Physiology and Injuries in Sports

1. Given below are two statements labelled Assertion (A) and Reason (R). (2024)

Assertion (A): The Basal Metabolic Rate (BMR) is the number of calories needed to maintain body function at resting condition.

Reason (R): A person who does not engage in any work, still requires energy for the functioning of their internal organs.

In the context of the above two statements, which of the following option is correct?

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false, but Reason (R) is true.

Ans. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

2. Given below are two statements labelled Assertion (A) and Reason (R). (2024)

Assertion (A) : In a normal standing posture, both knees touch each other, while there is a gap of 3-4 inches between the ankles.

Reason (R): It is due to Genu Valgum and it can develop due to an injury or infection in the knee or leg, rickets, severe lack of vitamin D and calcium, obesity, or arthritis in the knee.

In the context of the above two statements, which one of the following option is correct?

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

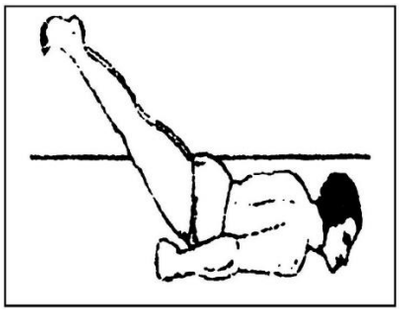
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false, but Reason (R) is true.

Ans. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

3. Identify the asana shown in the picture given below and choose the correct option from the following: (2024)



(a) Bhujangasana

(b) Katichakrasana

(c) Pawanmuktasana

(d) Shalbhasana

Ans. (d) Shalbhasana

4. Which of the following asana is useful for relaxation and removing fatigue ? (2024)

(a) Chakrasana

(b) Shavasana

(c) Makarasana

(d) Uttanpadasana

Ans. (b) Shavasana

5. Describe any three physiological changes due to ageing. (2024)

Ans. Physiological changes due to ageing : -

1. Changes in metabolism and body composition

2. Changes in respiratory system

3. Changes in brain and nervous system

4. Changes in digestive system

5. Changes in excretory system

6. Changes in sensory organs

7. Changes in endocrine system

8. Decline in muscle strength

9. Diminishes memory

10. Decrease in cardiovascular function,

11. Loss of bone density

12. Decrease in body mass

13. Decrease in mobility

(Explain any 3 points out of the above-mentioned point, or any other relevant points)

6. Study the pictures given below : (2024)

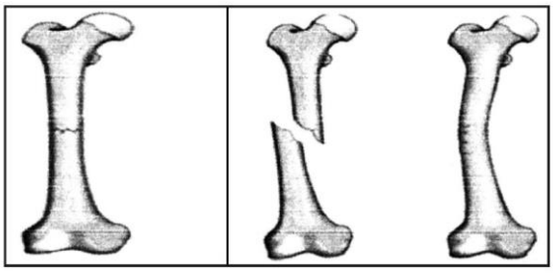


Image-1 Image-2 Image-3

Based on the above study and your knowledge, answer the following questions:

(a) Which type of fracture you see in image-1 ?

Ans. Transverse fracture

(b) When a bone breaks diagonally as shown in image-2, it is known as _____ .

Ans. Oblique fracture

(c) _____ fracture occurs when the broken ends of the bones are jammed together by the force of the injury.

Ans. Impacted fracture

(d) In which type of fracture bone is broken, splinted, or crushed into number of pieces ?

Ans. Comminuted fracture

7. Describe types of fracture. (Any Four) (2024)

Ans. Types of fracture :-

Stress Fracture - Stress fractures are tiny cracks in a bone

Green stick Fracture - A fracture in a soft bone, in which the bone bends.

Oblique Fracture - Oblique fracture occurs when a bone is broken at an angle/diagonally.

Impacted Fracture - An impacted fracture occurs when the force of the injury jams the broken ends of the bone together.

Comminuted Fracture - A comminuted fracture is one in which the broken ends of the bone are shattered into many pieces.

Transverse Fracture - Transverse fracture occurs when the bone is broken perpendicular to its length.

