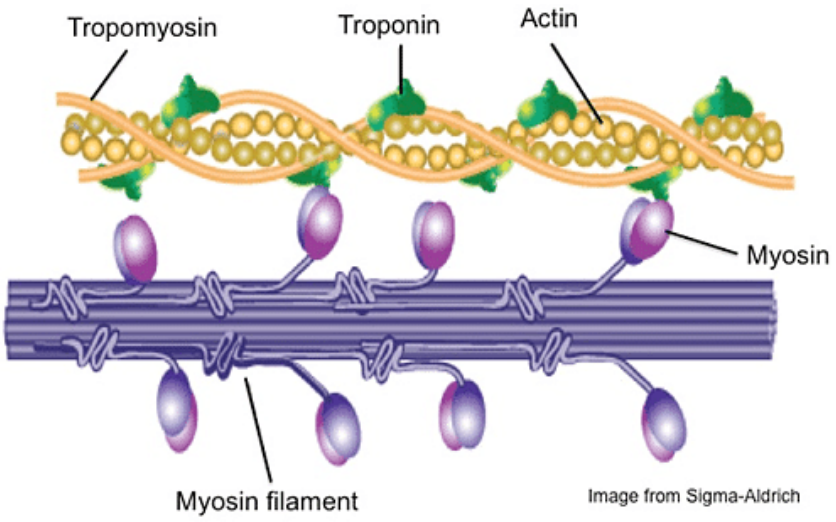
How Do We Move?

