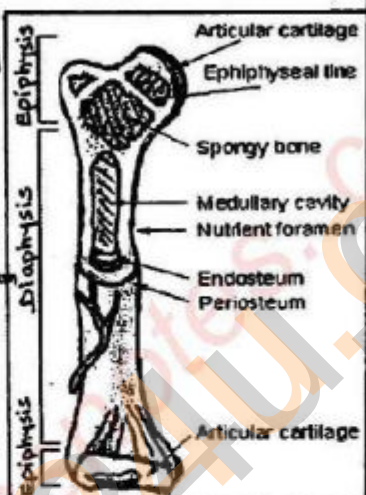
6- canaliculi :- Fine fibres arise from each lacunae called canaliculi.

parts of bone :- Bone consists of two major parts i.e-

i: **Compact bone :-** This is the outer dense and hard part of bone.

ii: **Spongy bone: (Bone Marrow) :-** The inner loose and spacious part of bone is called bone marrow or spongy bone which may be- form red bone marrow or yellow bone marrow. i.e-

a: **Red bone marrow :-** It is found in spongy bone, the ends of long bones, ribs, vertebrae, the sternum and the pelvis. It -



Chapter-16	125	Support and movement
------------	-----	----------------------

produces — Red blood cells, platelets and white blood cells.

b: yellow bone marrow: — It fills the shafts of long bones. It consists mostly of fat cells and serves as an energy reserve. It can also be converted to red bone marrow and produce blood cells when severe blood loss occurs.

Bone cells: — There are 3-main types of Bone cells which are responsible for bone growth and mineral homeostasis. i.e. —

1: Osteoblasts: — It is immature bone cell having single nucleus and lie below the periosteum in a single layer.

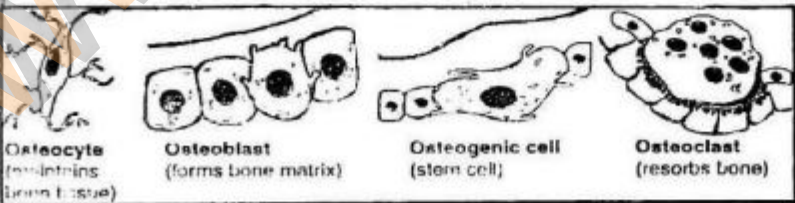
Function: — 1: — Osteoblasts make new bone cells — osteoclasts.
 2: It secretes collagen that mineralizes to become bone matrix.
 3: It is responsible for bone growth and the uptake of minerals from blood.

2: Osteocytes: — They are mature bone cells, long life and most abundant cell type of bone having star shaped and single nucleus.

Function: — 1: Osteocytes regulate mineral homeostasis and bone mass.
 2: They direct the uptake of minerals from the blood and the release of minerals back into the blood as needed.

3: Osteoclasts: — They are large cells and multi-nucleated.

Function: — Osteoclasts dissolve minerals in bones matrix and release them back into the blood.



Osteocyte
(maintains bone tissue)

Osteoblast
(forms bone matrix)

Osteogenic cell
(stem cell)

Osteoclast
(resorbs bone)

Bone is a dynamic, living tissues that are constantly being reshaped → Osteoblasts and osteoclasts both control the amount of bone tissues, by making new cells and breakdown.

Q2 Describe the main division of Human skeleton.

Answer: Human skeleton:

Total bones :- Human skeleton consists of bone and cartilage. but mostly the skeleton is bony. Before birth the human body consists of 350-bones, but at adult stage skeleton consists of 206-bones, because much of cartilage had been transferred into bones with the increase of age.

Division of Human skeleton:

Human skeleton can be divided into two main parts. i.e-

1: Axial-skeleton:

Definition :- The skeleton which is present or located in the mid body is called axial-skeleton.

Total bones :- It consists of 80-bones.

Function of axial skeleton :-

- 1- Axial-skeleton provides framework to the body.
- 2- This skeleton form axis of our bodies.

parts of axial skeleton :- axial-skeleton consists of- skull, vertebral column and rib-cage. i.e-

i: Skull :- (ETEA-2018, 2019)

Bones :- The human skull is composed of 22-bones (i.e- cranium and facial bones), beside 6-tiny ear bones and one hyoid (neck) bone. i.e-

a: Cranium: it consists of 8-bones, in which 4- bones are unpaired (i.e. frontal, occipital, sphenoid, ethmoid) and 2- bones are paired (i.e. a pair of parietal and a pair of temporal bones)

Function :— Its primary function is to protect the brain.

Advantages in birth time :— At the time of birth several bones of cranium are not completely formed. if the bones of cranium were completely formed at the time of birth, great difficulty would have been experienced in the birth canal.

b: Facial bones: there are 14 facial bones of which 6 are paired and 2 unpaired that form face. i.e-

Paired facial bones: a pair of zygomatic bones, a pair of lacrimal bones, a pair of nasal bones, a pair of inferior nasal conchae, a pair of palatine, and a pair of maxilla.

Unpaired facial bones: a vomer, a mandible (jaw).

c: Ear bones: there are 3 paired ear bones called ossicles. Each are containing 3-tiny bones. i.e- malleus, incus, and stapes.

Neck bone: there is one bone neck called hyoid bone, which is U-shaped bone and lies at the base of mandible (C-3) where anterior neck muscles is attached.

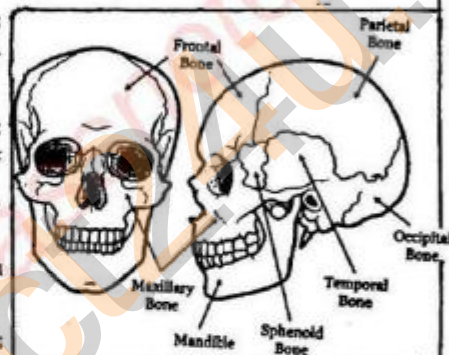
ii: Vertebral column: (ETEA-2005, 2008)

Back bone :— Vertebral column extends from the skull to the pelvis to form backbone which protects the spinal cord.

Bones :— The human vertebral column composed 26-bones.

Function :

- 1: vertebral column houses and protects spinal cord.
- 2: It is a rigid rod on the dorsal side of the trunk which provides axial support to the body.
- 3: It provide attachment site for pectoral girdle and pelvic-girdle.



Skull:

chapter-16	128	Support and movement
------------	-----	----------------------

Curvatures :- Normally the vertebral-column has 4-curvatures which provide more strength than the straight-column. i.e - Cervical - curvature, Thoracic-curvature, Lumbaric - curvature and pelvic-curvature.

vertebrae :- There are 33-vertebrae in - human which is divided into 4-groups. i.e -

1-cervical vertebrae :- These are 7-vertebrae which lie in neck region. They have intervertebral disc.

2-Thoracic Vertebrae :- These are 12-vertebrae which - located in the thoracic <chest> region. They have inter-vertebral disc.

3-Lumbar vertebrae :- These are 5-vertebrae which is located in lumbar <lower back> region with intervertebral disc.

4-pelvic vertebrae :- These are 9-vertebrae in pelvic - region. They have no intervertebral disc. They form two set, sacrum and coccyx i.e -

i-Sacral vertebrae :- First 5-vertebrae of pelvic region are called Sacral vertebrae. These are fused together.

ii-Coccyx or tail bone :- Last 4-fused pelvic vertebrae are called coccyx or tail bone which is vestigial <functionless> organ in human. ←(ETEA-2005)

iii: Ribs :

Rib cage: <chest box> - Ribs form rib-cage which --



chapter-16	129	Support and movement
------------	-----	----------------------

provides support to a semi-chamber called chest cavity.

Bones :- The human ribs composed of 24-bones.

Function :- Rib-cage protects the most sensitive parts of body (i.e.-heart, Lung, etc) and give support to chest.

Ribs Number :-

There are 12-pair of ribs in human. each pair is attached with each of the thoracic-vertebrae dorsally but ventrally 10-pairs are attached with the sternum (chest bone) and two pairs are free .i.e-



1-True ribs :- Those ribs which are directly connected with sternum are called true ribs. These are 7-pairs in No.

2-False ribs :- Those ribs which are not directly connected with sternum, but are indirectly attached through — intercostal arch, are known as false ribs. They are 3-pairs in number.

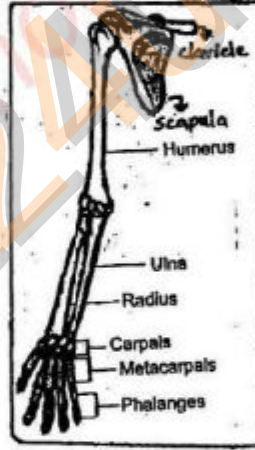
3-Floating ribs :- Those ribs which are free and are not attached with the sternum are know as floating ribs. Last 2-pairs of ribs are floating ribs.

2: Appendicular Skeleton :

Definition :- The skeleton which is Located or present in Limbs (appendage) is called appendicular skeleton.

