(b) How many laws were enunciated? What are these laws?

Ans. Newton laid down three laws, called the laws of motion. The first law declared that an object at rest or motion continues to remain so until acted upon by unbalanced forces. The second law, also called the law of acceleration, says that acceleration of an object is based on the net force applied and is inversely proportional to the mass of the object. The third law, called the law of reaction, says that every action has an equal and opposite reaction.

(c) How does the application of these laws affect sports?

Ans. The application of the first law can be seen when sportspersons stand still on the diving board or runners stay still at the starting blocks. Similarly, a cyclist is still till they start pedalling and have to apply brakes to stop. The second law as applied to sports is seen when a bowler swings their arm fast to throw the ball at a great pace or the force the shot-putter applies to throw the metal ball (shot) the farthest possible. The third law finds application in sports when a swimmer pushes hands and feet against water to swim forward or when the ball goes off the bat in the opposite direction when hit.

3. **The classroom needed to be emptied of tables and chairs for dance practice. Arun tried to push the table but it would not move even though it was not nailed down. Perplexed, he took his friends' help and together they could clear the room, but even then the movement was not smooth and resistance was felt by them.**

(a) Why Arun alone could not move the table?

Ans. The table could not be moved by Arun because of the static friction between the table and the ground. The carpet on the floor further increased static friction.

(b) How could he complete the task with his friends' help? Why was it still not easy?

Ans. When his friends joined in, they created a greater force that overcame the static friction. However, some resistance was still felt as the carpet and the floor offered dynamic friction to this movement.

(c) What is the practical application of this phenomenon in sports?

Ans. Friction has both advantages and disadvantages in sports. Spiked footwear is used by sportspersons to increase friction, thereby increasing stability. Many sports equipment like bats have rough grips so the friction helps to hold them better. On the other hand, skiers use smooth skis to decrease friction while skiing and carrom players use powder on the board to decrease friction and help smoothen movements of the strikers.

22. Define healthy weight.

Ans. Healthy body weight means for every inch of height a male should be one kg and every female should be 800 grams. However, it varies depending on the muscle-to-fat ratio.

23. What do you mean by obesity?

Ans. Obesity is the excess body fat. Over 30% body fat in men and over 35% in women is the cut-off point.

24. What are the contraindications of Vajrasana?

Ans. Vajrasana should not be practised in case of acute trouble or stiffness in feet, ankle and knees or if the practitioner has slip disc problem.

25. What do you mean by diabetes?

Ans. Diabetes is a disease that occurs because of the inability of the body cells to utilise the sugars from our food resulting in increased sugar levels in the blood.

26. What is asthma?

Ans. Asthma is a condition in which our airways become narrow and swell and produce extra mucus. This can make breathing difficult and trigger coughing, wheezing and shortness of breath.

27. Discuss briefly the benefits of Sukhasana.

Ans. It spreads a sense of calm and peace through our mind and body.
It relaxes the brain. It diminishes exhaustion, stress and anxiety.
The body alignment is improved. The back becomes stronger and steadier.
This *asana* gives your knees and ankles a good stretch.

28. Mention any five benefits of Parvatasana.

Ans. Parvatasana strengthens muscles of the arms and legs.

- It tones up spinal nerves and improves blood flow to the spinal region.
- It increases blood flow to the brain and gives mild benefits similar to inverted *asanas*.
- It tones up the abdominal organs.
- It decreases anxiety.
- It prevents respiratory problems.

29. What do you mean by back pain?

Ans. Pain in the lower area of the spine is called back pain.

30. Discuss the benefits of Gomukhasana.

Ans. It stretches the hips and provides power to the ankles, thighs, shoulders, armpits, chest, deltoid and triceps. It also relieves chronic knee pain. Besides strengthening the spine and abdominal muscles, it also strengthens the hip joint.

31. What do you mean by hypertension?

Ans. High blood pressure is a condition in which the long-term force of blood against the vessels is high. Blood pressure is determined both by the amount of blood the heart pumps and the amount of resistance to blood flow in the arteries. The more blood the heart pumps and the narrower the arteries, the higher the blood pressure will be.

32. What do you mean by motor development?

Ans. Motor development refers to the development of a child's bones, muscles and ability to move around and manipulate his or her environment. Motor development also involves how well children's muscles work. This is referred to as muscle tone.

33. What do you mean by gross motor development?

Ans. Gross motor development involves development of the large muscles in a child's body. These muscles allow us to sit, stand, walk and run, among other activities.

34. What do you mean by fine motor development?

Ans. Fine motor development involves the small muscles of the body, especially in the hand.

35. What do you mean by weight training?

Ans. Weight training is a common type of strength training for developing the strength and size of skeletal muscles. It utilises the force of gravity in the form of weighted bars, dumbbells or weight stacks in order to oppose the force generated by the muscles through concentric or eccentric contraction.

36. What do you mean by correct posture?

Ans. A good posture refers to the "three natural curves [that] are present in a healthy spine.". It is also called neutral spine. Looking directly at the front or back of the body, the 33 vertebrae in the spinal column should appear completely vertical.

37. What are postural deformities?

Ans. Postural deformity means not having proper alignment of the body parts.

38. What is kyphosis?

Ans. Kyphosis is a spinal disorder in which an excessive outward curve of the spine results in an abnormal rounding of the upper back.

39. What is scoliosis?

Ans. Scoliosis is a sideways curvature of the spine.