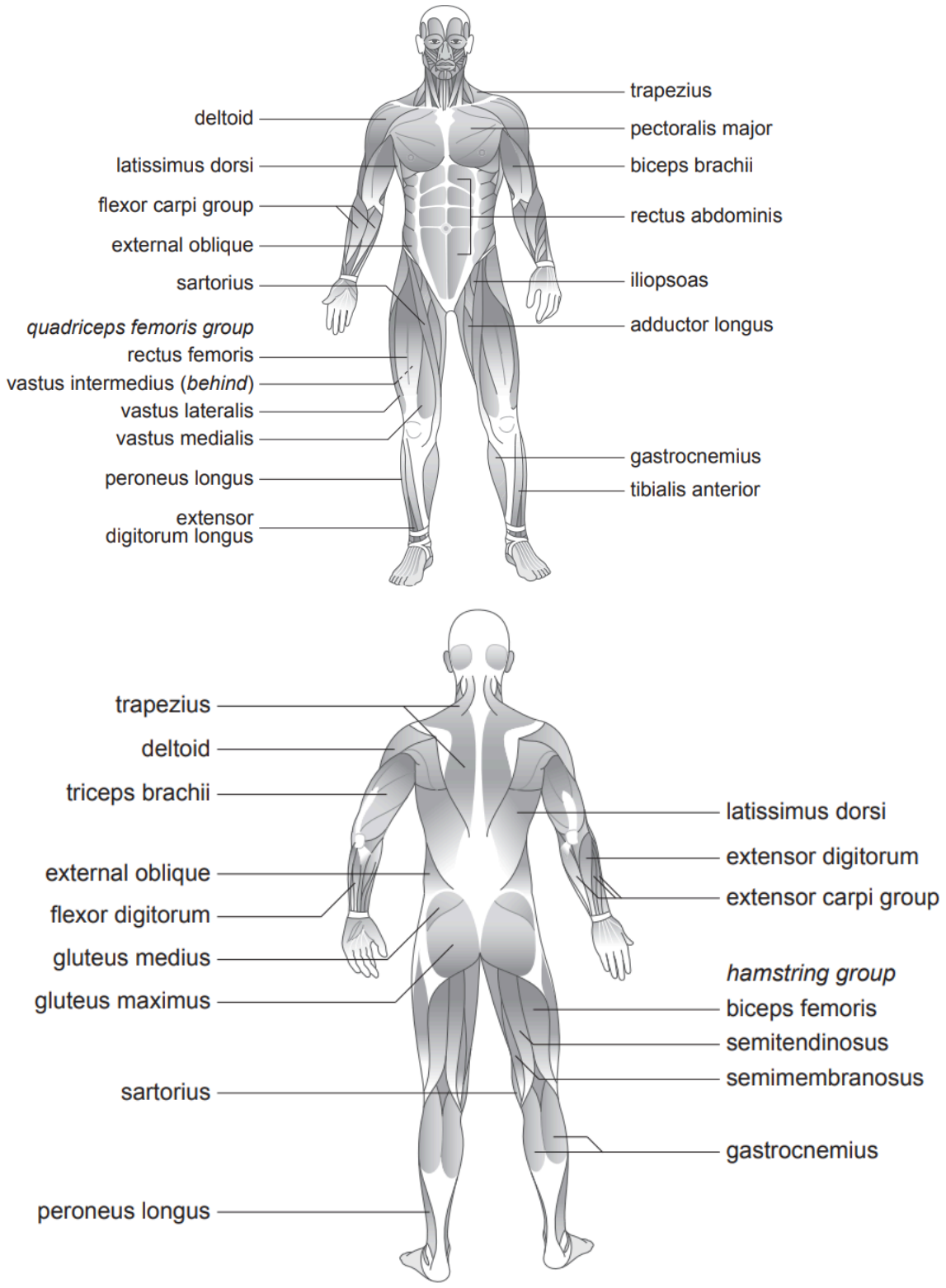


Name:

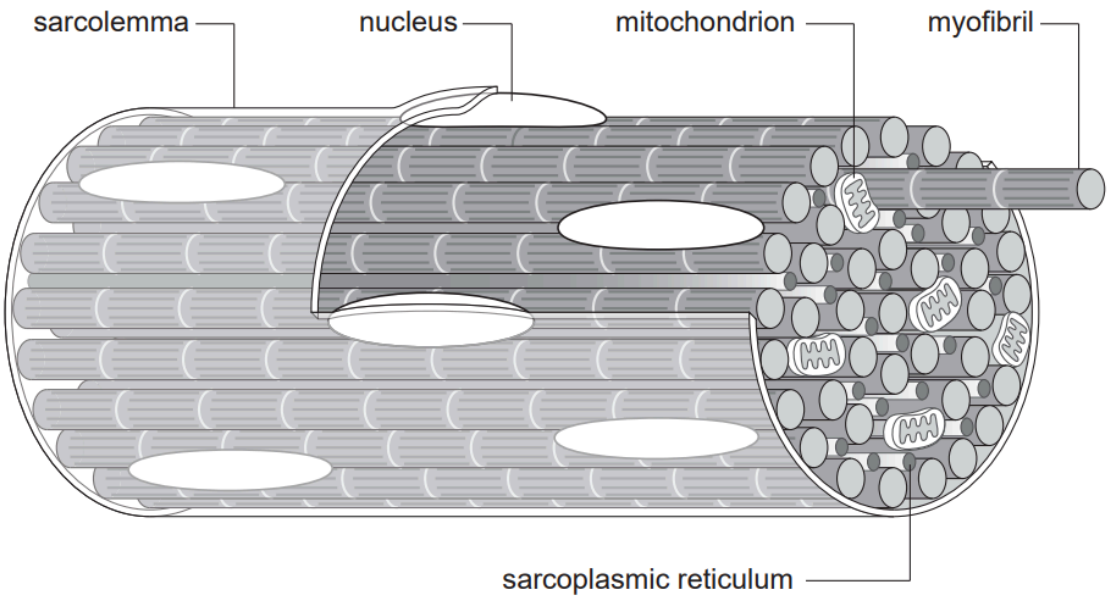
Teacher: Mr Trent

Assessment	1	2	3	4	5	6	7
Grade	7	7	7	7	7	7	7
	6	6	6	6	6	6	6
	5	5	5	5	5	5	5
	4	4	4	4	4	4	4
	3	3	3	3	3	3	3
	2	2	2	2	2	2	2
	1	1	1	1	1	1	1
	N/A	N/A	N/A	N/A	N/A	N/A	N/A