Total bones :- It consists of 126 bones.

Function :- 1:- pectoral girdle and fore Limb helping in

chapter-16	130	Support and movement
grasping <holding>, handling and movement. 2- pelvic girdle and hind limbs helps in movement i.e— walking, running, applying force, etc. <u>parts of appendicular skeleton:-</u> Appendicular skeleton consists of pectoral girdle, fore— Limbs, pelvic—girdle and hind—limbs. i.e— i: <u>pectoral girdle : <The shoulder>—</u> It is a appendicular skeleton which attaches fore—limb with axial—skeleton. <u>Bones :-</u> pectoral girdle consists of the following 3—bones. 1- <u>Coracoid :-</u> it is pectoral bone which meets the Sternum medially. 2- <u>Scapula :-</u> It extends dorsally. 3- <u>clavicle or beauty bone :-</u> It lies on the ventral side — between the Scapula and Sternum and anterior to coracoid. ii: <u>Fore Limbs : <The arms>—</u> The fore Limb is attached to the pectoral girdle. <u>Bones :-</u> Fore—Limb <arm> consist of following bones. 1- <u>Humerus :-</u> The upper bone of fore Limb is called — humerus which is connected to the scapula of pectoral girdle and form ball and socket joint. 2- <u>Radius and Ulna :-</u> The lower part of arm consists of two bones, one is Radius and another is ulna. both are		
		

chapter-16	131	Support and movement
Both are present parallel to each other. <u>3- carpels :-</u> In wrist region both bones (Radius and ulna) unite together and attach to other 8-bones called carpels. <u>4- Metacarpels :-</u> The carpels are attached to the 5-bones of palm called metacarpels. <u>5- phallanges :-</u> From metacarpels, 14-small bones arise called phallanges, present in fingers. <u>iii : pelvic girdle : (The hips girdle) -</u> It is the appendicular skeleton which attach the hind Limbs (legs) with the vertebral-column and support the pelvic-region. <u>Bones :-</u> The pelvic-girdle consists of two coxal bones, each is formed by the fusion of 3-bones i.e- ilium, ischium and pubis. <u>iv: Hind Limbs: (The legs) -</u> each hind Limb consists of Thigh, shank, ankle and foot. <u>Bones :-</u> Hind Limb (leg) consists of the following bones - <u>1- Femur :-</u> Each hind Limb (thigh) consists of upper larger bone called femur. It is the largest and strongest bone of the body. It is attached to the pelvic-girdle and forms ball and socket joint. <u>2- Tibia and Fibula :-</u> Below the femur, lower part of leg (shank), there lie two bones, one tibia and other is Fibula.		

chapter-16	132	Support and movement
<u>3-patella</u> :- At the upper side of tibia and Fibula, there is a small bone is present called patella which forms knee joint. It is classified as a sesamoid type of bone. <u>4-Tarsals</u> :- At the lower side of the tibia and fibula, there are 7-small bones present called Tarsals which form ankle. <u>5-metatarsals</u> :- At the lower side of tarsals there are 5-long bones called metatarsals which form foot region. <u>6-phalanges</u> :- In finger there are 14-small bones called - phalanges.		
Q3 Define joints. write its different types.		
<u>Answer</u> : joints : <Articulation> -		
<u>Definition</u> :- Any loose , flexible junction between two bones or between bone and cartilage is called joint. —OR— “ In vertebrates the bones of skeleton are different - types , the point where two bones meet together are called.. joint.”		
<u>Functions of joints</u> :		
1: They keep our bones together by holding them with each other. 2: They also allow the bones to move to different extents and give mobility to our body.		
<u>structural classification of joints</u> : <Types>		
structural classification of joints is based on the material binding the bone together and the presence or absence of joint-cavity. i.e -		
1: <u>Fibrous joints</u> : <immovable joints> -		

Chapter-16	133	Support and movement
------------	-----	----------------------

Binding material :- In fibrous joints the two bones are held by a thin layer of fibrous connective tissue.

joint cavity :- In fibrous joint no joint cavity is present b/w the two held bones.

Immovable joint :- Due to the absence of joint-cavity the fibrous joints are immovable.

Functions :-

- 1: These joints provide strength and support to the body.
- 2: These joints have protective role because they protect sensitive body organs or parts (i.e-brain).

Example :-

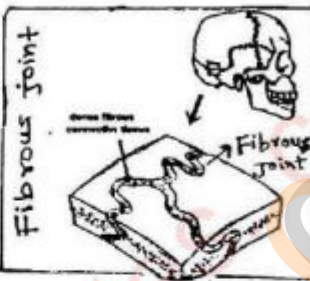
- 1- Fibrous joints are present b/w the bones of Skull.
- 2- Between sacrum and iliac of pelvic-girdles. and
- 3- Between the bones of pelvic girdle (ilium, ischium, pubis)

2: cartilaginous joints : (partial movable joint) -

Binding material :- In cartilaginous joints the two bones are held by Fibro-cartilage or Hyalin cartilage.

joint cavity :- In cartilaginous joint no joint-cavity is present.

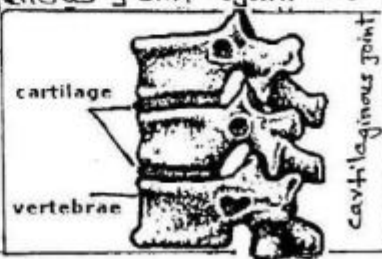
partial movable joint :- in cartilaginous joint again no joint-cavity is present but the bones can glide over each other to a limited extent and show partial movement.



Fibrous joint

cartilage

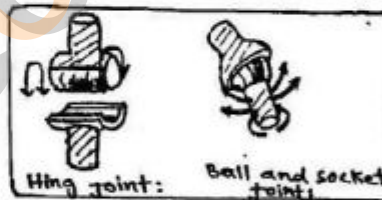
vertebrae



cartilaginous joint

chapter-16	134	Support and movement
<u>Function :-</u> In cartilaginous joint the cartilage forms a flexible connection, so these joint allow slight movement between the two bones or parts.		
<u>Example :-</u>		
1- cartilaginous joints are present b/w vertebrae. and		
2- Between wrist and ankle bones.		
<u>3: synovial joints : <movable joints> -</u>		
<u>joint cavity : <synovial cavity> -</u> In synovial joint, joint-cavity is present and the two held bones are separated by this joint cavity called synovial-cavity.		
<u>Synovial Fluid :-</u> In Synovial joints, the joint cavity is filled with fluid called synovial-fluid.		
<u>Freely movable :-</u> Due to joint-cavity in synovial-joint, all synovial joints are freely-movable.		
<u>structural plan :-</u> The synovial joints have different — Structural plan, based on synovial joint surface. This — Structural plan determines that type of movement allowed.		
<u>Ligament :-</u> The connective tissues which connect bone to bone at joint are called Ligaments. In synovial joints a number of band-like structure is present called ligament which gives strength and help in movement.		
<u>Types of synovial joints :-</u>		
The synovial joints can be classified further into 3-major categories. i.e—		

chapter-16	135	Support and movement
<u>i: Hing joint :</u> <u>Definition :-</u> Those joints where bones allow movement in two directions only are known as Hinge-joint. <u>Two direction Movement :-</u> At Hing joint one pair of muscle is attached allows forward and backward movement in one plane only or in two direction only. <u>Example :-</u> 1: Elbow joints. 2: Knee joint 3: joints between the phalanges of finger or toes etc.		
<u>ii: Ball and socket joint :</u> <u>Definition :-</u> Those joints where bones allow movement in all directions are known as ball and socket joint. <u>All direction movement :-</u> In this joint the rounded head or ball of one bone rotates in the - cup like socket of another bone. Such joints have at least two pairs of muscles present - perpendicular to each other. They provide maximum flexibility as a result it allow movement in all-direction. <u>Example :-</u> 1: Shoulder joints. 2: Hip joints		
<u>iii: pivot joint : < rotary joints > -</u> <u>Definition :-</u> These joints allows only rotary movement - around a single axis. -OR- " allow rolling at 180°." <u>Example :-</u> 1: wrist joints at elbow joint. 2: joints between skull and vertebral column.		