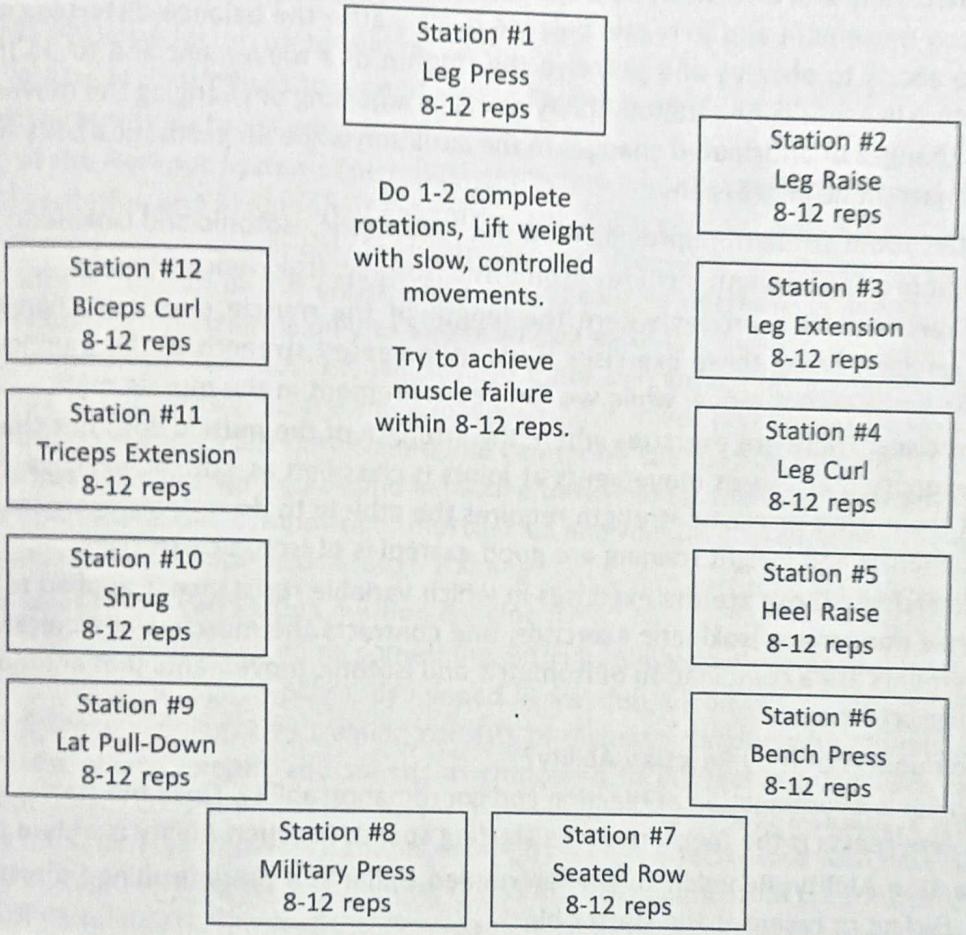
CBSE BOARD EXAMINATION QUESTIONS (With Answers)

1. Define flexibility and its types. (2020)

Ans. Flexibility is the range of movements at a joint that permits bending movements.
Flexibility can be classified as active flexibility and passive flexibility. Active flexibility is based on the muscle also moving and is of two sub-types, namely dynamic flexibility and static flexibility. Dynamic flexibility permits movement in the full range of motion of the joint. Static flexibility is when the stretch in a muscle uses the agonist muscle to oppose it.
Passive flexibility is when we use an assistant or an aid to flex, like using a wall or a chair to increase flexibility.

2. What is circuit training? Draw a diagram of circuit training with 12 stations and explain its importance in sports. (2020)

Ans. Circuit training is high-intensity resistance training that uses different exercises, each done in a sequence which is counted as part of a circuit. For example, if we need to create a 12-station circuit training, we draw it as follows:



This will combine strength training as well as cardio training. This can be easily customised and the advantage is that the workouts are short but highly effective and help combine cardio and strength in one sitting. Also, it is less expensive and can be done virtually anywhere. This combines both aerobic and anaerobic activities and is highly flexible and is adjustable as per the interest and time available.

3. Which method will you suggest to develop endurance? (2019)

Ans. To develop endurance, one needs specialised training over prolonged periods of time.
Improving and developing endurance is possible with many methods, chief among them being Continuous training, Interval training and Fartlek training.

4. What is the relationship between muscular size and strength? (2019 C)

Ans. Muscular strength refers to the amount of force a muscle can produce with a single maximal effort. The size of muscle fibres and the ability of nerves to activate muscle fibres are directly related to muscle strength.

5. Discuss in detail the methods of flexibility development.

Ans. Flexibility is the range of movement in a joint. Methods of improving flexibility include Active slow stretching, also referred to as static-active stretching. The second way is by Passive stretching, also known as static stretching by holding stretched limbs for some time. The third method is Kinetic or Ballistic Method where movements at a joint in a rhythmic way called kinetic movements are used. The fourth method is called Proprioceptive Neuromuscular Facilitation (PNF). This is a more advanced form of flexibility training that involves both stretching and contraction of the muscle group being targeted. (2019 C)

6. What do you understand by Coordinative ability? Discuss about different types of coordinative abilities.

Ans. Coordinative abilities are also defined as the abilities that depend upon coordinated effort of the central nervous system and the musculoskeletal system. These abilities help sportspersons do a group of movements with better quality and effect. The various coordinative abilities include Differential Ability which is the ability to determine the position of the body and its parts in time and space in relation to gravity. Orientation Ability is the ability of a person to adjust as per time and movement. Coupling Ability is the ability of a player to move his physical organs in order to do his activities. Reaction Ability is the ability to react immediately and effectively to a signal. Balance Ability is the ability to maintain balance during complete body movement and to regain balance quickly after the balance-disturbing movement. Rhythm Ability is the ability to observe and perceive the rhythm of a movement and to do the movement with external rhythm like music. Adaptation Ability refers to adjusting or changing the movement effectively on the basis of changes or anticipated changes in the situation while Kinaesthetic Ability helps sportspersons play using kinaesthetic impressions. (2019)

7. Write in detail about strength-improving methods—Isometric, Isotonic and Isokinetic.

Ans. Methods of improving strength include—Isometric, Isotonic, Isokinetic methods (2019)

Isometric Exercises: All exercises where the length of the muscle does not change are classified as isometric exercises. Doing these exercises leads to increased strength of the muscles. During isometric exercises the limbs do not move, while we can see movement in the muscle mass.

Isotonic Exercises: These are exercises where the strength of the muscle does not change but the length does. Any exercise that causes movements at joints is classified as isotonic exercise. Need for increased elasticity of the muscle or elastic strength requires the athlete to do isotonic exercises. Stationary jumps, squats, calisthenics and weight training are good examples of isotonic exercises.

Isokinetic Exercises: These are the exercises in which variable resistance is applied to a limb in constant motion. While performing Isokinetic exercises, one contracts the muscle while quickly moving the limb. These movements are a combination of isometric and isotonic movements that are most commonly used in all sporting activities.