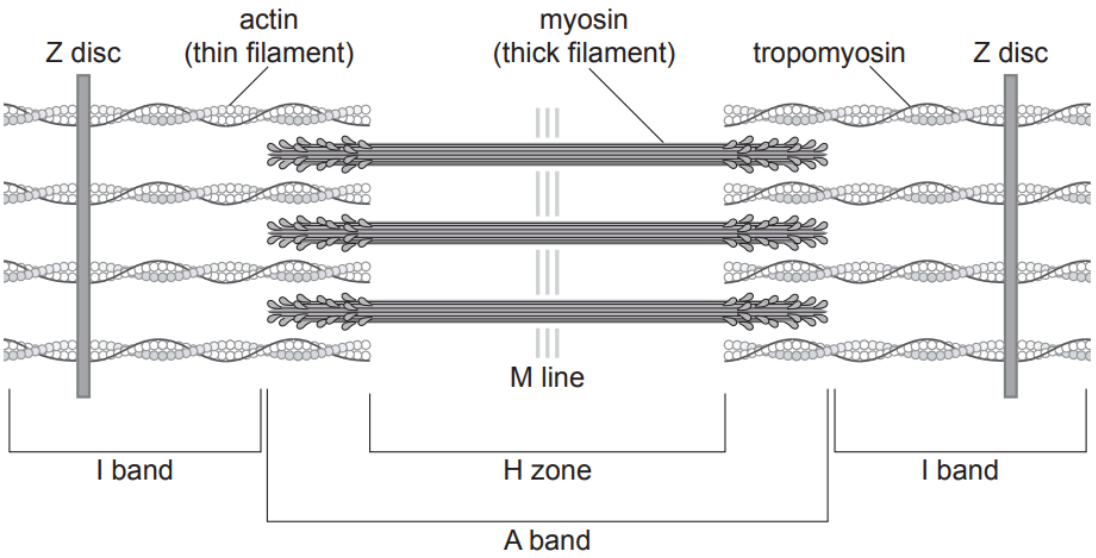
Date	Target	Achieved


deltoid
latissimus dorsi
flexor carpi group
external oblique
sartorius
quadriceps femoris group
rectus femoris
vastus intermedius (behind)
vastus lateralis
vastus medialis
peroneus longus
extensor digitorum longus
trapezius
pectoralis major
biceps brachii
rectus abdominis
iliopsoas
adductor longus
gastrocnemius
tibialis anterior
trapezius
deltoid
triceps brachii
external oblique
flexor digitorum
gluteus medius
gluteus maximus
sartorius
peroneus longus
latissimus dorsi
extensor digitorum
extensor carpi group
hamstring group
biceps femoris
semitendinosus
semimembranosus
gastrocnemius

10. Muscle fibre

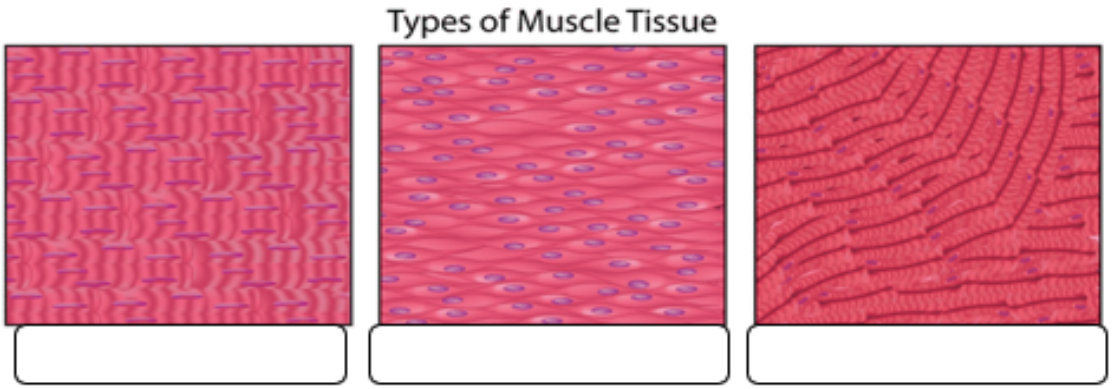


11. Sarcomere in a relaxed myofibril



B.1.3 Muscular function

B.1.3.1—The body uses different types of muscular contractions to create movement and stability. Each type of contraction has a different function



Why is the function of the muscles?