chapter-16	136	Support and movement
<u>Q4</u> write the different disorders of Human-skeleton.		
<u>Answer: Disorders of Human skeleton:</u>		
<u>Introduction:-</u> Human skeleton support an upright body. - Sometimes our skeletal-system becomes weak and results in deformations which reduces movement or cause completely immovability.		
<u>Causes of deformations:-</u> The causes of deformations are variable i.e- Genetic disorders, hormonal problems, nutritional deficiency, congenital disorders, Accidental, infections, etc.		
<u>Example:-</u> some of these disorders are given below.		
<u>1: Disc slip: < Herniating disc> -</u>		
<u>Disc:-</u> A layer of cartilage <or pad> between two - adjacent vertebrae is called disc or intervertebral-disc.		
<u>parts of disc:-</u> intervertebral disc consists of two parts. i.e- the outer fibrous membrane is called annular fibrosis while the inner gel like matrix is called nucleus pulposus.		
<u>Function of disc:-</u>		
These discs act as shockabsorbing pad between the bones of vertebrae during walking, running or jumping.		
<u>Disc slip:-</u> The disc actually don't slip, However it may ruptured or cracked, so that the inner jelly substance <- matrix> escape into surrounding tissues. This substances put pressure on adjacent nerves - <especially on Siatric Nerve> which causes severe pain. This condition		

chapter-16	137	Support and movement
is called disc slip or herniating disc. <u>Occurance</u> :- The most frequently affected area is lower back, but any disc may rupture, including those in the neck. <u>causes and risk factors</u>: 1: loss of elasticity of the intervertebral disc. 2: outer ring or part of disc become weak or degenerate. 3: Improper Lifting by twisting or turning. 4: Excessive strain forces like jumping. 5: Aging (older than 40 year). 6: - over weight. <u>Symptoms of disc slip</u>: 1- pain and numbness (poor sensation). 2- pain extends to arms and legs. 3:- muscle weakness. 4- pain become more severe at night. 5- pain become more prominent during walking or running. <u>Treatment of disc slip</u>: 1: Analgesics (pain relievers). 2: physiotherapy. 3: Severe case need surgery. 4: prolong rest on a hard bed. <u>prevention for disc slip</u>:- 1- Do regular exercise. 2- maintain a health weight. 3- Avoid lifting to much heavy load. <u>2: Spondylosis</u> : (Spinal osteoarthritis) - (ETEA-2017) <u>Definition</u>:- The degeneration of intervertebral disc in cervical, thoracic or lumbar region is called spondylosis <u>Types</u> :- There are 3-types of spondylosis. i.e.-		

chapter-16	138	Support and movement
i: <u>cervical spondylosis</u> :- The degeneration of intervertebral disc in cervical (neck) region is called cervical spondylosis. ii: <u>Thoracic spondylosis</u> :- The degeneration of intervertebral disc in Thoracic (chest) region is called Thoracic spondylosis. iii: <u>Lumbar spondylosis</u> :- The degeneration of intervertebral disc in lumbar (lower back) region is called lumbar spondylosis. <u>causes and risk factors:</u> 1: primary cause is aging. 2: A-genetic defect. 3: Injury or trauma (sudden accident). 4: Hormonal imbalance. 5: over weight. 6: Frequently put repetitive stress on certain joints. <u>Symptoms of spondylosis:</u> 1- Restriction of movement. 2- lack of coordination. 3- Difficulting in walking. 4- loss of balance. 5- pain in corresponding region like-neck, thoracic or lower back. 6- muscles weakness in Limbs. <u>Treatment of Spondylosis:</u> 1: Decompress therapy. 2: physiotherapy. 3: wearing a hard collar around the neck. 4: painkillers. 5: If treatment gives no response then surgery is advised. <u>prevention for spondylosis:</u> 1- take regular exercises. 2- maintain a healthy weight. 3: <u>Sciatica</u>: (ETEA-2018) <u>Definition</u> :- Sciatic refers to pain that radiates along the		

Chapter-16	139	Support and movement
------------	-----	----------------------

path of sciatic-nerve. — OR —

“ pain felt down at the back and outside of Thigh ,
Leg and foot is called sciatica.”

Sciatic-Nerve :- It is a large sized nerve originated
from the lower spin and enters buttock region where it
divided into two branches , one each running along sides of
thigh , shank and finally to foot. It is the main nerve —
Supplier to the legs.

Causes and risk factors :

1- pelvic injury.	1- Slipped disc.
2- obesity and over weight	3- Trauma and Fracture
3- certain disease (diabetes)	5- Age related changes.
4- carry heavy loads or drive a motor vehicle for long period	7- prolonged sitting.
5- piriformis syndrome (a pain disorder involving the — narrow muscle in the buttocks).	

Symptoms of Sciatica :

- 1: pain from lumbar (low back) region to buttocks.
- 2: many time the pain is feel like electric-shock.
- 3: Numbness , tingling (stinging sensation) -
- 4: muscles weakness in the affected leg or foot.

Treatment for Sciatica:

1- Anti-Inflammatory drugs.	2- corticosteroids injection.
3- physiotherapy	4- painkiller. 5- bed rest.
6- In severe cases the surgery may be needed.	

chapter -16	140	Support and movement
-------------	-----	----------------------

prevention for sciatica :- 1: Take Exercise regularly.
2: choose a seat with good lower back support , arm rest.
3: maintain healthy weight.
4: Arthritis : < Arthron mean joint >

Definition :- Inflammation of one or more joint is called arthritis

Types of arthritis :- Arthritis may be -

i: Osteoarthritis :- The common type of joint disorder in which cartilage is affected and started to wear away over-time is known as Osteoarthritis. occur in aged people

ii: Rheumatoid arthritis :- This is an auto-immune disease in which the body immune-system attacks on healthy joints

iii: Gout arthritis :- The type of joint-disorder in which the deposition of uric-acid crystal occurs in joints is known as Gouty arthritis.

Causes and risk factors:

1- old age like above 65-years.	2- obesity and over weight.
3- Broken bone.	4- infections <i.e bacteria>.
5- Auto-immune diseases.	6- uric-acid level.

7- Reduce the cartilage tissue at joints.

Symptoms of arthritis:

1: joint pain and swelling of joint.
2: Stiffness <rigidness> In joints. 3: difficulty in movement.
4: Redness of skin and feeling of warmth.
5: General wear and tear in joints.

chapter-16	141	Support and movement
6: Sometime Fever and inflammation occur.		
<u>Treatment of Arthritis :</u>		
1- physiotherapy	2- pain killer.	
3- Aspirin and similar analgesics	4- complete bed rest.	
5- Sometime need surgery.		
<u>prevention for Arthritis :-</u>		
1: Regular exercises.		
2: maintaining an appropriate weight.		
3: Early diagnosis and treatment.		
Q5 what are types of fractures. Describe the repair -		
<u>process of a simple fracture.</u>		
<u>Answer: Bone fracture :</u>		
<u>Definition :-</u> A fracture is the medical term for a broken bone which occur when the physical force is exerted on the bone is stronger than the bone itself.		
<u>Causes :-</u> Bone fracture is a crack in the bone due to accidents or falling down dangerously or the bone can not bear the force exerted on it or serious injury, thin and weak bones also cause bone fracture or crack.		
<u>Types of fractures:</u>		
1: <u>Simple fracture : (closed fracture)</u> - Simple fractures are type of bone fracture in which broken bones remain within the body and does not penetrate into skin.		
2: <u>compound fracture : (open fracture)</u> - It is the type		

Chapter-16	142	Support and movement
Of bone fracture in which broken bones are penetrating through the skin and exposed the bone and deep tissues to the exterior environment and form wound. 3: <u>Complicated Fracture</u>; a fracture of bone associated with significant injury to other structures such as arteries, nerves or muscles is called complicated fracture. <u>Repair of a fractured bone:</u> Fractured bone is treated by reduction process. i.e- <u>Reduction</u>:- Rearrangement (Realignment) of the ends of broken bone in straight line is called reduction. <u>Types of reduction</u>:- Reduction may be external or internal. 1: <u>External reduction</u>:- In external the ends of the broken bones are arranged carefully into original shape (coaxed) by the physician hand. 2: <u>Internal reduction</u>:- In internal reduction the ends of the broken bones are connected together surgically with pins and wires. <u>Healing</u>:- After broken bone is reduced, it is immobilized by a cast or by traction to allow the healing process to begin. <u>Healing time</u>:- Healing is variable regarding age and bone-type. <u>For example</u>:- For a simple fracture the healing time is 6-8 weeks for small or medium sized bones in young - adults. But the healing time is much longer for heavy - weight bearing bones and for bones of elderly people, because of their poorer blood circulation. <u>Repairing phases of fractured bone</u>:- The repairing process of a simple fracture takes place in 4-phases or stages. i.e-		

1: Hematoma formation:-

Hemorrhage:- As bone breaks, the blood vessels of bone itself and surroundings also break or tear, as a result in bleeding. This is also called hemorrhage.

Hematoma:- After bleeding a large mass of clotted blood is formed called Haematoma at that site.

Bone cells begin die:- After breakdown of blood-vessels, blood (nutrients) supply to bone stops soon after the bone cells deprived of food begin to die and tissues at fracture site become swollen and painful.

2: Fibrocartilaginous callus formation:

Soft callus:- within few days, several events lead to formation of soft callus. capillaries begin to grow in the injured region. The phagocytic cells invade to that area and begin cleaning up the debris.

production of Fibroblast:- The broken (injured) bone - releases certain chemicals which attract stem cells called osteoblasts. These stem cells develop into Fibroblast cells.