(Explain any 4 fractures from the above-mentioned fractures)

Previous Years' CBSE Board Questions

7.1 Physiological Factors Determining Components of Physical Fitness

LA (5 marks)

1. Explain the physiological factors determining speed. *(AI 2017)*

7.2 Effect of Exercise on the Cardio Respiratory System

VSA (1 mark)

2. What do you mean by 'Cardiac Output'? *(2018, Delhi 2016)*

SA (3/4 marks)

3. Discuss in detail 2 long term and 2 short term effects of exercise on cardio respiratory system. *(Term-II, 2021-22)* R

4. Maintaining physical activities for a longer period brings desirous changes in circulatory system. Justify your answer by highlighting three benefits of exercise. *(Delhi 2015)*

LA (5 marks)

5. What is the effect of exercise on cardio respiratory system and muscular system ? *(2020)*

6. What are the long term effects of regular exercise on the cardio-vascular system? Explain. *(2018)*

7. What do you mean by 'Oxygen-Intake' and 'Oxygen-Uptake'? Explain the effects of exercise on Respiratory system. *(Delhi 2017)*

7.3 Effect of Exercise on the Muscular System

VSA (1 mark)

8. Explain the term hypertrophy of muscles. *(Delhi 2017, Delhi 2015)*

9. Suggest any two Isometric exercises for shoulder region. *(Delhi 2015)* R

SA (3 marks)

10. What do you know about the term 'cardiac output'? *(2018)*

7.4 Physiological Change due to Ageing

SA (3 marks)

11. "Regular physical activity can delay your ageing process." Justify your answer in the light of the effect of activities on physiological changes. *(AI 2015)* Ap

7.5 Sports Injuries : Classification (Soft Tissue Injuries : Abrasion, Contusion, Laceration, Incision, Sprain and Strain ; Bone and Joint Injuries – Dislocation, Fractures – Green Stick, Comminuted, Transverse Oblique and Impacted)

MCQ

12. Match List 1 and List 2, selecting the correct option :

Sr. No.	List 1		List 2
1.	Abrasion	A	Joint Injury
2.	Green Stick Fracture	B	Soft Tissue Injury
3.	Shoulder Dislocation	C	Cause of Sports Injury
4.	Lack of Fitness	D	Bone Injury

	1	2	3	4
(a)	A	B	C	D
(b)	B	D	A	C
(c)	B	D	C	A
(d)	D	B	A	C

(2020) Ev

VSA (2 marks)

13. Elucidate any four types of fractures. *(2023)*

SA (3/4 marks)

14. Draw diagram and explain the management of any 2 types of bone injury. *(Term-II, 2021-22)*

15. Discuss the preventive measure of sports injuries. *(2020)*

LA (5 marks)

16. Contusion and dislocation are common sports injuries. Write in detail about the symptoms and management of these injuries. *(Delhi 2019)*

17. What are the causes of 'Sports-Injuries'? How Sports-Injuries can be prevented? Explain briefly. *(Delhi 2017)* R

7.1 Physiological Factors Determining Components of Physical Fitness

MCQ

1. Physiological factors determining speed:
   (a) Explosive strength (b) Body weight
   (c) Muscle composition (d) Both (a) and (b).
   (2020-21)

SA (3/4 marks)

2. Explain any three physiological factors determining strength. *(2022-23)* R

3. Discuss physiological factors determining speed. *(Term-II, 2021-22)*

7.3 Effect of Exercise on the Muscular System

VSA (2 marks)

4. List any four changes happening in the muscular system due to exercising. *(Term-II, 2021-22)*

7.5 Sports Injuries : Classification (Soft Tissue Injuries : Abrasion, Contusion, Laceration, Incision, Sprain and Strain ; Bone and Joint Injuries – Dislocation, Fractures – Green Stick, Comminuted, Transverse Oblique and Impacted)

MCQ

5. Gliding movement occurs at which joint?
   (a) Knee (b) Hip
   (c) Wrist (d) Elbow
   (Term-I, 2021-22)

6. _____ bone comes out of socket in hip dislocation.
   (a) Femur
   (b) Humerus
   (c) Tibia
   (d) Fibula *(2020-21)*

7. Dislocation is related to
   (a) Bone injury
   (b) Skin Injury
   (c) Muscular injury
   (d) Joint injury *(2020-21)*

8. Fracture where a part of broken bone enters another bone
   (a) Simple fracture
   (b) Compound fracture
   (c) Impacted fracture
   (d) Green stick fracture *(2020-21)*

VSA (2 marks)

9. Explain any two types of soft tissue injuries with the help of examples. *(2022-23)*

10. What is Laceration and how can it be managed? *(Term-II, 2021-22)*

SA (3 marks)

11. Create a flowchart to explain classification of sports injuries. *(Term-II, 2021-22)* Ap

OR

Create a flow chart for common Sports Injuries while enlisting the sub parts. *(2020-21)*

ANSWERS

Previous Years' CBSE Board Questions

1. Speed of a sports person is determined by following factors:

(a) The mobility of nervous system : The contraction and relaxation of the muscles is controlled by the nervous system. The frequency of contraction and relaxation of muscles is determined by the excitability of the nerves. Mobility of nervous system means excitation and relaxation of motor nerves that causes contraction and relaxation in muscles. The mobility of nervous system is of great importance in sprinting, running, etc. The mobility of nervous system can be increased up to a certain extent by training and better skills.