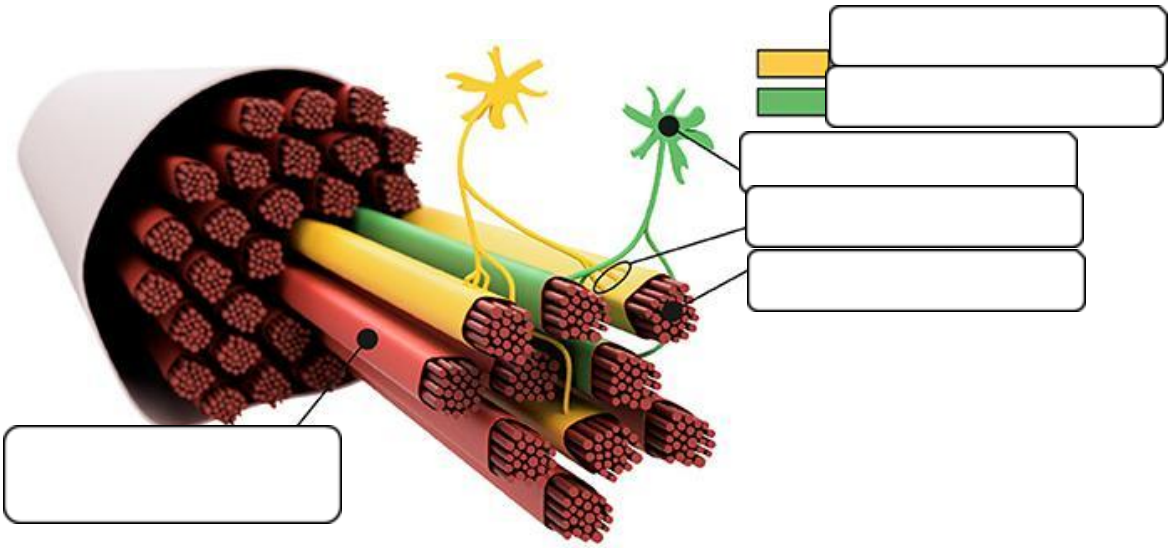
1.
2.
3.
4.

What are the 4 main properties of muscles?

1. C
2. E
3. E
4. E

€ Muscles are organised in functional groupings called motor units that contract using the all-or-none principle.

How are muscles structured to support their function?



1. Muscles are organized into functional groupings known as:

a) Motor units
b) Muscle groups
c) Nerve bundles
d) Sarcomeres

2. The fundamental process that muscle groups enable is:

a) Digestion
b) Circulation
c) Movement
d) Respiration

3. The all-or-none principle states that when a motor neuron sends a signal:

a) Only some muscle fibers will contract
b) The entire muscle contracts
c) All the muscle fibers it controls contract fully
d) The signal is transmitted to other motor neurons

4. A motor unit consists of a motor neuron and:

a) The blood vessels supplying the muscle
b) The muscle fibers it innervates
c) The bones it moves
d) The sensory receptors in the muscle