Reconstruction:- fibroblasts and osteoblasts migrate into fracture site and begin reconstruction of the bone. i.e.-

Fibrocartilaginous callus:-

Fibroblasts produce connective-tissue (i.e collagen fibres) which span the break and connect the broken bone ends and some differentiate into chondroblast that secrete matrix.

Chapter-16	144	Support and movement
------------	-----	----------------------

where as osteoblasts are becoming mature and is converted to osteocytes which initially synthesize spongy bone which is later on calcified. This entire structure is called fibro-cartilaginous callus which hold the broken bone.

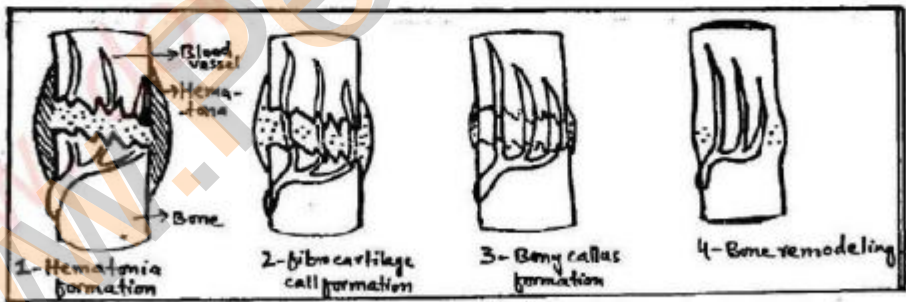
3: Bony callus formation:-

within a week, the fibrocartilaginous callus is converted to a bony-callus. Now it becomes calcified. The fracture disappears. after about two months the ends of the bones are strongly united together.

4: Remodeling:-

Reshape of bone callus :- After several months bony-callus is remodeled into new bone by the excessive deposition of material.

Final structure:- Final structure of remodeled area resembles that of the original unbroken bone because it responds to the same set of mechanical stimuli.



1-Hematoma formation
2-fibrocartilage call formation
3-Bony callus formation
4-Bone remodeling

Q6 Explain the different joint injuries.

Answer: Joint injuries:-

chapter-16	145	Support and movement
------------	-----	----------------------

Definition :- An injury to any joint in the body is called joint -injury.

Effects :- Severity of symptoms varies depending on the type and location of injury. A joint injury can involve damage to the bones , Ligaments or other tissues of the joint.

Example of joint injury:- joint injury may be -

1: joint dislocation :

Definition :- The Slipping out of joint from its original - place is called joint dislocation.

Effects :- when a joint is dislocated then it is not able to work properly. During severe dislocation of joint , Ligaments Tendons and even muscles become injury , cause immobility.

causes and risk factors :

- 1- most common causes are blow , fall or trauma.
- 2- Rheumatoid arthritis can also cause dislocation of joint.
- 3- Some diseases Like defective Ligament can also cause it.
- 4- Excess of Stress or mechanical pressure on joint.
- 5- unsafe behavior during physical activities.
- 6- dislocated a joint in the past.
- 7: Aging.

Symptoms of joint dislocation:

1: Swelling (abnormal enlargement).	2: Severe pain.
3: Redness of affected area.	4: loss motion.
5: joint instability	6: tingling feeling
7: numbness around the affected ^{area} I.	8: Reduce muscle strength

chapter-16	146	Support and movement
<u>Treatment of joint dislocation:</u>		
1- The slipped joint is again manipulated or repositioned into the same place from where it was dislocation.		
2- Surgery may be needed during more severe condition.		
3- pain killers.		
<u>prevention for joint dislocation:-</u>		
1: wear protective gear or clothing when doing physical activities		
2: Avoid standing on unstable items such as chair. etc.		
<u>2: Sprain:</u>		
<u>Definition:-</u> any injury to ligament due to sudden over-stretching is known as sprain.		
<u>Occurance:-</u> Generally sprain occurs in ankle, knee and wrist.		
<u>Ligament:-</u> Ligaments are tough, fibrous connective tissues which connect bones to other bones and prevent abnormal - movements of skeleton. ← (ETEA-2008)		
<u>Causes and risk factors:</u>		
1: This is generally occurs when the joint is over extended.		
2: when a joint is forced to move it into an unnatural position.		
3: Fatigue of muscles after which suddenly start exercise cause sprain.		
4: weak ligaments may also cause this condition.		
5: Heavy weight lifting may cause sprain.		
<u>Symptoms of sprain:</u>		
1- joint pain	2- Swelling of joint.	
3- Redness	4- Stiffness of joint.	

chapter-16	147	Support and movement
5- Restricted range of movement. 6- Discolouration of the skin in affected area. <u>Treatment of sprain:</u> 1: physical therapy 2: painkiller 3: complete rest 4: icing, Dressing and bandages (stripe - ∞.) 5: In most severe cases surgery is referred. <u>Prevention for sprain :-</u> 1- wear protective ^{foot} wear during activities that place stress on your ankle and other joints. 2- Avoid high heeled shoes. 3- always warm up before exercise Q7 <u>What are muscles. write its different types.</u> <u>Answer:</u> muscles: <u>Meaning :-</u> muscle is a Latin word which mean little mouse because its contraction looks like the running of a little mouse. <u>Definition :-</u> muscles are the bundles of cell or fibres which can be contracted and expanded to produce physical movement. <u>Origin :-</u> muscles are mesodermal in origin. <u>Body mass :-</u> muscle-tissues makes up nearly half of the human body mass or weight. <u>Number :-</u> There are about 650-muscles in human body. most of which occur in pairs. about 600-muscles are voluntary. <u>Characteristics of muscles:</u> muscles have the following characters -		

chapter-16	148	Support and movement
1: muscles can respond to stimuli or nerve impulses. 2: muscles have the ability to shorten in length. 3: muscles can be stretched when pulled. 4: muscles can return to original shape and length after contraction or extension. 5: Muscles can convert chemical energy into mechanical energy.		
<u>Types of muscles</u>:- There are 3-types of muscles. i.e.-		
<u>1: Skeletal-muscles</u>:		
<u>Definition</u>:- Muscles that are attached to the skeleton and associated with the movement of bones are called skeletal-M;		
<u>Characteristics</u> : (ETEA-2020)		
<u>1- Cell shape</u>:- The skeletal-muscle cell shape is spindle or cylindrical that is why the skeletal muscles are long structures		
<u>2- Nucleus</u>:- In skeletal-muscle cell many nuclei are present.		
<u>3- Striations</u>:- Skeletal-muscles are also called striped or - striated muscle because they show alternate light and dark bands.		
<u>4- Muscle appearance</u>:- Skeletal muscles have regular stripes.		
<u>5- Voluntary</u>:- The skeletal muscles are consciously controlled and therefore are called voluntary muscles or highly adaptable.		
<u>6- Cause and speed of contraction</u>:- It is controlled by nervous system and their speed of contraction is slow to rapid.		
<u>7- Evolutionary occurrence</u>:- It is modern form of muscles.		
<u>8- Fatigue</u>:- These muscles get tired after short period.		
<u>9- Function</u>:- It is associated with the movement of bones.		

Chapter-16	149	Support and movement
<u>Example :-</u> muscles of arms and legs. etc.		
<u>2: Cardiac muscles: <myocardium>- (ETEA-2010,2012,2020)</u>		
<u>Definition :-</u> cardiac muscles occur only in the heart where they constitute the bulk of the heart walls.		
<u>Characteristics :</u>		
<u>1- cell shape :-</u> Heart muscle is composed of chains of single cell. the cells are branched, interconnected and organized into fibres		
<u>2- Nucleus :-</u> cardiac muscle cell has a single nucleus.		
<u>3- Striations :-</u> The cardiac muscles are also called striated or striped muscles because they show alternate light and dark bands.		
<u>4- muscle appearance :-</u> They have irregular stripes.		
<u>5- Involuntary :-</u> They are spontaneous and involuntary.		
<u>6- cause and speed contraction :-</u> It is spontaneous and the speed of contraction is spontaneous and involuntary. They contract at constant rate but can contract faster (i.e shift into high gear) for a short time. •		
<u>7- Evolutionary occurrence :-</u> They are the most modern muscle.		
<u>8- Fatigue :-</u> These muscles do not tired.		
<u>9- Function :-</u> cardiac muscles are responsible for the contraction and Relaxation of heart walls and pumps blood.		
<u>Example :-</u> These are muscles of the heart.		
<u>3: Smooth muscles: (ETEA-2013)</u>		
<u>Definition :-</u> Smooth muscles working smoothly and slowly-OR- "Smooth muscles are the earliest evolved muscles present -		

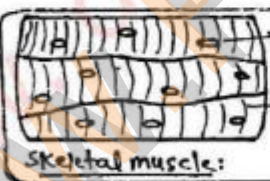
chapter-16	150	Support and movement
------------	-----	----------------------

throughout the animal-kingdom.