(b) Muscle composition : Our muscles are composed of three types of fibers **Type I, Type IIA and Type IIB.** Hence speed to a great extent is determined by the overall ratio of the muscle fibers in the body of an athlete. Though this is genetically determined, with correct training the performances can be adequately improved.

(c) Explosive strength : Explosive strength is vital for every quick and explosive movement. Examples of such quick movements include a quick punch in boxing, jerk lift in weight lifting, point of start in sprinting, etc. Explosive

strength depends on muscle composition, muscle size, metabolic process and muscle coordination. All factors that determine explosive strength can be improved by training, except muscle composition (it is determined genetically and cannot be modified).

(d) Flexibility : It is the ability of the body to allow maximum range of movement of muscles and joints. If there is flexibility, there is freedom of movement that allows muscles to move at a faster rate. It also is an important factor in executing explosive strength in a sporting activity. Flexibility allows maximum range of movement without internal resistance; thus flexibility reduces the chances of injury.

(e) Bio-chemical reserves and metabolic power : For muscles to work continuously at high speed, it requires more energy, which is consumed at a very high rate. For this purpose adenosine triphosphate (ATP) and creatine phosphate (CP) stores in the muscles should be enough. In case energy stores get depleted, then the speed of contraction of muscles decreases, which also leads to the reduction of speed. The storing capacity of ATP, and CP can be increased by training. The release of energy from ATP, largely depends on metabolic rates of the athlete.

When glucose stores are used up the body begins to convert glycogen to glucose by enzymatic action. This is more important for sports that last for longer duration. This again stresses the importance of metabolic power and bio-chemical energy reserves in the body.

2. Cardiac output is measured as litres per minute. Cardiac output is the amount of blood pumped in one minute. Thus, it can be increased with either increase in stroke volume or heart rate or both. Regular exercise is helpful in increasing cardiac output of the heart. The players who regularly exercise are found to have resting cardiac output of 25-35 liters per minute whereas the cardiac output of untrained individuals is 14-20 liters per minute at rest.

3. Short term and long term effects of cardio respiratory system are:

Short term effects:

(i) **Increased heart rate :** Normal human resting heart rate is about 72 beats per minute though elite sports persons often have a resting heart rate close to 40. Heart rate increases before an important activity this is called "anticipatory response". Increase in heart rate before an exercise regimen is the anticipatory response. As an individual begins exercising the heart rate increases as the exercise becomes more intense.

(ii) **Increase in stroke volume :** Stroke volume is the amount of blood pumped by the left ventricle of the heart in one contraction. Normal stroke volume for healthy adult male is considered to be 70 ml/beat. In case of elite athletes, it can be as high as 100 ml/beat. (This also explains how they can manage with a low resting heart rate – since one stroke volume is about 40% larger). During intense exercise the stroke volume can double.

Long-term effects :

(i) **Increase in the size of heart :** After performing an exercise for a long time, the strength and size of heart increases. In fact, left ventricle adapts the most. Heart walls grow thick and the muscles become strong.

(ii) **The decrease in resting rate :** Regular exercise for a long period of time decrease to the resting rate of the heart. It is observed that after a period of 10-week training, resting rate reduces from 72 beats per minute to 60 beats per minute. After exercising for a long period of time, efficiency of the heart increases. Thus at rest, it can pump adequate blood in fewer beats. Elite athletes have their resting heart rate between 30-40 per minute.

Commonly Made Mistake

- Sometimes students get confused between immediate and long term effects of exercise on cardio-respiratory system.
  Short term effects occur immediately as someone begin to exercise while long term effects are more concerned with adaptive changes over time with regular exercise.

4. Regular exercise positively affect the circulatory the system because of the following improvements:

(a) Improves cardiovascular endurance, that is the heart, lungs and blood vessels deliver more oxygen to the muscles.

(b) The decrease in resting rate of the heart : Regular exercise for a long period of time decreases the resting rate of the heart. It is observed that after a period of 10-week training, resting rate reduces from 72 beats per minute to 60 beats per minute. After exercising for a long period of time, efficiency of the heart increases. Thus at rest it can pump adequate blood in fewer beats. Elite athletes have their resting heart rate between 30-40 per minute.