5. The primary source of energy for muscle contraction is:

a) Oxygen
b) ATP

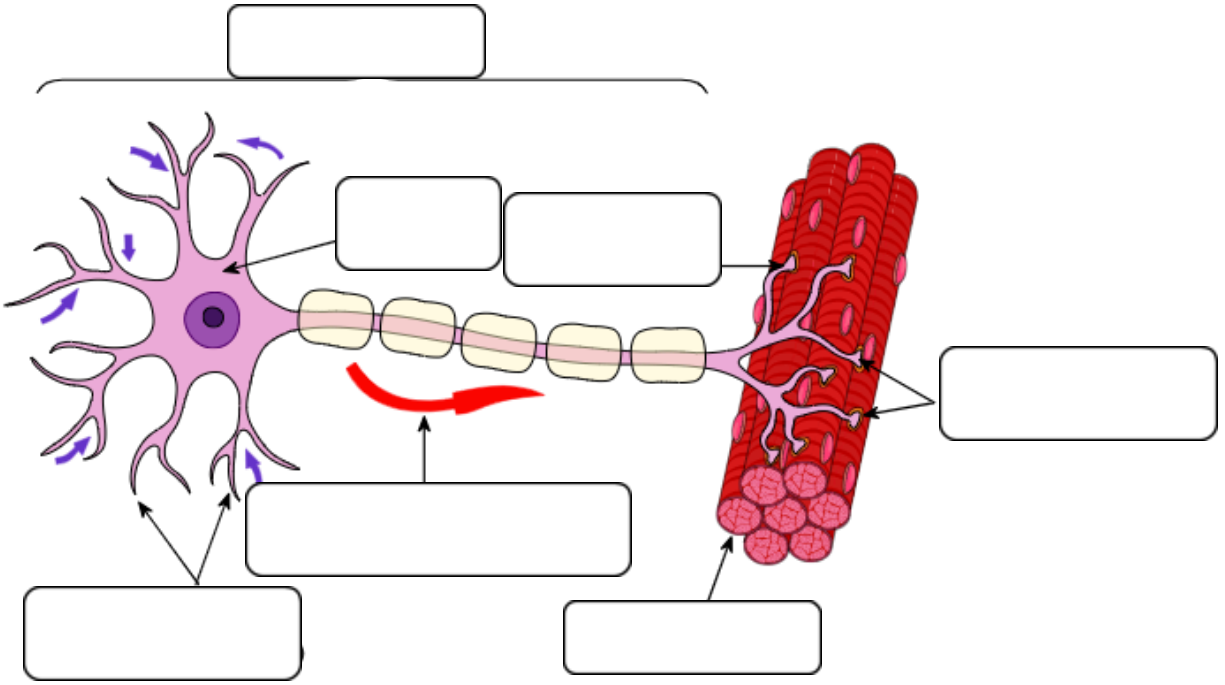
c) Lactic acid
d) Myoglobin

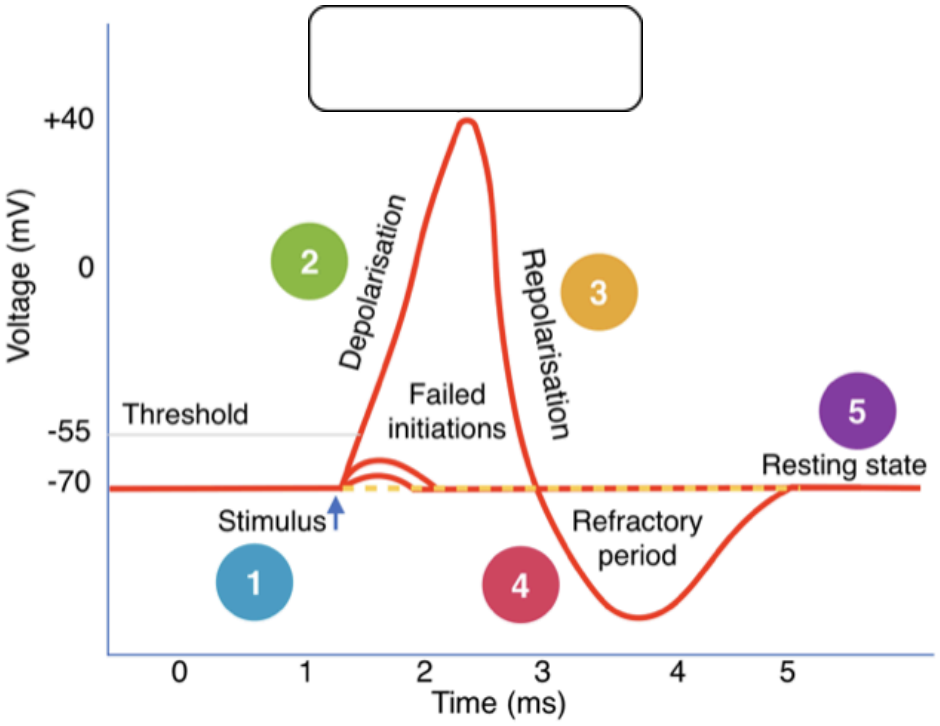
6. The breakdown of ATP in muscle cells is essential for:

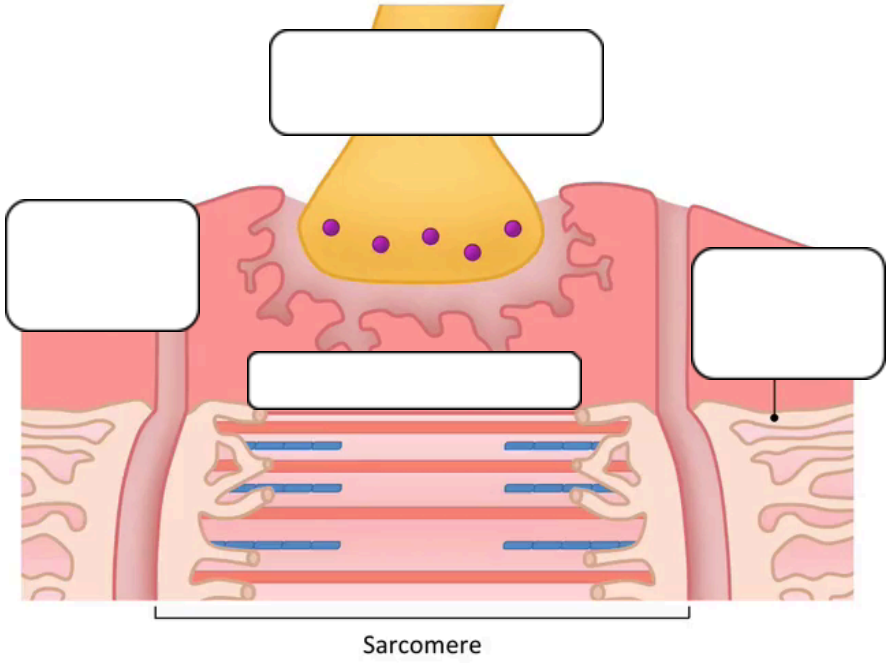
a) Maintaining muscle function and contraction
b) Producing nerve impulses
c) Blood circulation
d) Increasing bone density