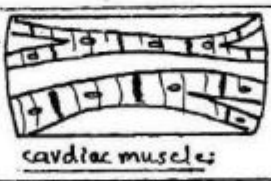
Characteristics :

- 1- Cell shape :- Smooth muscle cells are long and spindle shaped.
- 2- Nucleus :- Each smooth muscle cell contains single nucleus.
- 3- Striation :- Smooth muscles are also called non-striated or unstriated muscles because they have no light and dark bands.
- 4- muscle appearance :- They are unstriated or sheet like.
- 5- Involuntary :- The contraction of smooth muscle is involuntary.
- 6- Causes and speed of contraction :-
It is spontaneous and controlled by nervous system and - hormones and the speed of contraction is slow.
- 7- Evolutionary occurrence :- It is the earliest form of muscles.
- 8- Fatigue :- These muscles do not tire.
- 9- Function :- They control the movement of substances through hollow-organs.

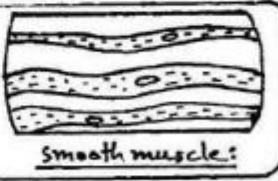
Example :- They are present in blood-vessels, digestive tract, respiratory tract and urinary bladder.



Skeletal muscle:



cardiac muscles:



Smooth muscle:

Q8 Explain the structure of Human Skeletal-muscle.

Answer: Human skeletal muscle:

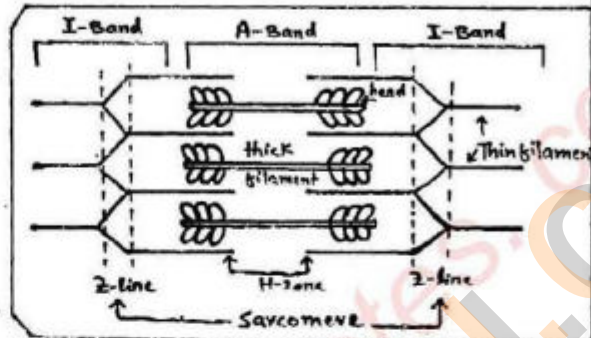
Definition :- The muscles that are attached to the skeleton

Chapter-16	151	Support and movement
and are associated with the movement of bones are - called skeletal-muscle.		
<u>Structure of skeletal muscle:</u>		
<u>Muscle fibre or cell :-</u> Each muscle consists of muscle - bundles which are further composed of muscle cells or fibres.		
<u>Structure of muscle fibre or cell: (ETEA-2017,2020)</u>		
<u>1: Shape :-</u> Each muscle fibre is a long cylindrical, unbranched shaped.		
<u>2- Diameter :-</u> The diameter of muscle fibre is 10-100 μm .		
<u>3- Sarcolemma :-</u> Each muscle fibre is surrounded by a - membrane called sarcolemma.		
<u>4- Sarcoplasm :-</u> Each muscle fibre consists of a semi-fluid matrix called sarcoplasm or cytoplasm.		
<u>5- Organelles :-</u> Sarcoplasm of muscle fibre contains different organelles and biological molecules. i.e -		
<u>i: Nuclei :-</u> many nucleus near the periphery of each fibre.		
<u>ii: Sarcosomes :-</u> each muscle fibre contain a large number of mitochondria called sarcosomes.		
<u>iii: Sarco complex :-</u> each muscle fibre contain Golgi complex called Sarco complex.		
<u>iv: Sarcoplasmic reticulum :-</u> The endoplasmic reticulum of muscle fibre is called sarcoplasmic reticulum which can store a large amount of Ca^{+2} ion.		
<u>v: Molecules :-</u> Each muscle fibre contain - stored glycogen and myoglobin molecules (which give red colour to fibre).		

chapter-16	152	Support and movement
<u>6-T-tubules</u> :- The sarcolemma of each muscle fibre is invaginated at regular interval forming a T-shaped tubule called Transverse (T) tubule.		
<u>7-Triad</u> :- T-tubule along with the two adjacent invaginated Sarcoplasmic reticulum is known as triad. The nerve impulse is carried through T-tubule to the adjacent sarcoplasmic - reticulum from where Ca^{2+} ion release for contraction.		
<u>Ultra-structure of muscle fibre or cell</u> :		
At higher magnification, each muscle fibre-cytoplasm contains a large number of myofibrils. i.e. -		
<u>Myofibrils</u> :- The characteristics and components of myofibrils are -		
<u>1: Striped appearance</u> :- Each myofibril has alternate light and dark bands which give the fibre its striped appearances.		
<u>2: Diameter</u> :- Each myofibril has 1-2 μm in diameter.		
<u>3: Sarcomeres</u> :- The myofibril consists of smaller contractile units called sarcomeres which is the distance between two successive Z-Lines.		
<u>4: Light and dark bands</u> :- In each sarcomere a series of light and dark-bands are present along the length of each - myofibril. i.e. -		
<u>Light band</u> :- (isotropic band) - The light band is known as I-band (isotropic band) and also called non-polarized band - because it can not polarize the visible light.		
<u>Dark band</u> :- (Anisotropic band) - Each dark band is -		

chapter-16	153	Support and movement
Known as A-band (Anisotropic band) and also called - polarized band because it can polarize the visible light. <u>Other part of Light and dark bands:</u>		
<u>i- H-Zone:</u> < H stand for Hele mean bright > - Each dark-band has a lighter strips in its mid-section - called H-zone.		
<u>ii- M-line:</u> - The H-Zone is bisected by dark line called M-line, <medial-line>		
<u>iii- Z-line:</u> - < Z for zwischen means between > - Each light band has a darker stripe in its mid section - called Z-line.		
<u>S: myofilaments:</u> - Each myofibril consists myofilaments or contractile protein, which help in muscle movement.		
<u>Types of myofilaments:</u> - each myofilament is made up of central thick-filament surrounded by thin filament which Linked together by cross-bridges. i.e. -		
<u>i: Thick filament:</u> < myosin > -		
<u>myosin protein:</u> - The thick filament, which is about 16-nm in diameter, is composed of myosine protein.		
<u>Structure of thick filament:</u> - Each thick-filament or myosin molecule has a tail terminating in two globular heads. i.e. -		
<u>myosin Tail:</u> - myosin tail consists of two long polypeptide chains coiled together.		
<u>myosin head:</u> - myosin head is also consists of two light polypeptide chains. one lobe of head hydrolysis the ATP during		

contraction while the other lobe of head form cross bridge because they link the thick and the thin - Filaments - together during muscle contraction as it contains actin attachment site.



ii: Thin Filament : < Actin > -

Diameter :- Thin filaments are about 7-8 nm thick.

Actin protein :- The thin filament is composed of actin protein. Each actin molecule contains two polypeptide chains which overlap each other. Actin also contains myosin attachment site.

Tropomyosin :- Tropomyosin are two strands of another protein twisting around the actin chains. In relaxed condition tropomyosin covers all the active sites of actin-molecule to prevent contraction.

Troponin :- Troponin is other major protein in thin filament. It is actually 3-polypeptide complex, one binds to actin, another binds to Tropomyosin while 3rd binds to Ca^{+2} ions.

Q9 Explain the mechanism of contraction and relaxation of muscle.

Answer: muscle contraction:-

Contractility :- The ability of muscles to contract is known as contractility. When muscle contracts the length of each

chapter-16	155	Support and movement
------------	-----	----------------------

Sarcomere is reduced.

Sliding filament Hypothesis:

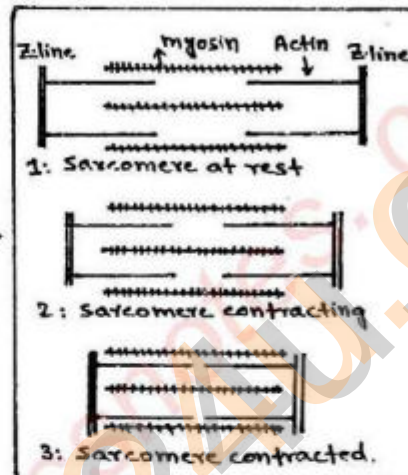
Development :- H-Huxley and A.F-Huxley and their colleagues suggested a hypothesis in 1954 to explain all events in muscle contraction, this is called sliding filament hypothesis or theory.

Explanation :-

According to this hypothesis the thin-filament slides over the thick filaments but there is no change in the original length of thin and thick filaments.