8. What do you understand by Reaction Ability?

Ans. Reaction Ability is a combination of reaction and coordination ability. Once the starter signal is given, how fast the athlete reacts is the measure of his starting speed. Reaction Ability is of two types: (2019 C)

Simple Reaction Ability: Reaction to predetermined signal in a predetermined direction is exhibited in swimming, cycling or racing at the starter block.

Complex Reaction Ability: This is useful when the direction of movement of the athlete is not predetermined as in football or hockey. Similarly, the non-striker in cricket has to respond to the batsman's call for a run.

Reaction time is the time taken by a sportsperson to respond to the given command. *For example*, how fast the swimmer jumps into water after the command determines the performance. Less reaction time translates into better performance.

9. Define Friction and name its types.

Ans. Friction is a force that holds back the movement of a sliding object. It is of two types—static and dynamic. (2017)

10. What is endurance? Explain its types.

Ans. Endurance is the capacity of something to last or to withstand wear and tear. There are two types of endurance—Cardiovascular, which is the ability of the body to deliver blood, oxygen and nutrients to working muscles, and the ability of the muscles to use that oxygen to do work. The other is Muscular endurance, which is the ability of a muscle to do work without fatiguing. Endurance is also divided into (2017)

2. Shalini, the school badminton champion, wants to go to the next level. Her feeling is that she needs to improve her strength so she approaches the head coach for advice. The coach suggests a series of different exercises.

(a) What different types of exercises are recommended to increase strength?

Ans. The different types of exercises to increase strength are isometric, isotonic and isokinetic. While in isometric exercises the focus is on increasing strength by not changing the length of the muscles, isotonic exercises focus on changing the muscle length while maintaining its tone. Isokinetic exercises focus on offering varying resistance to a moving muscle.

(b) What are examples of isotonic exercises?

Ans. Stationary jumps, squats, callisthenics and weight training are examples of isotonic exercises.

(c) What isokinetic exercises were suggested to Shalini?

Ans. Isokinetic exercises combine isometric and isotonic exercises. Thus, Shalini was encouraged to use machines which allow muscles to gain strength consistently through the full range of muscle movement. Walking on the treadmill, basic squats as well as walking at a brisk pace was what Shalini was told to do.

3. The new school head coach, Mr Dev, wanted to introduce a new concept of circuit training to his athletes. He first explained why it was important and how it was done. He also talked about the different types of circuit training.

(a) What is implied by circuit training?

Ans. Circuit training is a form of body conditioning using high intensity. It focuses on strength building and muscular endurance. A circuit involves completing all sets of exercises in the program.

(b) What different types of circuit training are there?

Ans. Mr Dev explained that there are seven different types of circuit training. These are strength training, cardio training, strength and cardio training, sports-specific training, timed circuit training, competition circuit training and repetition circuit training.

(c) What is the importance of circuit training?

Ans. Circuit training combines aerobic and resistance training. This makes it a high-intensity workout. Since it combines cardio and strength training, less time is used but the maximum effect is achieved. While increasing metabolism, it does not cause boredom or take up lots of time. Also results appear faster.

40. What are bow legs?
Ans. Bow legs (or genu varum) are when the legs curve outward at knees while the feet and ankles touch.
41. What is knock knee?
Ans. "Knock knee" is a condition in which the knees angle in and touch each other when the legs are straightened.
42. What do you mean by women's sports participation?
Ans. Women's sports include amateur as well as professional sports and they participate in all varieties of sports, both competitive sports and sports for relaxation.
43. What do you mean by menarche?
Ans. Menarche is the occurrence of the first menstrual period in a female adolescent.
44. What is menstrual dysfunction?
Ans. This is a blanket term for disorders that affect the menstrual cycle.
45. What do you mean by female athlete triad?
Ans. Female athlete triad is a combination of three conditions: disordered eating, amenorrhoea, and osteoporosis. A female athlete can have one, two, or all three parts of the triad.
46. Mention the symptoms of female athlete triad in brief.
Ans. Signs and symptoms of the female athlete triad include:
Fatigue, weight loss, bone loss, absent or abnormal periods, stress fractures. Also present are fasting or limiting food intake, binge eating and self-induced vomiting.
47. What do you mean by eating disorders?
Ans. Eating disorders describe illnesses that are characterised by irregular eating habits and severe distress or concern about body weight or shape.
48. What is osteoporosis?
Ans. Osteoporosis is a condition that weakens the bones, making them fragile and more likely to break.
49. What do you mean by amenorrhoea?
Ans. Amenorrhoea is the absence of menstruation—one or more missed menstrual periods. Women who have missed at least three menstrual periods in a row have amenorrhoea as do girls who haven't begun menstruation by age 15.
50. What do you mean by bulimia?
Ans. Bulimia nervosa is an eating disorder usually characterised by periods of bingeing—or excessive eating—followed by some kind of compensatory behaviour.
51. What is anorexia nervosa?
Ans. Anorexia nervosa—often simply called anorexia—is an eating disorder characterised by an abnormally low bod weight, an intense fear of gaining weight and a distorted perception of weight.
52. What do you mean by tests?
Ans. Tests are used to gather information about the athletes evaluating their capacity, ability, needs and endurance.
53. What do you mean by measurement?
Ans. Measurement is the assignment of a number to a characteristic of an object or event, which can be compare with other objects or events.
54. What do you mean by muscular strength?
Ans. Muscular strength refers to the amount of force a muscle can produce with a single maximal effort.
55. What do you mean by motor fitness?
Ans. Motor fitness is a term that describes an athlete's ability to perform effectively during sports or other physical activi
56. What do you mean by cardiovascular fitness?
Ans. Cardiovascular fitness is the ability of the heart and lungs to supply oxygen-rich blood to the working musc tissues and the ability of the muscles to use oxygen to produce energy for movement.
57. What do you mean by Harvard step test?
Ans. The Harvard step test is a type of cardiac stress test for detecting and diagnosing cardiovascular disease. I also a good measurement of fitness and a person's ability to recover after a strenuous exercise by check the recovery rate.
58. What is Rockport one-mile test?
Ans. After a brief warm-up, the subject walks as briskly as possible for one mile (1609 metres) with a heart r monitor. Tester records heart rate (beats per minute).
59. What do you mean by senior citizen fitness test?
Ans. It is a simple, easy-to-use battery of test items that assesses the functional fitness of older adults. The describes easy to understand and effective tests to measure aerobic fitness, strength and flexibility us minimal and inexpensive equipment.
60. State any one physiological factor which determines flexibility.
Ans. Many factors are taken into account while establishing personal flexibility: joint structure, ligaments, tend muscles, skin, tissue injury, fat (or adipose) tissue, body temperature, activity level, age and sex all influe an individual's range of motion about a joint.