7. The role of metabolism in muscle contraction is to:

a) Store excess energy
b) Convert glucose into ATP for energy
c) Prevent muscle fatigue
d) Transport oxygen to the brain







Action potential initiated in the motor neuron

⬇

Acetylcholine released into the synaptic cleft

⬇

Depolarisation spreads along the sarcolemma and T tubules

⬇

Calcium ions are released from the sarcoplasmic reticulum

⬇

Sarcomere contraction is triggered, shortening the muscle fibre

- € Muscular contraction requires the metabolism of ATP within the muscle cells.

Draw and annotate ADP and ATP

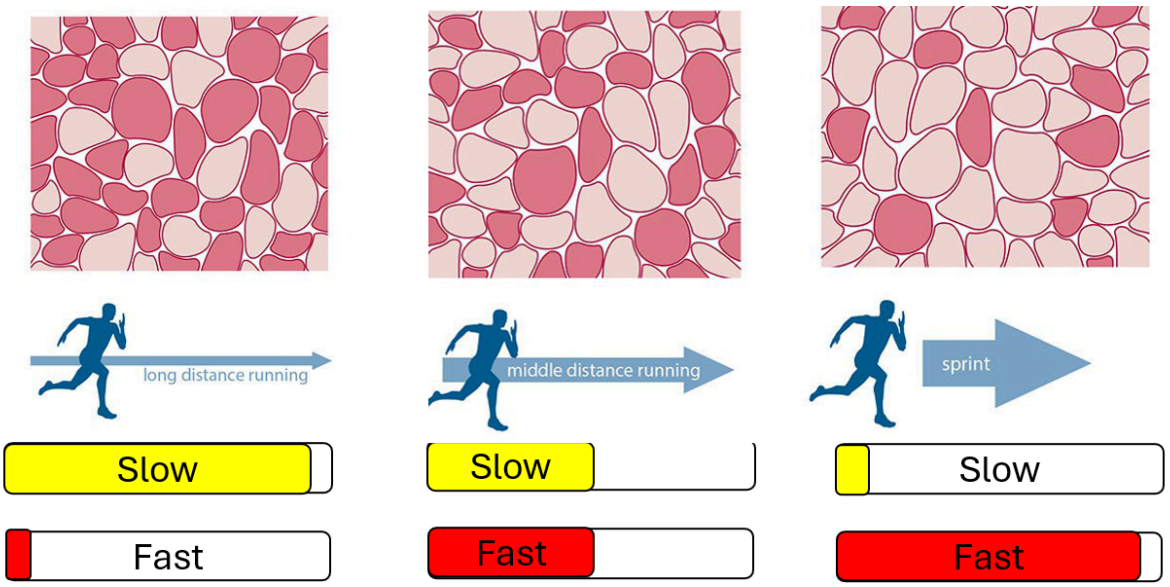
Research Task:

- How does maximal force capability differ between muscle fibre types?

- How does mitochondrial numbers differ between muscle fibre types? Why?

- What is myoglobin and how does the muscle fibre type affect it?

- What is capillary density and how does the muscle fibre type affect it?


long distance running
middle distance running
sprint
Slow
Fast
Slow
Fast
Slow
Fast

- € Motor units are differentiated by fibre type and neuron diameter:
- € types I, type IIa type IIx.