Mechanism of sliding filament :- (ETEA-2019)

- 1: unexposed actin binding site :- During relax condition the binding sites on thin filaments are unexposed so myosin heads cannot form cross-bridges with it.
- 2: Nerve impulse :- whenever a stimulus is received by receptors, that message will reach to CNS, and from CNS it carried by motor neuron into the cytoplasm of muscle fibre through T-tubule.
- 3: Release of Ca^{2+} ions :- Due to nerve impulse Ca^{2+} ions are release from Sarcoplasmic-reticulum (E.R).
- 4: Expose binding sites :- After releasing, Ca^{2+} ions binds to troponin, as a result the myosin and actin binding sites



Chapter-16	156	Support and movement
are exposed. <u>5: Formation of cross bridges:-</u> After exposing the binding sites, the myosin heads binds to binding sites of thin filament and form cross bridges with the help of energy released from ATP during hydrolysis at head region. <u>6: Sliding:-</u> After formation of cross bridges, the myosin pull the thin filaments toward it centre. as a result thin filament slide fast over thick-filaments and muscle is contracted. <u>7: Events occurs in contraction:</u> The following changes occur during muscular contraction. - i- Z-lines come closer together. - ii- I-band reduces. - iii- H-zone disappears. - iv- Thin filaments slide over thick filaments. - v- no changes occurs in A-bands. - vi- no changes occurs in the original length of thin and thick-filaments. <u>Muscle Fibres Relaxation: (Recovery)-</u> <u>1: Nerve impulse stop:-</u> After contraction of muscle, the nerve impulses, which are coming toward muscle fibres, stop-down. <u>2: Reaccumulation of Ca^{+2} ions:-</u> When nerve impulses stop-down the sarcoplasmic-reticulum again reaccumulates Ca^{+2} ions by active transport within milliseconds. <u>3: Cross bridge break up:-</u> The cross bridges, between myosin heads and binding sites of actin, breaks up with the help of energy released from hydrolysis of another ATP at head region.		

chapter-16	157	Support and movement
<u>4: Return of thin filament :-</u> After breaking of cross bridges the thin filaments return to their state of minimum overlap.		
<u>5: muscle relaxation :-</u> when thin filaments return to their original position the sarcomere once again attain their maximum length and muscle becomes relaxed.		
<u>Control of muscle contraction :</u>		
<u>All or none phenomenon (principle) :-</u>		
The contraction of each muscle fibre is based on "All-or-none principle" i.e- all of its fibrils participated in contraction.		
<u>Statement :-</u>		
It states that there will be complete contraction of muscle fibre if there is a stimulus while there would be no contraction in the absence of stimulus. but there is no incomplete - contraction of muscle fibre.		
<u>Explanation :-</u> when a muscle fibre receives message, it shows complete response or there is no response. There is no incomplete contraction in any muscle fibre. All muscle fibres contract with equal power, even that sometime the - contraction is less or more depend on stimulus intensity.		
<u>Motor units :</u>		
<u>Definition :-</u> A group of muscle fibres whose contraction is controlled by a single neuron is called motor unit.		
<u>Explanation :-</u> muscle contraction is a physical relationship between neurons and muscle fibres. The axon of a motor		

chapter-16	158	Support and movement
Neuron has many branches. Each branch of motor neuron ends up at a single muscle fibre. A group of muscle fibres whose contraction is controlled by a single motor is known as motor unit.		
<u>Work of motor unit</u>:- A particular muscle may have many motor units. Thus the strength of muscular contraction depends on the number of motor units involved. if less motor units are involved, muscular contraction will be weak, but if many - motor units are involved, muscular contraction will be very strong.		
<u>Threshold value</u>:- "Maximum value of stimulus to which response can be shown is known as Threshold value." Each stimulus has its own - threshold value. if stimulus intensity is below the threshold level then there will be no response.		
Q10 What is antagonism. Relate Knee pair of muscles in your body to antagonist movement.		
<u>Answer</u>:- <u>Antagonistic muscles</u>:		
<u>Introduction</u>:- Most muscles of our body work in pair in such a way that when one muscle contracts the other relaxes or vice versa. This type of muscles arrangement is called - antagonism and the muscles acting in this way are called antagonistic - muscles.		
<u>Explanation</u>:- Antagonistic muscles work in pair. one muscle		

is called Flexor and the other is called extensor. i.e.-

1: Flexor :

Definition :- It is the muscle which bends or flexes a Limb (arm, Leg) when contracts, is called a flexor.

Example :- Hamstrings muscles of our upper legs.

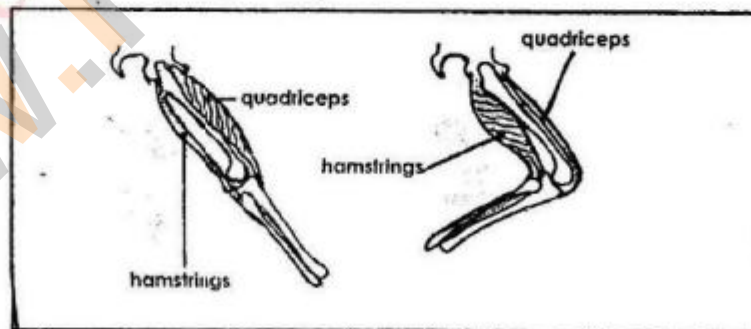
2: Extensor :

Definition :- It is the muscle which extend or straighten a limb (arm, leg) when contracts is called extensor.

Example :- Quadriceps muscles of our upper legs.

Mechanism of antagonism :- These two muscles quadriceps femoris and hamstrings of our legs act as opposing muscles i.e.-

- 1: when the Quadriceps muscles of our legs contracts, the hamstrings muscles relaxes and the legs is straighten or extended.
- 2: when the hamstrings muscles contracts, the Quadriceps - muscles relaxes and the legs is bent or flexed.
- 3: Therefore Quadriceps muscles is called extensor or - agonists while the Hamstrings muscles are called flexor or antagonists.



chapter-16	160	Support and movement
Q11 write the different problems or disorder of muscles.		
Answer: muscle problems:		
1: muscle cramps:		
Definition :- The prolong painful contraction of one or more muscles is called muscle cramps.		
Example :- writer's cramp is a familiar example of - temporary contractures.		
Causes and risk factors :-		
1- Straining and over use of muscle.	5: Aging.	
2- Dehydration and lack of minerals.	7: Depletion of oxygen.	
3- compression of nerve and narrowing of arteries.		
4- Imperfect posture of muscle.		
6- Heavy exercise.		
8- Formation of lactic-acid in muscles.		
9- more common during pregnancy.		
10- Diabetes, nerve, Liver or thyroid-disorders.		
Symptoms of muscle cramps:		
1: Involuntary contraction and spasm. Muscle stretched and tight.		
2: muscle pain occurs at night or even after prolonged exercise		
3: person is unable to write properly like in writer's cramp 2		(Dystonia).
4: contraction of eye muscle (Blepharo spasm).		
5: most muscle cramps develop in the leg-muscles.		
Treatment of muscle cramp:		
1- physical therapy.	2- Stay well hydrated.	

chapter-16	161	Support and movement
------------	-----	----------------------

3- Medications also helps to relax muscles.

2: muscle Fatigue :-

Definition :- muscle fatigue is a state of physical inability to contract. —OR— "Reduced capacity of muscle to do work after prolonged stimulation is known as muscle fatigue".

Reason :- complete lack of ATP causes permanent — contraction of muscle. This is because when muscle is — contracted, myosin remains attached to actin in contracted form until new ATP arrives. But if there is no ATP, a condition of permanent contraction arise which causes fatigue

Causes and risk factors :

- 1: Accumulation of lactic-acid in muscle.
- 2: excess concentration of K^+ and interacellular chloride.
- 3: mal-nutrition (Deficiency of nutrients).
- 4: Heavy exercise or work
- 5: Emotional disturbance.
- 6: Depletion of glucogen and oxygen.
- 7: less availability of ATP in muscles.
- 8: Infections.
- 9: Defect in circulatory, respiratory and endocrine systems.

Symptoms of muscle fatigue:

1- multi-joint pain without redness or swelling.	
2- Shortness of breath.	3- muscle pain.
4- lack of sensation.	5- weight loss.
6- Anxiety and depression	7- chest pain.
8- muscles reduce the ability to generate force.	

chapter-16	162	Support and movement
------------	-----	----------------------

9- Diarrhea, Fever, chills, vomiting and lack of motivation.

Recovery :- IF Fatigue is caused by short and rapid - activity, then its recovery will also be rapid. However, if Fatigue is caused by low intensity exercise for long duration, then its recovery also takes several hours.

prevention of muscle fatigue :-

1: maintain a well balanced diet.	4: improve aerobic-
2: Drink more water as much possible.	capacity.
3: prevent dehydration, electrolyte loss.	5: etc.

3: Tetany :

Definition :- Tetany is medical-condition which involves involuntary contraction of muscle due to diseases or any condition that increases action potential towards muscle cells.

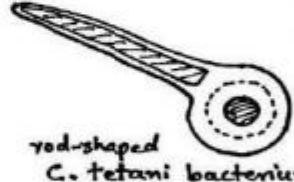
Occurance :- The spasm and twitching of muscles particularly those of face, Hand and feet is called tetany.

Causes and risk factors :

- 1: Reduction of Ca^{2+} level in blood (Hypocalcemia)-
- 2: underfunction of parathyroid gland (Hypoparathyroidism).
- 3: low level of CO_2 and Mg^{+} .
- 4: Severe diarrhea.
- 5: some medication may lead to tetany.
- 6: Kidney diseases, pancrease-disease, pregnancy, etc.
- 7: malnutrition, vitamin-D-deficiency.
- 8: Electrolyte imbalance.