5. Define circuit ... discuss the advantages and disadvantages of circuit training.
6. Dynamic strength is divided into three parts. Write in brief about each.
7. Explain in brief about circuit training and prepare six station programmes.
8. Differentiate between 1:1 and 1:2 ratio training with suitable examples.
9. Describe pace races. Why are they important?
10. How many types of speed are there? Discuss any two types in detail.
11. What is speed endurance and how can we enhance it?
12. How many types of coordinative abilities are there? Discuss any three of your choice.
13. How can we improve coordinative abilities?
14. When was circuit training introduced and why?
15. What is bending backwards called and what sports is it useful in? Give an example.
16. What is acceleration run? Mention its advantages.
17. Discuss the role of acceleration ability in sports.
18. What is Fartlek training and what are its disadvantages?
19. What is explosive strength? In what sports is it important and why?
20. How is muscle strength measured? Explain in detail with specific mention of its units.

E. Case-based/Source-based Integrated Questions

1. **Once the school team won a tournament, many of the players were not willing to turn up for practic believing that they were in peak form. Mr Singh, the coach, then had to talk to them to explain wha training in sports meant and why it was important.**

(a) How did Mr Singh define training?

Ans. Training is the act of teaching a person a particular skill or type of behaviour. In sports, it also means having a focus on exercise and diet to prepare for the event.

(b) What is the focus of continuous training sessions?

Ans. Continuous training is required not only to maintain the results and goals achieved but also to upgrade and update skills daily. It also focuses on reaching the maximum in motor skills vis-a-vis the sport.

(c) How do training sessions help with planning strategy for future events?

Ans. Training sessions are vital to sports as they help identify the weaknesses and strengths of the individual player as well as the team as a whole. During training sessions, corrections can be applied and strengths focused on. In team events, an individual can be upgraded to focus on a specific task, like selecting a person as an opening batsman or wicketkeeper or opening bowler, etc.

Specific and General endurance. Specific endurance is the ability to stand against fatigue in sport-specific conditions. The better your sport-specific endurance, the better you perform at a specific sport. It can be characterised as a combination of various types of endurance you need to maximise your ability to succeed in your discipline.

General endurance characterises the ability of the whole body to tolerate endurance exercises and diminish fatigue.

11. What does the term 'Fartlek' mean and who developed this training method? (AI 2017)

Ans. Fartlek, which means "speed play" in Swedish, is continuous training with interval training. Fartlek runs are a very simple form of a long-distance run. Fartlek training is simply defined as "periods of fast running intermixed with periods of slower running."

Fartlek was developed by Gösta Holmér in 1937. It was initially designed for Swedish cross country.

12. Explain Interval training method. (AI 2017)

Ans. Interval training is a type of training that involves a series of low-to-high-intensity workouts interspersed with rest or relief periods. The high-intensity periods are typically at or close to anaerobic exercise, while the recovery periods involve activity of lower intensity. After warming up, increase the intensity for 30 seconds and then resume normal pace.

13. Explain the physiological factors determining speed. (AI 2017)

Ans. Speed of an athlete is determined to a great extent by the genetic factors.

The factors that contribute to speed include:

(a) **Mobility of the Nervous System:** The rapid contraction and relaxation of muscles is made possible by the rapid excitation and inhibition of the concerned motor centres. Nervous system can maintain this rapid excitation and inhibition only for a few seconds after which excitation spreads to neighbouring centres causing tension in the entire body. This results in decrease in speed. The mobility of the nervous system can be trained only to a very limited extent.

(b) **Muscle Composition:** The muscles, which have more percentage of fast-twitch fibre, contract with more speed in comparison to the muscles which have lower percentage by slow-twitch fibre. The muscle position is genetically determined and cannot be changed by training.

(c) **Explosive Strength:** For very quick and explosive movements, explosive strength is indispensable. It depends upon metabolic composition, muscle size and muscle coordination. The explosive strength of the muscles can be improved through training.

14. What is endurance? How can Fartlek method develop it? (2016)

Ans. Endurance is "the ability to keep doing something difficult, unpleasant, or painful for a long time".

Fartlek training (meaning 'speed play'), developed in Sweden, incorporates aspects of interval training with regular distance running. This training consists of distance running with "bursts of harder running at more irregular points, lengths and speeds as compared to interval training". *For example*, a Fartlek training session might consist of a warm-up for 5-10 minutes; running at a steady, hard speed for 2 km; rapid walking for 5 minutes (recovery); sprints of 50-60 seconds interspersed with easy running; full-speed uphill for 200 m; rapid walking for one minute; repeating this routine until the time schedule has elapsed (a minimum of 45 minutes). This leads to development of both aerobic and anaerobic capacities.

15. Briefly explain different types of coordinative abilities. (AI 2016)

Ans. Coordinative abilities are defined as the abilities that depend upon coordinated effort of the central nervous system and the musculoskeletal system.

In sports, coordinative abilities are as under:

(a) **Differential Ability:** It is the ability to determine the position of the body and its parts in time and space in relation to gravity. This ability to achieve a high degree of accuracy and economy of separate body movements is phased in a motor action. It is useful mostly for dancers and gymnasts.

(b) **Orientation Ability:** It is the ability of a person to adjust as per time and movement. Thus, while playing, say football, the person not only needs to sense his position but also that of the moving ball and his opponent.

(c) **Coupling Ability:** It is the ability of a player to move his physical organs in order to do his activities. Mostly, this needs coordinative action between hands and eyes, feet and eyes. This ability is based

What do you mean by plane? Discuss the types of planes.