Characteristic	Type 1 (Slow Twitch)	Type 2a (Fast Twitch, Oxidative)	Type 2b (Fast Twitch, Glycolytic)
Primary Function	Endurance and sustained contractions	Moderate endurance and strength	
Fiber Type	Slow oxidative fibres	Fast oxidative glycolytic fibres	_____glycolytic fibres
Contraction Speed		Fast (moderate contraction speed)	Very fast (rapid contraction)
Force Production		Moderate force output	High force output
Fatigue Resistance	Very high (resistant to fatigue)	Moderate (fatigue-resistant but less than Type 1)	
Mitochondria Content	High (lots of mitochondria for aerobic metabolism)		Low (few mitochondria, relies on anaerobic metabolism)
Capillary Density	High (lots of capillaries for oxygen delivery)	Moderate (some capillaries for oxygen delivery)	Low (fewer capillaries, relies on anaerobic processes)

Myoglobin Content	High (more oxygen-carrying myoglobin)	Moderate (less myoglobin than Type 1)	Low (minimal myoglobin content)
Primary Energy Source	Oxygen (aerobic respiration)	Both oxygen (aerobic) and glucose (anaerobic)	Glucose (anaerobic glycolysis)
Fatigue Onset	Delayed (very resistant to fatigue)	Intermediate (fatigues more quickly than Type 1)	Quick (fatigues rapidly due to reliance on anaerobic energy)
Motor Unit Size	Small (one neuron controls fewer muscle fibres)	Intermediate (one neuron controls more fibres than Type 1)	Large (one neuron controls many muscle fibres)
Activity Examples			
Muscle Fiber Colour	Red (due to high myoglobin content)	Pink (due to mix of oxidative and glycolytic activity)	White (due to low myoglobin content)

Create a presentation on 1 Type of Muscle Fibre (Type 1, Type 2a, Type 2b)

3 x slides of information

1 x Question and answer (NO AI)

Planning Space

Compare and contrast muscle fibres using sporting examples (8 marks)

Slow-Twitch (Type I) Muscle Fibres:

a) Contract slowly and generate less force.

b) High endurance due to high capillary density, myoglobin, and mitochondria.

c) Use aerobic respiration for energy (efficient but slower ATP production).

d) Fatigue-resistant, suited for prolonged activities.

e) **Sporting Example:** Marathon runners rely on slow-twitch fibres for sustained endurance over long distances.

Fast-Twitch (Type II) Muscle Fibres:

f) Contract quickly and generate more force.

g) Lower endurance due to fewer mitochondria and capillaries.

h) Use anaerobic respiration for energy (rapid ATP production but causes fatigue).

i) Suitable for explosive, high-intensity movements.

j) **Sporting Example:** Sprinters rely on fast-twitch fibres for short bursts of maximum effort.

Type IIa (Fast Oxidative) Muscle Fibres:

k) Intermediate fibres, combining some endurance with power.

l) Can use both aerobic and anaerobic respiration.

m) **Sporting Example:** 400m runners use Type IIa fibres for sustained speed over a middle distance.

Type IIb (Fast Glycolytic) Muscle Fibres:

n) Produce maximum power but fatigue very quickly.

o) Rely almost entirely on anaerobic respiration.

p) **Sporting Example:** Powerlifters and 100m sprinters use Type IIb fibres for explosive strength.

€ Their recruitment patterns vary depending on the activity.

Word Fill: Principle of Orderly Recruitment in Muscle Fibers

Question 1:

The Principle of Orderly Recruitment explains how different motor units are recruited based on _____.

✅ **Force**
🟥 Strength
🟦 Speed
🟩 Endurance

Question 2:

The smallest motor units, which are recruited first, contain _____ muscle fibres.

✅ **Type 1**
🟥 Type 2a
🟦 Type 2b
🟩 Type X

Question 3:

Slow-twitch muscle fibres are best suited for _____ activities.

✅ **Endurance**
🟥 Explosive
🟦 Power
🟩 Speed

Question 4:

As force increases, larger motor units with _____ fibres are recruited.

✅ **Type 2a**
🟥 Type 1
🟦 Type 2b
🟩 Type X

Question 5:

When maximum force is required, the largest motor units contain _____ fibres.

✅ **Type 2b**
🟥 Type 1
🟦 Type 2a
🟩 Type X

Question 6:

Type 2b fibres rely on _____ metabolism for energy.

✅ **Anaerobic**

🟥 Aerobic

🟦 Oxidative

🟩 Phosphagen

Question 7:

This recruitment pattern ensures that _____ fibres are used first to conserve energy.