Symptoms of Tetany :- The common symptoms of tetany are

chapter-16	163	Support and movement
1- cramping in hand and feet muscles. 2- painful involuntary contraction. 3- swelling and redness of muscles. 4- Tingling and numbness 5: shortness of breath. 6- muscle achness or pain. 7: Vomiting, convulsions, seizures 8- Unusal sensations in the hands or feet.		
<u>Treatment and prevention :</u>		
1- Intravenous calcium is given to quickly restore Ca^{+2}-levels. 2- Infusion of calcium or megnesium. 3- Drinking of much more water. 4- oral calcium plus vitamin-D administration. 5- use balance diet. 6: Exercise 7- warming the muscle with heat pad.		
<u>4: Tetanus : <lock jaw> - (ETEA-2019)</u>		
<u>Definition :-</u> The infection of nervous system leading to painful muscle contraction particularly of jaw and neck-muscle is called Tetanus.		
<u>causes :- <causal Agent>-</u> The bacterium which cause this disease is called "clostridium - Tetani". This bacterium is found in soil, dust and animal feces. Such bacteria live in the form of spores, in an inactive form. But they can remain infectious for more than 40-years. Such bacteria enters to human body by wounds. inside the body it produce toxin or poison called Tetanospasmin.		

chapter-16	164	Support and movement
<u>Mode of action</u>:- Tetanospasmin which is produced by - Tetanus bacteria, block the nerve signals from spinal cord to motor neurons which cause severe muscle spasm <— involuntary movement>. The spasm can be so powerful that they tear the muscle or cause fracture of the spinal cord.		
<u>Symptoms of Tetanus</u>: 1: painful contraction of body-muscles. 2: Spasm and stiffness in jaw muscles. 3: Difficulty in swallowing. 4: Stiffness in neck and abdominal muscles. 5: Fever, sweating, elevated blood pressure, abnormal heart beat.		
<u>Treatment and prevention</u>:- 1- proper cleaning of wounds. 2- Tetanus-antitoxin medicines is - usually injected to neutralize toxins. 3- Vaccines against Tetanus are used to immunize children. e.g- Toxoid-Vaccines. 4- medications may be used to help regulate involuntary - muscle activity. 5: cover the wound.		
		 rod-shaped C. tetani bacterium
<u>Difference between tetany and tetanus</u>:		
<u>Introduction</u>:- Tetany is a clinical sign or manifestation in a certain conditions while tetanus is a bacterial disease-or- Infectious disease. In fact, tetany can be a clinical sign of - tetanus.		

chapter-16	165	support and movement
<u>Difference :-</u>		
The following are important difference between the two -		
1: <u>Tetany</u> :- Tetany is involuntary muscle contraction or spasms occurs due to hyper-excitability of the underlying muscle - which is multiple cause such as - hypercalcemia, mal function of parathyroid gland, severe diarrhea, etc.		
2: <u>Tetanus</u> :- Tetanus is caused by a toxin produced by C.tetani which affects the neurons, leading to uncontrolled impulses, which leads to muscle-spasms, abnormal heart rate, blood-pressure, sweating, fever, stiffness in jaw muscles, etc.		
End		
<u>Note for Question No-2:</u>		
Table: 16.3 The 28 bones of the skull are tabulated here.		
Skull	Unpaired bones	Paired bones
Cranium bones 8	Frontal Occipital Sphenoid Ethmoid	Parietal Temporal
Facial bones (face) 14 bones	Mandible Vomer	Maxilla Zygomatic Lacrimal Nasal Inferior concha Palatine
Auditory ossicle (ear bones) 6 bones		Malleus Incus Stapes

chapter-16	166	Support and movement
------------	-----	----------------------

Exercise

Exercise MCQs

A . Multiple Choice Questions (MCQs).

1. Which of the following symptoms is NOT caused by tetanus?
 a) Muscle spasms b) Respiratory failure c) Lockjaw **d) Increased appetite**
2. Cartilage tissue:
 a) Has a rich blood supply. b) Has ability for a quick regeneration.
c) Has chondrocytes as precursor cells. d) Is solid and firm but pliable.
3. Major inorganic components of vertebrate bone is
 a) Calcium carbonate **b) Calcium phosphate**
 c) Potassium hydroxide d) Calcium chloride
4. A condition that produces a reduction in bone mass sufficient to compromise normal function is _____.
 a) osteomalacia b) osteomyelitis **c) osteoporosis.** d) osteopenia
5. The cells that maintain mature compact bone are _____.
 a) chondrocytes b) osteoclasts **c) osteoblasts** d) osteocytes
6. The bones in the long axis of the body make up the _____.
 a) long bones b) appendicular skeleton c) trabeculae **d) axial skeleton**
7. Bone-forming cells originate from _____.
 a) osteoprogenitor cells **b) osteoblasts** c) osteocytes d) osteoclasts
8. Hydroxyapatite in bone matrix that gives bone its hardness is primarily composed of
a) calcium and phosphates b) calcium and osteoclasts
 c) calcium and vitamin D d) calcium and osteocytes
9. The joint between skull bone is an example of
 a) ball and socket joint b) hinge joint
c) immovable joint d) slightly moveable joint
10. In an antagonistic pair, the muscles work
 a) parallel **b) opposite** c) equal d) perpendicular
11. Which one is the longest bone in the human body?
 a) stapes b) humerus c) ulna **d) femur**
12. Total number of bones found in right upper limb is:
a) 32 b) 24 c) 26 d) 60
13. How many bones are present in human skull?
 a) 42 b) 32 c) 12 **d) 22**

chapter-16	167	support and movement
14. Number of floating ribs in humans are: ☐ a) 2 pairs ☐ b) 3 pairs ☐ c) 4 pairs ☐ d) 12 pairs 15. Identify the type of joint is found in wrist: ☐ a) Saddle joint ☐ b) Gliding joint ☒ c) Pivot joint ☐ d) Hinge joint 16. Which of the following is a Ball and Socket joint ☐ a) Ankle joint ☐ b) Elbow joint ☒ c) Shoulder joint ☐ d) Thumb joint 17. Which of the following is a part of the pectoral girdle? ☐ a) Sternum ☒ b) Clavicle ☐ c) Pelvic bone ☐ d) Hyoid bone 18. Which of the following is associated with pain in the lower back in a person ☐ a) Thoracic vertebrae ☐ b) Cervical vertebrae ☐ c) Coccygeal vertebrae ☒ d) Lumbar vertebrae 19. One of the following is NOT a part of the axial skeleton. ☐ a) Sternum ☐ b) Vertebral column ☒ c) Scapula ☐ d) Skull 20. Which of the following joints can move in only direction? ☒ a) Hinge joint ☐ b) Ball and Socket joint ☐ c) Gliding joint ☐ d) Pivot joint 21. Knee cap is technically called as: ☐ a) clavicle ☒ b) patella ☐ c) radius ☐ d) femur 22. Which bone is not attached to any other bone in the human body? ☐ a) Stapes ☐ b) Patella ☒ c) Hyoid ☐ d) Scapula 23. The organic portion of bone's matrix is important in providing all but; ☐ a) tensile strength ☐ b) hardness ☐ c) resist stretch ☒ d) flexibility 24. In skeletal muscle, calcium facilitates contraction by binding to ☐ a) tropomyosin ☐ b) actin. ☒ c) troponin. ☐ d) myosin. 25. The function of the T tubules in muscle contraction is to ☐ a) make and store glycogen ☐ b) release Ca^{2+} into the cell interior and then pick it up again ☒ c) make the action potential deep into the muscle cells ☐ d) to hamper the nerve impulse 26. Muscles utilized for controlling the flow of all substances within lumen are grouped as ☐ a) hormonal system ☐ b) skeletal system ☐ c) cardiac muscles ☒ d) smooth muscles 27. A small band of dense, white and fibrous elastic tissue is grouped as ☒ a) ligament ☐ b) muscle junction ☐ c) muscle filament ☐ d) muscle cartilage 28. In the striated muscles, the functional unit of contractile system is ☐ a) Z band ☐ b) cross bridges ☒ c) sarcomere ☐ d) myofibril		