5. Elucidate Newton's laws of motion. Discuss their application in various sports.
6. What do you mean by axis? Discuss the types of axes of rotation.
7. Explain the advantages and disadvantages of friction in sports.
8. Use of spikes in sport shoes is beneficial. Give reasons.
9. Compare static and dynamic friction and give an example to illustrate them.
10. How does the study of biomechanics help in sports?
11. Describe the three laws as described by Newton.
12. What is rotation and how is it used in sports?
13. What are the movements that take place at the ankle joint? Name them and explain any two.
14. Is friction advantageous or disadvantageous in sports? Explain giving reasons.
15. Why is dusting powder used on the carrom board? Explain.
16. The recoil of a gun, when fired, is an example of which Newton's law? Explain in detail.
17. What is circumduction? Where is it used in sports?

E. Case-based/Source-based Integrated Questions

1. **During the class, Ramesh was struck by the fact that the human body is capable of a variety of different movements. He also realised that a lot of this knowledge was used in sports as part of teaching biomechanics and its practical application in sports.**

(a) What are the main types of movements?

Ans. The human body is capable of four main types of movements. These are at the joints and include flexion — when two surfaces of the body come closer to each other — and extension — when they move away from each other. Also, with reference to the midline of the body, the movement towards the midline is called adduction while the movement away from the midline is known as abduction.

(b) How does the study of motion help in sports?

Ans. Study of motion of the human body, also known as biomechanics, has a very important role to play in the understanding of sports movements. Besides helping prevent injury, biomechanics is also useful in optimising sports performance of an athlete to achieve the highest results. This is vital in sports like javelin throw and jumping events.

(c) What motion does the arm of a fast bowler perform?

Ans. When fast bowlers are bowling, the shoulder undergoes a 360-degree movement at the joint. This is called circumduction. This combines most of the angular movements in a circular fashion.

2. **In a class on mechanics of the human body, Mr Suresh, the teacher, explained that the precise laws of motion were elucidated as early as 1687. These were compressed into a few basic laws and find great application in all fields including sports.**

(a) Who laid down the laws of motion in 1687?

Ans. The laws of motion were laid down by Sir Isaac Newton in 1687 in his book *Principia Mathematica*.

19. What is movement speed? Explain the methods to develop speed endurance. (AI 2015)

Ans. For the purpose of sports, speed is defined as the ability to move quickly across the ground or move limbs rapidly to grab or throw.

Following are the methods of developing speed:

Acceleration Run: Acceleration sprints are a good form of anaerobic training. They are particularly an effective means of emphasising and maintaining the technical components of the sprint action as the speed increases. The progressive nature of acceleration sprinting reduces the risk of muscle injury. Acceleration is the rate at which the speed of an object changes. Acceleration takes place in the first 0-30 metres or in about 3-4 seconds from the start of a sprint. After approximately 30 metres, acceleration turns into maximum velocity and the top speed is hit.

Pace Run: Running a specific distance at a constant pace is called pace running. A sportsperson is trained to maintain the speed throughout the distance. Longer the race, steadier should be the speed. Peak speed is avoided but constant speed is the norm. This helps improve endurance as well as speed. To complete a race of, say, 1500 metres, the runner ought to run at a suggested pace—33% slower than the maximum possible speed. Rather than burning out early, the idea is to pace out energy consumption so that it lasts the whole distance. Seasoned athletes understand and practise this concept.

20. What is active flexibility? (2014)

Ans. Active flexibility is the capacity of a joint to perform motion while the muscles are also moving. It is focused on increasing the extensibility and the neuromuscular efficiency of a muscle. It is of two types:

Dynamic Flexibility: It is the ability to perform dynamic movements within the full range of motion in the joint. Common examples include twisting from side to side or kicking an imaginary ball. Dynamic flexibility is generally more sport-specific than other forms of mobility.

Static Flexibility: It refers to the ability to stretch an antagonist muscle using only the tension in the agonist muscle. An example is holding one leg out in front of you as high as possible. The hamstring (antagonist) is being stretched while the quadriceps and hip flexors (agonists) are holding the leg up.

21. Write a brief essay on Fartlek training method. (AI 2014)

Ans. The word 'fartlek' is a Swedish term which means 'speed play'. It is a running session which combines speed and endurance. The principle behind fartlek training is to enable the body to adapt to various speeds, conditioning the body to become faster over longer distance.

When running a fartlek training session, you run for either a set time or distance and within that block you don't stop and rest. If you want to improve your speed, you would then increase the speed of the slower segments of your run slightly over time so that they become closer to the speed your faster segments are already at. To improve the endurance aspect of the fartlek session, you would simply reduce the shorter, recovery segments. If you want to improve both speed and endurance, then you can combine both the aspects within the fartlek session.

84. What is circumduction?
Ans. Circumduction refers to a conical movement of a body part, such as a ball and socket joint or the eye. Circumduction is a combination of flexion, extension, adduction and abduction.

85. What do you mean by plane?
Ans. A flat surface on which a straight line joining any two points on it would wholly lie. In mathematics, a plane is a flat, two-dimensional surface that extends infinitely far.

86. What do you mean by training?
Ans. Training is teaching or developing in oneself any skills and knowledge that relate to specific useful competencies.

87. What is sports training?
Ans. Sports training allows the body to gradually build up strength and endurance, improve skill levels and build motivation, ambition and confidence. It also allows athletes to gain more knowledge about their sport enabling them to learn about the importance of having a healthy mind and body.

88. Define speed.
Ans. Speed is the ability to move quickly across the ground or move limbs rapidly to grab or throw.

89. Define strength.
Ans. Strength is the maximal force you can apply against a load.

90. What are pace races?
Ans. A competitive pace race is a timed race in which the objective is not to finish in the least time but to finish within the prescribed time and in the best physical condition.

91. What is short-term endurance?
Ans. A type of aerobic resistance, this is the ability to resist fatigue for a duration of 45 seconds to 2 minutes.

92. What is acceleration ability?
Ans. The ability to pick up maximum speed from a stationary stance is the acceleration speed.

93. What is locomotor ability?
Ans. A locomotor skill is a physical action that propels an individual from one place to another.

94. What is speed endurance?
Ans. Speed endurance is the ability to prolong the amount of time where a near-maximal speed can be maintained.

95. What is the motto of Khelo India?
Ans. 'Kheloge kudoge toh banoge lajawab' is the motto of Khelo India.

96. What does the term Paralympics stand for?
Ans. The Paralympics are Olympic-style games for people with impairments—para stands for parallel, meaning equal to.

97. Define wellness.
Ans. Wellness is an active process of becoming aware of and making choices towards a healthy and fulfilling life. It is more than being free from illness.