(c) Increase in tidal air capacity : Tidal air capacity is the lung volume representing the normal volume of air displaced between normal inhalation and exhalation when extra effort is not applied. In a healthy, young human adult, tidal volume is approximately 500 mL. In people doing exercise for a long time and having normal lung function, the tidal volume can double to 1000 mL.

5. The effects of exercise on cardio respiratory system:

(i) **Increased heart rate :** Normal human resting heart rate is about 72 beats per minute though elite sports persons often have a resting heart rate close to 40. Heart rate increases before an important activity this is called "anticipatory response". Increase in heart rate before an exercise regimen is the anticipatory response. As an individual begins exercising the heart rate increases as the exercise becomes more intense.

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about 40% larger). During intense exercise the stroke volume can double.

Effects of exercise on muscles :

(i) **Increased heart rate :** Normal human resting heart rate is about 72 beats per minute though elite sports persons often have a resting heart rate close to 40. Heart rate increases before an important activity this is called "anticipatory response". Increase in heart rate before an exercise regimen is the anticipatory response. As an individual begins exercising the heart rate increases as the exercise becomes more intense.

(ii) **Increase in stroke volume :** Stroke volume is the amount of blood pumped by the left ventricle of the heart in one contraction. Normal stroke volume for healthy adult male is considered to be 70 ml/beat. In case of elite athletes, it can be as high as 100 ml/beat. (This also explains how they can manage with a low resting heart rate – since one stroke volume is about 40% larger). During intense exercise the stroke volume can double.

6. Long term effects of exercising on cardiovascular system are as follows :

(a) **The increase in the size of heart :** After performing an exercise for a long time, the strength and size of heart increases. In fact, left ventricle adapts the most. Heart walls grow thick and the muscles become strong. The thickness derived from exercising is healthy because the heart has to do the extra work only for about an hour. Whereas with high blood pressure it has to work continuously.

(b) **The decrease in resting rate :** Regular exercise for a long period of time decrease the resting rate of the heart. It is observed that after a period of 10-week training, resting rate reduces from 72 beats per minute to 60 beats per minute. After exercising for a long period of time, efficiency of the heart increases. Thus at rest it can pump adequate blood in fewer beats. Elite athletes have their resting heart rate between 30-40 per minute.

(c) **Stroke volume increases :** Stroke volume (amount of blood pumped with the single heartbeat) increases. Estimated average stroke volume amounts range between 50 to 70 ml at rest. Elite athletes have estimated stroke volumes between 90 to 110 ml at rest.

(d) **The increase in cardiac output at rest :** Cardiac output is the amount of blood pumped in one minute. Regular exercise is helpful in increasing cardiac output of the heart. The players who regularly exercise are found to have resting cardiac output of 25-35 liters per minute whereas the cardiac output of untrained individuals is 14-20 liters per minute at rest.

(e) **Increased blood vessels :** To meet energy requirement of muscles, more blood has to reach there with nutrients and oxygen. Thus, the number of the capillaries increases. Capillaries also widen to facilitate the blood flow. As a result, blood supply becomes more efficient and effective.

(f) **Decreased blood pressure :** After doing regular exercise for a long period of time, blood pressure decreases and the symptoms of hypertension disappears. The decrease in systole blood pressure can be as much as 10 mm of mercury. Hence, reducing the chances of heart attack. However, patients with hypertension must first consult their physician before beginning exercising.

7. **Oxygen Intake :** It refers to the ability of a person's lungs to take in large amount of oxygen from the atmosphere by the breathing process. It further depends on lung size, active alveoli, the strength of respiratory muscles, the size of chest cavity, etc. Oxygen intake is rarely a limiting factor for well-trained sportspersons.

Oxygen uptake or VO_2 max (also called maximal oxygen consumption, peak oxygen uptake or maximal aerobic capacity) is the maximum rate of oxygen consumption measured during incremental exercise.

Effects of Exercise on Respiratory System : During exercise the rate and depth of breathing increases - this makes sure that more oxygen is available for the blood to be carried to the muscles. This also helps in efficiently removing more carbon dioxide and metabolic wastes produced by greater muscle activity.

The rate of breathing can be measured by counting the number of breaths in one minute. The depth of breathing can be measured using a spirometer.