chapter-16	168	Support and movement
Short Questions		
Q1: - what are the main difference b/w bone and cartilage.		
Ans:-	Bone:	Cartilage: (ETEA-2012)
1: It is hard, inelastic and tough.	1: It is soft, elastic and flexible.	
2: Mature cells are osteocytes.	2: Mature cells are chondrocytes.	
3: Matrix contains collagen-I.	3: Matrix contains collagen-II.	
4: Bones have rich blood supply	4: No blood circulation in cartilages	
5: Matrix is mostly inorganic.	5: Matrix is mostly organic.	
6: They are constantly reshaped	6: Cartilage are not reshaped.	
7: Bone marrow is present	7: Bone marrow is absent.	
8: They are 2-types - compact and spongy bones.	8: They have 3-types - Hyalin, elastic and fibro cartilage.	
Q2: - Enlist the main components of axial & appendicular skeleton.		
Answer: Axial skeleton:		
<u>Definition</u> :- The skeleton which is present or located in the mid body is called axial skeleton.		
<u>Main components</u> :- axial skeleton consists of-		
1: <u>Skull</u> :- It contain - 8-cranium bone, 14-facial bones, 6-ear bones and one neck bone.		
2: <u>Vertebral column</u> :- It contain 33-vertebrae and 26-bones.		
3: <u>Ribs</u> :- It contain 24-ribs or 24-bones.		
<u>Appendicular skeleton</u> :		
<u>Definition</u> :- The skeleton which is located or present in		

chapter-16	169	Support and movement
Limbs (appendages) is called appendicular skeleton. <u>Main components</u> :- Appendicular skeleton consists of - 1: <u>pectoral girdle</u> :- It contains 3-bones. 2: <u>Fore Limbs</u> :- It contain 30-bones. 3: <u>pelvic girdle</u> :- It contain two coxal bone, each one further consists of 3-bones. 4: <u>Hind Limbs</u> :- It also contain 30-bones.		
Q3:	- Name the 3-types of joints and list down the fundamental functions of joints	
	<u>Answer</u> :- See Question No-3. (write only functions of - Fibrous joint, cartilaginous joint and synovial joint.)	
Q4:	- what do you mean by disc slip and which factors contribute to disc slip?	
	<u>Answer</u> :- See Question No-4 (write only part-1 - disc slip)	
Q5:	- what is sprain and how sprains are treated.	
	<u>Answer</u> :- See Question No-6 (write only part-2 - sprain).	
Q6:	- Differentiate b/w tetany and tetanus.	
	<u>Answer</u> :- See Question No-10 (write only last part of Q-10).	
Q7:	- what is the function of intervertebral discs.	
	<u>Answer</u> :- <u>Function of Intervertebral discs</u> :- The discs throughout the spine have 3-primary functions. i.e.-	
	1: They act as a shock absorbers in the spine, positioned between each bony vertebra.	
	2: They as a tough ligments that hold the vertebrae of spine together.	

chapter-16	170	Support and movement
------------	-----	----------------------

3: They are cartilaginous joints which allow for slight - mobility in the spine.

Q8: - Distinguish b/w the annulus fibrosus and anulus pulposus.

Answer: Intervertebral disc: region of a disc

Definition :- vertebrae in the vertebral-column are connected with one another by a cushion like pad called intervertebral disc.

parts of disc :- Intervertebral disc consists of 2- parts i.e-

1: Annulus fibrosus :- It is the hard outer part of disc. It is made of fibro-cartilage. It holds vertebrae together.

2: Nucleus pulposus :- It is the inner semi-fluid part of disc. It act as a rubber ball to give elasticity to disc.

Long Questions

Q1: - Describe the structure of bone.

Answer :- See Question No-1 (write only bone topic) -

Q2: - Describe major divisions of human axial-skeleton.

Answer :- See Question-2. (write only axial-skeleton).

Q3: - what are types of fractures. Describe the repair process of a simple fracture.

Answer :- See Question No-5.

Q4: - Compare smooth, cardiac, and skeletal muscles.

Answer :- See Question No-7. (write only types of muscles).

Q5: - Explain the ultra-structure of human skeletal muscle.

Answer :- See Question No-8.

Q6: - Explain the sliding filament theory of contraction using appropriately labeled diagrams of a relaxed and a contracted Sarcomere.

Answer: - See Question No-9. <write only sliding filament hypothesis with mechanism in Question No-9>.

Q7: - Describe the structure of a Sarcomere and indicate the relationship of the Sarcomere to the myofibril.

Answer: - See Question No-8. <write only from Sarcomere to last of Question No-8>.

End

Note for Question No-2 in theory:

Table: 16.2 Distribution of bones in human body.

Main part	Subdivision		Total bones
Skull	Cranium	8 bones	28
	Ears	6 bones	
	Face	14 bones	
Neck	Hyoid	bone 1	1
Trunk	Vertebral column	26 bones	51
	Chest bone	1	
	Ribs	24 bones	
Limbs	Upper limbs	64	126
	Lower limb	62	

Chapter-16	172	ETEA - MCQs
Previous Entry Test MCQ's of Biology Chapter No -16: (Support and Movement)		2012 ETEA
2005 ETEA 1. The number of vertebrae in vertebral column of man are: (a) 37 (b) 35 (c) 34 (d) 33 2. The number of vertebrae in Coccyx is (a) 2 (b) 3 (c) 4 (d) 5		8. Fatigue free muscles are: (a) Striped (b) Unstriped (c) Cardiac (d) Triceps 9. The colour of bone marrow is: (a) Red (b) Yellow (c) Orange (d) Both A and B 10. A none -connective tissue is: (a) Areolar tissue (b) Tendon (c) Neuron (d) Ligament 11. Regeneration of cartilage is carried on by: (a) Collagenous fibers (b) Blood vessels (c) Perichondrium (d) Matrix 12. Process of bone formation is called (a) Calcification (b) Chondrification (c) Decalcification (d) Ossification 13. Bicep muscle is attached to the hummers by: (a) Tendon (b) Ligaments (c) Elastic fibers (d) Areolar
2006 ETEA 3. The cartilage present in trachea is (a) Fibrous (b) Hyaline (c) Elastic (d) Neurotic		2013 ETEA
2008 ETEA 4. The human sacrum consists of how many vertebrae: (a) Two (b) Three (c) Four (d) Five 5. Bones are held together of the joints by: (a) Tendons (b) Smooth muscles (c) Ligaments (d) Nerves		14. Contraction can be sustained for a long period of time by: (a) Skeletal muscles (b) Smooth muscles (c) Cardiac muscles (d) All of the above 15. Bones is surrounded by a membrane called: (a) Perichondrium (b) Prostomium (c) Perimycium (d) Periosteum
2010 ETEA 6. Heart muscles are called: (a) Smooth muscles (b) Myogenic muscles (c) Striated muscles (d) Skeletal muscles		2014 ETEA
2011 ETEA 7. A network of tubules that runs through compact bone is called the: (a) Haversian canal (b) Periosteum (c) Marrow (d) Joint		16. The bone dissolving cells are called. a) Osteoclast b) Osteoblasts c) Osteocytes d) Fibroblast

chapter-16

173

ETEA-MCQs

2015 ETEA

17. Osteopenia starts at the age of -

a). 30-40 b). 30-35
c). 40-45 d). 50-60

2016 ETEA

18. Mature cells of cartilage are...

a) Chondrocytes b) Osteocytes
c) Osteoblasts d) Osteoclasts

2017 ETEA

19. In which of the following disorder the structure and function of normal spinal cord is damaged?

(a) Arthritis (b) Sciatica
(c) Spondylosis (d) Disc slip

20. Sarcolemma is the membrane around?

(a) Bone (b) Joints
(c) Muscle fiber (d) Heart

2018 ETEA

21. Piriform is syndrome is associated with which of the following disorder:

(a) Arthritis (b) Sciatica
(c) Spondylosis (d) Disc slip

22. The number of Hyoid bone in human skull region is:

(a) 1 (b) 6 (c) 22 (d) 206

2019 ETEA

23. Tetanus is the infection of:

(a) Respiratory system
(b) Nervous system
(c) Circulatory system
(d) Bones and muscles

24. Which one of the following items gives it correct total number?

(a) Cervical vertebrae-7
(b) Floating ribs in human-3

(c) Auditory ossicles-8

(d) Cranium bones-4

25. During muscles relaxation the calcium ions are:

(a) Released from sarcoplasmic reticulum into sarcoplasm
(b) Forced back from sarcoplasm to sarcoplasmic reticulum
(c) Further forced from sarcoplasmic reticulum into sarcoplasm
(d) Neither released more nor forced back but remain constant

26. In the human skull the unpaired bones are:

(a) Frontal, occipital, ethmoid and sphenoid
(b) Frontal, ethmoid, sphenoid and zygomatic
(c) Ethmoid, sphenoid, zygomatic and frontal
(d) Temporal, Sphenoid, frontal and ethmoid

27. Which one of the following bone is the only moveable portion of the skull?

(a) Maxilla (b) Frontal bone
(c) Mandible (d) Zygomatic

2020 ETEA

28. What do we call the cell surface membrane of a muscle fibre?

a. Sarcolemma
b. Plasma membrane
c. Sarcoplasm d. Myofibrils

Key: -

1.d	2.c	3.b	4.d	5.c	6.b
7.a	8.c	9.d	10.c	11.c	12.d
13.a	14.b	15.d	16.a	17.a	18.b
19.c	20.c	21.b	22.a	23.b	24.a
25.b	26.a	27.c	28.a		

More Notes, Books Visit Now: www.Perfect24u.com

www.Perfect24u.com