98. What is yoga?
Ans. Yoga means a spiritual and ascetic discipline, a part of which, including breath control, simple meditation, and the adoption of specific bodily postures, is widely practised for health and relaxation.

99. What is the meaning of asana?
Ans. Asana is traditionally defined as a "seat". Most commonly, it is the seated posture used for meditation.

100. How many elements of yoga are there?
Ans. Eight.

101. What do you mean by growth and development?
Ans. The process of growth is defined as an increase in size; development is defined as a progression towards maturity. Thus, the terms are used together to describe the complex physical, mental and emotional processes associated with the "growing up" of children.

102. What is circuit training? Give a few examples.
Ans. Circuit training consists of a consecutive series of timed exercises performed one after the other with varying amounts of rest in between each exercise. An example of a simple circuit training workout might consist of push-ups, sit-ups, squats, chin-ups and lunges.

103. What is exercise adherence?
Ans. Exercise adherence is defined as maintaining an exercise regimen for a prolonged period of time following the initial adoption phase.

104. What is flexibility in sports?
Ans. Flexibility is the capacity of a joint or muscle to move through its full range of motion.

105. What is motivation?
Ans. Motivation is an internal process that makes a person move towards a goal.

106. What are the nutritive components of diet?
Ans. Proteins, carbohydrates and fats are the nutritive components of diet.

61. What do you mean by cardiac output?
Ans. Cardiac output (CO) is the product of the heart rate (HR), or the number of heart beats per minute (bpm), and the stroke volume (SV), which is the volume of blood pumped from the ventricle per beat; thus, CO = HR × SV. Values for cardiac output are usually denoted as L/min.
62. What do you mean by stroke volume?
Ans. Stroke Volume (SV) is the volume of blood pumped from the left ventricle per beat.
63. Why does involvement in regular exercise delay the onset of fatigue?
Ans. Regular physical activity increases the blood flow to our body and improves our cardiovascular health and fitness. This allows more blood and oxygen to the body providing energy to do work, thus delaying the onset of fatigue.
64. What is heart rate?
Ans. Heart rate, also known as pulse, is the number of times a person's heart beats per minute.
65. Explain ageing briefly.
Ans. Human ageing is the physiological changes that take place in the human body leading to senescence, the decline in biological functions and the ability to adapt to metabolic stress. The reasons of ageing are damage, such as DNA oxidation, which may cause biological systems to fail, or to the programmed ageing concept whereby internal processes (such as DNA methylation) may lead to ageing.
66. What do you mean by oxygen intake and oxygen uptake?
Ans. It is the amount of oxygen which can be taken by the lungs from air and consumed by the working muscles from the blood.
67. What do you mean by fracture?
Ans. A break in the structure of a bone is known as fracture.
68. What is contusion?
Ans. A contusion happens when an injured capillary or blood vessel leaks blood into the surrounding area.
69. What is strain?
Ans. A strain is an acute or chronic soft tissue injury that occurs to a muscle, tendon, or both (contractile components).
70. What is abrasion?
Ans. Abrasion is a wound consisting of superficial damage to the skin.
71. What do you mean by bruises?
Ans. A bruise, also known as a contusion, is a type of haematoma of tissue in which capillaries are damaged by trauma, causing a localised internal bleeding that spills into surrounding tissues.
72. What is greenstick fracture?
Ans. A greenstick fracture is a fracture in a young, soft bone, in which the bone bends and breaks partially.
73. What is comminuted fracture?
Ans. A comminuted fracture is a break or splinter of the bone into more than two fragments.
74. What is impacted fracture?
Ans. An impacted fracture occurs when the broken ends of the bone are jammed together by the force of the injury.
75. What is incision?
Ans. Incised wounds are cuts that are caused by sharp-force trauma, usually by a sharp-edged object.
76. What is first aid?
Ans. First aid is the help given to a sick or injured person until full medical treatment is available.
77. Name the types of movements.
Ans. The types of movements are: Flexion, Extension, Adduction, Abduction.
78. What is Flexion?
Ans. Flexion is the bending of a particular joint so that the bones that form that joint are pulled closer together.
79. What are Newton's three laws?
Ans. (a) Every object in a state of uniform motion will remain in that state of motion unless an external force acts on it.
(b) Force equals mass times acceleration.
(c) For every action there is an equal and opposite reaction.
80. State the law of acceleration.
Ans. It states that "the acceleration produced in a body is proportional to the force applied".
81. What is gravity?
Ans. Gravity or gravitation is a natural phenomenon by which all things with mass or energy—including planets, stars, galaxies, and even light—are brought towards the earth.
82. What do you mean by biomechanics?
Ans. Biomechanics is the science of movement of a living body, including how muscles, bones, tendons, and ligaments work together to produce movement.
83. What is vertical axis?
Ans. Vertical axis is the line that runs from top to bottom through the centre of the body.

on the muscle strength and flexibility. *For example*, in volleyball, a player smashes the ball according to the lift of the ball and the blockers very quickly sync the movements of their hands, head and feet.

(d) **Reaction Ability:** It is the ability to react immediately and effectively to a signal. This is of two types—simple reaction ability and complex reaction ability.

- **Simple Reaction Ability:** It is the ability to respond to a stimulus that is known beforehand to the person such as a starter pistol.
- **Complex Reaction Ability:** It is the response to unknown or unexpected signals. These are not known beforehand, *e.g.*, the reaction of the non-striker responding to a batsman's call for a run.

(e) **Balance Ability:** It is the ability to maintain balance during the complete body movement and to regain balance quickly after the balance-disturbing movement. *For example*, a gymnast landing after a manoeuvre or a skier or skater twisting along the course yet maintaining an erect posture.

(f) **Rhythm Ability:** It is the ability to observe and perceive the rhythm of a movement and to do the movement with external rhythm like music. This is very useful in sports like gymnastics and figure skating as well as in synchronised swimming. Many a time, the rhythm needs to be maintained without external aid like music, *e.g.*, in swimming and diving.

(g) **Adaptation Ability:** It refers to adjusting or changing the movement effectively on the basis of changes or anticipated changes in the situation. This involves increased use of motor skills.

(h) **Kinaesthetic Ability:** It helps sportspersons play using kinaesthetic impressions. Hitting a ball behind you as in tennis or a backstroke to pick up the shuttle in badminton involves this ability.