The important effects of exercise on respiratory system are as follows:

(a) **Increase in tidal air capacity :** Tidal air capacity or tidal volume (symbol VT or TV) is the lung volume representing the normal volume of air displaced between normal inhalation and exhalation when extra effort is not applied. In a healthy, young human adult, tidal volume is approximately 500 mL. There is a substantial inspiratory and expiratory reserve in the lungs. Doing exercise increases the tidal volume by decreasing the inspiratory and expiratory reserve. In people with normal lung function, the tidal volume can double to 1000 mL.

(b) **Decrease in rate or frequency of respiration in the long term :** When a normal person starts exercising then his rate of respiration increases but as he continues to exercise for a long period of time, his resting rate of respiration decreases. This happens because of an increased tidal volume.

(c) **Strengthens the diaphragm :** Regular exercise helps to strengthen the diaphragm and improves its flexibility.

(d) **Second wind is rarely felt :** In well trained athletes, chances of second wind happening is reduced. During a distance race, as the body gets well acclimated to the conditions and begins to use oxygen more efficiently, the need to rely on anaerobic respiration for production of energy is reduced by the body. Second wind is the "flush of relief" when the muscles finally get the oxygen they need.

(e) **Activates alveoli :** Due to bad lifestyle, our alveoli become inactive because of the lesser requirement of oxygen. But, when a person starts exercising, the lungs work harder to meet the oxygen requirements of the body. The lungs adapt to regular exercise by activating more alveoli. More alveoli can supply more oxygen to working muscles and tissues.

(f) The increase in lung capacity : When someone exercises, his body requires more amount of oxygen than at normal (rest) state. Due to this the lungs inhale more oxygen and heart pumps more blood to meet the demand. The lung capacity can be improved up to 15% by regularly doing aerobics. However, you must remember that the size of the lungs remains the same.

(g) Increase in vital air capacity : Normal adults have a vital capacity between 3-5 L. Depending on height, weight, sex, age and ethnicity. A low vital capacity is often associated with a disability, obesity or chronic respiratory disease. Exercising increases vital capacity because the muscles require additional nutrients when they perform tough exercise, which requires the lungs to take in more oxygen. The lungs will need to expand further to take in this extra oxygen, which will increase vital capacity. Consistent exercises can also improve the overall health of your lungs.

8. Muscle hypertrophy involves an increase in size of skeletal muscle through a growth in size of its component cells. Regular exercise can lead to an increase in size by up to 60%. Two factors contribute to hypertrophy: sarcoplasmic hypertrophy, which focuses more on increased muscle glycogen storage; and myofibrillar hypertrophy, which focuses more on an increased myofibril size.

9. **Isometric exercise for shoulder region :**

(a) Stand a few inches away from a wall and push your hands towards the wall. Fully stretch the hands and press against the wall as if you are trying to press the wall away. Hold the resistance for 12-14 seconds and do two more sets.

(b) Side dumbbell isometric holds. Start with the feet apart at shoulder width distance and hold two dumbbells. Internally rotate your shoulders so that the side deltoid muscles are the main areas hit during the exercise. Bring the dumbbells up and feel the pressure on your side deltoid muscles. Hold this position for 20-30 seconds.

10. Cardiac output is the total volume of blood pumped by the heart in one minute.

Cardiac output = heart rate × stroke volume

Cardiac output is the amount of blood pumped in one minute. Regular exercise is helpful in increasing cardiac output of the heart. The players who regularly exercise are found to have resting cardiac output of 25-35 liters per minute whereas the cardiac output of untrained individuals is 14-20 liters per minute at rest.

11. Exercise has countless benefits for the aged, including a healthier heart, stronger bones and improved flexibility. Exercise also improves cognitive function. Scientists have found that brain neurons - the special cells that perform all the necessary function to keep us alive, as well as help us think - increase after a few weeks of regular exercise. Physical activity is medicine for older adults and delays the process of ageing. It helps in the following parameters :

Role of physical activity in maintaining functional fitness in aged population :

(a) Reduce the loss of muscle mass : Muscle mass decreases with advancing age. Ageing has a negative impact on metabolism. Regular exercise delays the loss of lean body mass and loss in metabolism rate. Regular exercise also reduces the accumulation of fats.

(b) Maintaining bone density : Ageing process reduces bone density steadily. Regular exercise delays the loss of bone density and can actually improve bone mineralization. However, with doctor's advise, old age people particularly women should take vitamin D and calcium supplemented food.

(c) Slows down brain ageing : People who exercise regularly show better cognitive function. This suggests that exercising may be helpful in slowing brain ageing.