16. Explain what strength is and write the methods of improving strength. (AI 2016)

Ans. Strength is "the quality or state of being strong; bodily or muscular power; vigour." Strength is also defined as "the capacity of an object or substance to withstand great force or pressure."

Methods of improving strength—Isometric, Isotonic, Isokinetic

(a) **Isometric Exercises:** The word isometric comes from 'iso' meaning same and 'metric' meaning length. Hence, all exercises where the length of the muscle does not change, are classified as isometric exercises. Doing these exercises leads to increased strength of the muscles. During isometric exercises, the limbs do not move, while we can see movement in the muscle mass.

(b) **Isotonic Exercises:** These are the exercises where the strength of the muscle does not change but the length does. Any exercise that causes movements at joints is classified as isotonic exercise. Need for increased elasticity of the muscle or elastic strength requires the athlete to do isotonic exercises. Stationary jumps, squats, calisthenics and weight training are good examples of isotonic exercises.

(c) **Isokinetic Exercises:** These are the exercises in which variable resistance is applied to a limb in constant motion. While performing isokinetic exercises, one contracts the muscle while quickly moving the limb. These movements are a combination of isometric and isotonic movements that are most commonly used in all sporting activities. Isokinetic exercise, a type of strength training, is mostly done on machines. These exercises allow the muscle to gain strength consistently through a range of muscle movements. It uses specialised exercise machines that produce a constant speed no matter how much effort you expend.

17. Suggest any two isometric exercises for shoulder region. (2015)

Ans. The two isometric exercises for shoulder region are:

Isometric Flexion: Stand just 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.

Isometric Shoulder Press: Hold the dumbbells in each hand and position your arms at 90 degrees. Start pressing with one of the arms, keeping the other arm static. It is where one arm is doing the isometric movement while the other is doing the dynamic movement.

18. "Pace races mean running the whole distance of a race at a constant speed." Which are the races included in pace races? (AI 2015)

Ans. A competitive pace race is a timed race in which the objective is not to finish in the least time but to finish within the prescribed time and in the best physical condition. Examples include 400 m, 800 m and 1500 m races.

(a) What did he define sports psychology as?

Ans. Mr Singh defined sports psychology as the science of helping sportspersons overcome problems, enhance performance and achieve goals. It is also about improving the mindset to excel.

(b) What importance does it have in sports?

Ans. Sports psychology has great application in bettering the performance of a sportsperson. It focuses on improving the mindset to excel. It also helps overcome intense pressure that competitions present and aids recovery from injury, thus enhancing performance.

(c) How often should he be talking to the athletes he is training?

Ans. Mr Singh should talk to his athletes before every event, especially major competitions. This would help boost their confidence. Even during the games, he should give a pep talk and encourage on-field performance.

2. **Your school cricket team features members with diverse thought processes and characteristics. During a preparatory session, Mr Singh explained how different people have different personalities and traits. He also talked about the different dimensions of personalities among the team.**

(a) How did Mr Singh define personality?

Ans. Personality is defined as a combination of characteristics or qualities that form an individual's distinctive character. It focuses on different patterns of feeling, thinking and behaving.

(b) Based on body types, what types of personalities were explained?

Ans. Based on body types, Sheldon called personalities ectomorphic, mesomorphic and endomorphic. Ectomorphs are people with thin narrow shoulders, legs and arms with a narrow face and chest. These personalities keep to themselves. On the other hand, Endomorphs are people with wide shoulders and hips, who are easy-going and fun-loving, with an even temper. Mesomorphs are people that are in-between, with an attractive body, large head and narrow waists. They are adventurous and courageous.

(c) What were the different dimensions of personality explained?

Ans. Personality is multidimensional. These dimensions range from the physical (how we look), to mental and social dimensions as well as emotional dimensions. Physique is an important part of personality but intellectual qualities are also vital to a well-rounded personality. Having social skills is important as is being emotionally stable.

3. **After a loss in the extramural cricket tournament, the whole team was feeling low. The school Principal decided to have a motivator, Dr Sharma, come and talk to them to boost their morale. The motivator explained how we need self-determination and made a distinction between different types of motivation. After his talk, the team got excited again and resumed practice with great vigour.**

(a) How did he define the various types of self-determination?

Ans. Dr Sharma explained that self-determination was of two types. Intrinsic motivation was when the players had an internal feeling of wanting to win the next tournament. The second type, called extrinsic motivation, was what he offered by explaining how to overcome the fear of failure and to bounce back.

(b) What techniques did he suggest for the team to regain vigour?

Ans. The motivator encouraged the team to set goals, feel that they were in a healthy environment and that the teaching methods on offer were modern and up-to-date. He also focused on maintaining a positive attitude, tracking their progress and results, and also encouraged everyone to listen to music and have a positive self-talk every day.

(c) What importance did he lay on goal setting?

Ans. Dr Sharma explained that goals have to be in line with the physical and mental capacity of the individual players as well as the team. He suggested that while aiming high, they should divide goals into immediate, and medium- and long-range. Setting up progressively tougher goals was the idea he encouraged. Also, he advocated patience and enough time to reach the decided goals.

E. Case-based/Source-based Integrated Questions

1. A sports physiology expert, Mr Singh, was invited to deliver a talk to the school teams to explain the various determinants of strength and the measures required to improve performance. He also explained that strength, speed and flexibility were all very important to achieve optimum performance in the competitions.

(a) What determinants of strength did the expert focus on?

Ans. Mr Singh explained that strength came from various physiological factors. These included the size of an athlete's muscles, the body weight, the muscle composition of an individual as well as the intensity of nerve impulse. Bigger the muscle size, stronger it was. Also, muscular weight was important. A factor that was intrinsic to strength was the ratio of fast-to-slow twitch fibres in an individual's muscles. Stronger the nerve impulse, more was the strength.

(b) How did he explain the concept of speed?

Ans. Speed of an athlete, Mr Singh said, was also multifactorial. While genetics had a big role to play in nerve impulse excitability of the muscle, one could focus on enhancing the flexibility of the muscle. Choice of the sport was determined by muscle composition but strength was mentioned as contributing to speed. Increasing the energy reserve and metabolic power is possible by increasing aerobic respiration.