(d) Reduces risk of age related Diseases : Sporting activities prevents or delays many age dependent diseases like diabetes, cancer, stroke, heart disease and osteoporosis, etc. Regular exercise by the old, may decrease the time it takes for a wound to heal by 25%. Also, a healthy, strong body can better fight off infection and makes recovery from illness or injury easier.

(e) Improves muscle strength : Exercises increase the size of muscle which ultimately increases muscle strength.

(f) Enhances the capacity of lungs : Regular exercise enhances the capacity of lungs. It reduces the loss of elasticity of the lungs and diaphragm. It plays a key role in keeping the chest muscles strong. Regular exercise increases oxygen uptake and oxygen exchange.

(g) Improves flexibility : Regular exercises improves the elasticity of tendons, ligaments, and joint capsules. Exercise decrease the stiffness of joints. In this way there is increase in flexibility.

(h) Improves balance and coordination : Injury caused by falls are the most frequent cause of hospitalization for the elderly. Regular exercise can help prevent them. Falling leads to injuries like broken hips or other bones, and exercise is a key component to improve functional reach and balance.

(i) Improved quality of life and increased life expectancy : New studies have found that seniors who exercise, improve not only their physical fitness but experience psychological benefits as well. Exercise can help alleviate symptoms of depression and improve the mood in general. The increased mobility that comes from regular, moderate exercise can help a senior maintain his or her independence if it is done on a long-term basis. This has a direct positive bearing on their quality of life.

(j) Reduces stress and tension : Regular exercise relaxes the mind, reduces mental and physical strain. Regular exercise also stimulates the production of endorphins, the body's natural painkillers and mood elevators. Thus, regular exercise brings happiness and delays ageing process.

12. (b) : (1)-B, (2)-D, (3)-A, (4)-C

Related Theory

- Sports injuries are broadly categorised into two kinds :
  - (i) Acute injuries (which happen suddenly)
  - (ii) Chronic injuries (which are usually related to overuse and develop gradually overtime)

13. Types of bone fractures are – (i) Green Stick, (ii) Transverse, (iii) Linear (iv) Spiral, (v) Oblique displaced, (vi) Comminuted.

14. (i) **Greenstick** – A fracture in a young, soft bone, in which the bone bends.

Causes – These fractures most commonly occur with a fall.

Prevention – Promotion of regular exercise, ensuring the child's safety by providing proper safety equipment and adequate calcium in the child's diet can also help to prevent this kind of fracture.

Treatment - Removable splints result in better outcomes than casting in children with – Torus fractures of the distal radius.

(ii) **Comminuted** – A fracture in which a bone is broken, splinted, or crushed into number of pieces.


Comminuted

Causes – Direct and indirect trauma or violence can be causes for commutated fracture.

Prevention – Maintaining strong bones by eating food that is rich in calcium and regular exercise can help in the prevention of this type of fracture.

Treatment - An X-ray is important for diagnosing of the condition. An open reduction when the bone fragments are jammed-together using surgical nails, wire plates etc. is required for comminuted fracture.

(iii) **Transverse** – Transverse fracture is when there is a straight break right across a bone.


Traverse

Causes - When a large amount of force is transmitted directly *i.e.*, perpendicularly to the bone.

Prevention – Physical activity and weight bearing exercises will make the bones stronger and denser. Bones can also be strengthened by eating foods rich in calcium and taking regular exercise.

Treatment - Can be treated at home along with rest and medicine. A back brace (called TSL) or abdominal binder may be prescribed to reduce the pain by limiting motion at the fracture site.

15. Due to the intensity and frequency of their training, it can be difficult for competitive athletes to avoid sports injuries. However, simple precautions and practices can prevent injury.

(a) Warm up : It is very important to warm up properly before starting to exercise more vigorously or play a vigorous game. A proper warm-up routine should last for a minimum of 10 minutes. One should start with a few minutes of gentle exercise, such as walking or jogging, to get the blood flowing to the muscles. Gradually, the pace should be increased till running level is reached. Once your muscles are warm, gentle stretching exercises should be done, paying particular attention to the muscle groups that will be used.

(b) Conditioning : Particularly when there is change in climate one must condition the body, including heat acclimatization for few days. As part of their pre-participation evaluation, athletes should be tested for cardio-respiratory fitness, flexibility, and muscle strength. Those who have particular injury potential due to weakness or tightness should be put on an individualized exercise program.

16. **Symptoms of Contusion :**
(i) Swelling and pain
(ii) Muscle fail to respond
(iii) Stiffness over the area
(iv) Redness start, may turn blue or black.

Management for Contusion :
(i) Proper use protective sports equipment.
(ii) If there is more swelling use anti inflammatory
(iii) Cold compression should be use immediately
(iv) Do flexibility exercise for rehabilitation
(v) After three days apply heat instead of ice pack.

Symptoms of Dislocation :
(i) Severe pain over the joint
(ii) Swelling of the joint
(iii) Inability to move the joint
(iv) Changing shape of joint.

Management of Dislocation :
(i) Support the joint using cushion or padding
(ii) Keep the person Calm and Cool
(iii) Let the injured person sit or lie in a comfortable position
(iv) Use ice pack on dislocated area
(v) Call medical help immediately

17. The various causes of sports injuries can be summarized as follows -

(a) Overuse : Overuse or repetitive movements is considered as the number-one cause of sports injuries. Runners, swimmers and tennis players are particularly susceptible to overuse injuries, including tennis elbow, tendinitis, shin splints and shoulder impingement.

(b) Stops and twists : Sports that incorporate quick stopping and twisting motions -- including basketball, gymnastics and soccer encounter a high number of knee and ankle injuries.

(c) Falls : Any athlete can fall in the midst of an activity. In addition to the obvious breaks that can occur from a fall, wrist sprains are common. One's natural instinct when falling is to put one's hands down to break the fall in which the wrists bear the weight, which can easily stretch or tear a ligament.

(d) Lack of fitness and nutritional inadequacy : Poor physical fitness alone or along with poor nutrition habit (particularly poor electrolyte balance) can cause injury in competitive sports.

(e) Improper equipment : For example using a very heavy racquet in tennis, or a heavy bat in cricket can cause injury. A runner may experience an injury if he wears shoes that do no provide enough support.

Prevention of Sports Injuries

Due to the intensity and frequency of their training, it can be difficult for competitive athletes to avoid sports injuries. However, simple precautions and practices can prevent injury.

(a) **Warm up :** It is very important to warm up properly before starting to exercise more vigorously or play a vigorous game. A proper warm-up routine should last for a minimum of 10 minutes. One should start with a few minutes of gentle exercise, such as walking or jogging, to get the blood flowing to the muscles. Gradually, the pace should be increased till running level is reached. Once your muscles are warm, gentle stretching exercises should be done, paying particular attention to the muscle groups that will be used.

(b) **Conditioning :** Particularly when there is change in climate one must condition the body, including heat acclimatization for few days. As part of their pre-participation evaluation, athletes should be tested for cardio-respiratory fitness, flexibility, and muscle strength. Those who have particular injury potential due to weakness or tightness should be put on an individualized exercise program.

(c) **Not overdoing it :** While starting a new exercise programme, one should not overdo it. If one has not exercised for a long time, strenuous activity could do more harm than good. Once the fitness improves, one will be able to increase the level of activity.

(d) **Avoid dehydration :** One should always drink plenty of water when exercising to prevent dehydration. One should plan to drink one glass of water for every 20 minutes of exercise. This should be in addition to drinking the recommended six to eight glasses (1.2 litres) of water a day. If one is exercising in warm weather or participating in endurance sports, one should drink more water.

(e) **Use the right technique :** To avoid a sports injury, one should always use the correct technique. Using the proper technique for the sport can help reduce the risk of overuse injuries, such as tendonitis and stress fractures.

CBSE Sample Questions

1. (d) : Both (a) and (b) **(1)**

2. **Strength –** Strength component has varied sub-types like maximum strength, Explosive strength, Strength, Endurance etc. Each has different types of exercise, intensity and duration so physiological factors vary. In games like weightlifting, jumps, sprint or power, agility and strength dominating sports where force production is high, fatigue is quick, and fast twitch fibre percentage must be high in muscles. ATP-CP system or anaerobic system works to produce energy for strength training. Stroke volume (the volume of blood pumped out of the left ventricle of the heart during each systolic cardiac contraction) is a vital parameter as far as cardiovascular system is concerned. **(3)**

3. Speed is the ability to move quickly on the ground. However, speed is not just how fast someone can run (or cycle, swim, etc.), but is dependent on their acceleration from a stationary position. It also pertains to speed maintenance that is minimising deceleration. Movement speed requires good strength and power, high proportion of fast twitch muscle fibres, efficient mechanics of movement to the muscle power. Speed of a sports person is determined by following factors :

(i) **The mobility of nervous system :** The contraction and relaxation of the muscles is controlled by the nervous system. The frequency of contraction and relaxation of muscles is determined by the excitability of the nerves. Mobility of nervous system means excitation and relaxation of motor nerves that causes contraction and relaxation in muscles. The mobility of nervous system is of great importance in sprinting, running, etc.