(c) What different aspects of flexibility did he talk about?

Ans. Mr Singh explained that the flexibility of an athlete was proportional to muscle strength. Joint structure, age and gender were also important considerations. Warming up was important to increase flexibility as were stretching exercises before a full performance. Care should be taken to avoid injuries to prevent limitation of flexibility later on.

2. Regular exercise is important. However, many children in your class do no exercise at all. To encourage all students to take part in exercise programs conducted by the school, a talk was organised to explain the benefits of exercise to heart, lungs and the muscular system.

(a) What advantages does exercise offer to the heart according to the talk?

Ans. In her talk, the expert explained that exercise offers many benefits to the heart and cardiovascular system. These include making the heart stronger by increasing the muscular size of the heart, thus contributing to better cardiac output, decreased blood pressure at rest as well as a slower resting heart rate. More blood is pumped with each heartbeat and more oxygen reaches the organs because the capillary network increases. This, in turn, leads to early recovery after exercise and lowers the risk of chronic diseases like diabetes and high blood pressure.

(b) How is muscular system benefited by regular exercise?

Ans. Regular exercise has a very beneficial effect on the muscular system. Muscle size and the bulk increases with regular exercise as does the tone of the muscles. The reaction time of muscles becomes better and the posture also improves. Fat deposits in the muscle decrease and fatigue is delayed. The oxygen storage capacity of muscles increases and stronger muscles lead to swifter, more flexible movements.

(c) What benefits of exercise on the respiratory system were explained in the talk?

Ans. Exercise hugely benefits the lungs and the respiratory system. Regular exercise increases the size of the chest and the lungs which, in turn, increases the amount of air inhaled and exhaled with each breath. There is later onset of the feeling of breathlessness as well as increased endurance. Increased use of alveoli creates better lung perfusion and vital capacity of the lungs goes up.

APPENDIX A

VIVA VOCE

1. What are the aims of physical education?

Ans. Physical education is "education through the physical". It aims to develop students' physical competence and knowledge of movement and safety, and their ability to use these to perform in a wide range of activities associated with the development of an active and healthy lifestyle.

2. Define physical education.

Ans. Definition of physical education: Instructions in the development and care of the body ranging from simple callisthenics to a course of study providing training in hygiene, gymnastics, and the performance and management of athletic games.

3. What is a knockout tournament?

Ans. In a knockout tournament, all contestants get eliminated from the competition one by one till only the winner is left. Once defeated, a team or an individual does not get a second chance.

4. What is a round-robin tournament?

Ans. A round-robin tournament is a competition in which each contestant meets all other contestants.

5. What is seeding?

Ans. This is a method of ranking players and teams on the basis of their past performance.

6. What do you mean by Organising Committee?

Ans. This committee, headed by a Chairman, has the overall responsibility of organising, running and concluding an event.

7. What do you mean by a 'bye'?

Ans. When the number of teams or players in any given tournament is not even, we need to give byes to them because we want to have only top four teams in the semi-finals of the event.

8. What do you mean by planning?

Ans. Once the desired goal of an event is decided, we need to put things and action together to attain the said goal. This is what is called planning.

9. What are specific sports programmes?

Ans. Specific sports programmes include non-competitive sports events for a social cause. These events may be as simple as a 5-km community walk to a fund-raiser or a health awareness sports event.

10. What are consolation tournaments?

Ans. At times, some good teams have a bad day and get eliminated from a tournament. So, some organisers hold a Consolation Tournament giving an extra chance to the defeated teams to participate and win. This gives the good teams an opportunity to get secondary honours.

11. What do you mean by extramural?

Ans. These are the sports activities that are held outside the walls of a school or an institution.

12. What do you mean by single-league tournament?

Ans. In single-league tournaments, each team gets an opportunity to play every other team at least once and the winner goes into the next round straightaway.

13. Define an intramural tournament.

Ans. A tournament held within a school or institution for its students only is called intramural tournament.

14. What do you mean by a balanced diet?

Ans. A balanced diet means a diet that has all the nutrition that is required on a daily basis in specific quantities.

15. What do you mean by nutrition?

Ans. Nutrition is the intake of adequate food in relation to the body's dietary needs.

16. What are the types of nutrients?

Ans. The nutrients that we need in large quantities are called macronutrients and those needed in small quantities are called micronutrients.

17. Enlist the macronutrients.

Ans. Proteins, fats and carbohydrates are the macronutrients.

18. What are fats?

Ans. Fats are one of the three main macronutrients.

19. What are micronutrients?

Ans. These are food components needed in very small quantities but on a daily basis.

20. What is food intolerance?

Ans. Food intolerance occurs when a person has difficulty digesting a particular food.

21. Fats are derived from two sources. Name them.

Ans. Fats are derived from animal and vegetable sources. Plant-based fats include fats such as nuts and seeds and oils from grains and seeds. Animal sources of fats are butter, whole milk, products made with whole milk, meats and eggs.

(b) Boys and girls had one difference in a test. Which test was it and what was the difference?

Ans. The difference between boys and girls is in the Medicine Ball Put Test where while the ball for boys weighs 3 kilograms while the ball used for girls is of 1 kilogram.

(c) How is the Standing Broad Jump performed and what is its aim?

Ans. Standing Long Jump, also known as Broad Jump, is done with the students taking off from a clearly marked line. Two feet take-off and landing are used and the longest distance jumped by landing on feet in three attempts is taken as the score.

3. To add fun and to motivate children, the school decided to encourage parents also to take part in a series of fitness tests. The grandparents were also encouraged to come and take part in these tests in the presence of children.

(a) What are the fitness tests for the elderly called?

Ans. The tests for parents and grandparents are called the Rikli and Jones Test, named after the inventors of these tests.

(b) How many tests were made available to the parents and grandparents?

Ans. The elderly undergo a series of six tests. These include Chair Stand Test, Arm Curl Test, Chair Sit and Reach Test, Back Scratch Test, Eight Foot Up and Go Test, and Walk/Step in Place Test.

(c) What is the Walk Test and Step in Place Test for the elderly?

Ans. In the Walk Test, the elderly people are encouraged to walk for six minutes on a 200-feet track. The distance covered in six minutes is measured and compared to the set standards. An alternative is to stand at a fixed place and step up and down for a two-minute timeframe, and the number of steps is counted.

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