The mobility of nervous system can be increased up to a certain extent by training and better skills.

(ii) **Muscle composition** - Our muscles are composed of three types of fibers **Type I, Type IIA and Type IIB.** Hence speed to a great extent is determined by the overall ratio of the muscle fibers in the body of an athlete. Though this is genetically determined, with correct training the performances can be adequately improved. **(4)**

4. **Changes happening in the muscular system due to exercising.**

(i) **Change in size and shape of Muscle :** Regular exercise helps in enlarging cells of muscles which in turn helps in changing size and shape of muscles.

(ii) **Increase in the Strength of Muscles :** A person who does exercise daily has stronger muscles and such muscles work more. These become stronger by getting more nutritious food in the form of oxygen.

(iii) **Increase in Coordination :** Regular exercise increases coordination in the muscles. These become stronger by doing exercise. As a result a person does not feel fatigue even by working for a long time. If the muscles do not have co-ordination or have incomplete co-ordination then the working becomes impossible.

(iv) **Entrance of Greater Quantity of Oxygen in the Body :** Muscles have to do more work during exercise. The consumption of oxygen increases in the person who exercises. Thus blood reaches quickly in the muscles.

(v) **Increase in Supply of Blood :** Muscles get chemical substances like glycogenephoscoratine, potassium etc. by doing regular exercise. These chemical substances increase the speed of blood.

(vi) **Proper Blood Circulation :** During rest, the blood completes a round of the body in 21 seconds, but it completes the round in just 15, 10 or 8 seconds while exercising. The heart muscles work faster during exercise.

(Any four) (2)

5. (c) : Wrist **(0.80)**
6. (a) : Femur **(1)**
7. (d) : Joint injury **(1)**
8. (c) : Impacted fracture **(1)**
9. (i) **Abrasion –** Abrasion injuries most commonly occur due to moving contact with a rough

surface, causing a grinding, or rubbing away of the upper superficial layers of the epidermis.

Cause – Abrasion injuries commonly occur when exposed skin encounters a rough surface, causing a grinding or rubbing away of the upper layers of epidermis

(ii) **Contusion** – It is the type of hematoma, which refers to any collection of blood outside of a vessel.

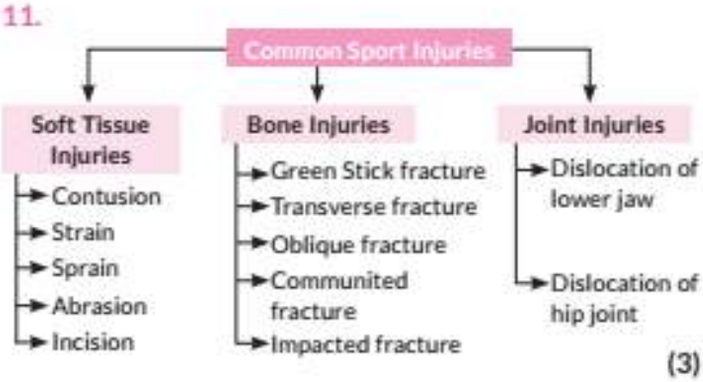
Cause – When a part of the body is struck by enough force to crush underlying muscle fibres and connective tissue without breaking the skin, a contusion may occur. It can be due to a blow from a collision with a player or a piece of equipment or because of a heavy fall. **(1 + 1 = 2)**

10. **Laceration :** A laceration is an injury that results in an irregular break in the skin, more commonly referred to as a cut, but defined as a torn and ragged wound. Lacerations are caused when an object strikes the skin and causes a wound to open. Depending on a variety of characteristics (angle, force, depth, object), some lacerations can be more serious than others, reaching as far as deep tissue and leading to serious bleeding. The predominant symptoms of lacerations are mild to serious breaking of the epidermis, tears in the first layer of skin that can range from small slices to deep gashes. Depending on the depth of the laceration, there can be bleeding of different levels of severity. Mild lacerations may experience brief bleeding accompanied by mild pain. Deeper lacerations will experience greater bleeding and more intense pain.

Treatment of laceration

i. Stop bleeding at the earliest by compression or by pressing.
ii. Clean the surface of the affected part using water and soap.
iii. Cover the affected part with medicinal cotton bandage or apply band aid. **(1 + 1 = 2)**

11.



(3)