✅ **Smallest**

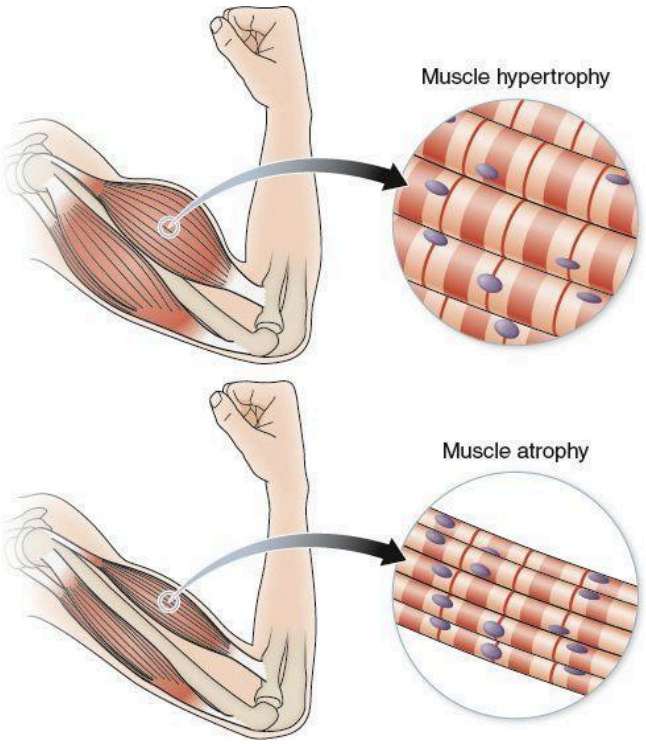
🟥 Strongest

🟦 Fastest

🟩 Weakest

€ Hypertrophy and atrophy of muscle can cause alterations in a motor unit recruitment pattern.

Describe transient and chronic hypertrophy.



Explain the principles of muscular hypertrophy

	● Muscle fibres experience microscopic tears due to high-intensity resistance training. ● Over time, with consistent training and proper recovery, muscle fibres become larger and stronger. ● Satellite cells multiply and fuse to the damaged muscle fibres, helping repair and reinforce them. ● Resistance training (e.g., weightlifting) applies progressive overload to the muscles. ● The body synthesizes more proteins to rebuild the muscle fibres thicker and stronger. ● Proper nutrition, especially protein intake, supports muscle repair and growth. ● The nervous system adapts, improving muscle recruitment and coordination. ● Rest and recovery allow muscle repair and growth to take place.

- € Contractions can be described in four different ways: isometric, isotonic concentric, isotonic eccentric and isokinetic.
- € Isometric
- € isotonic concentric
- € isotonic eccentric
- € isokinetic

Example		Term		Description
Holding a plank position, pushing against a wall, or holding a weight in place without moving it.		**Isotonic Concentric**		A type of muscle contraction where the muscle generates force but does not change length. No movement occurs.
Lowering a dumbbell during a bicep curl (muscle lengthens as you lower the weight).		**Isokinetic**		A type of muscle contraction where the muscle changes length at a constant speed throughout the entire movement, usually done with specialized equipment.
Lifting a dumbbell during a bicep curl (muscle shortens as you curl the weight up).		**Isometric**		A type of muscle contraction where the muscle shortens as it generates force, resulting in movement.
Using a leg press machine that maintains a constant speed as you push and release the weight.		**Isotonic Eccentric**		A type of muscle contraction where the muscle lengthens while generating force, usually when resisting a force.

- Isometric: No movement, muscle stays the same length (e.g., holding a position).
- Isotonic Concentric: Muscle shortens while producing force (e.g., lifting a weight).
- Isotonic Eccentric: Muscle lengthens while producing force (e.g., lowering a weight).
- Isokinetic: Muscle changes length at a constant speed (e.g., using specialized exercise machines).

€ Muscles usually function in pairs, and act with reciprocal inhibition: their pairings are agonist and antagonist.
€ Define Agonist & antagonist.

Muscle antagonistic pairs refer to pairs of muscles that work in _____ to each other, producing opposite movements at a joint. For movement to occur, muscles need to contract and relax in a coordinated manner. One muscle of the pair _____(agonist), while the other _____ (antagonist), allowing smooth, controlled movement.

Muscle antagonistic pairs refer to pairs of muscles that work in **opposition** to each other, producing opposite movements at a joint. For movement to occur, muscles need to contract and relax in a coordinated manner. One muscle of the pair **contracts** (agonist), while the other **relaxes** (antagonist), allowing smooth, controlled movement.

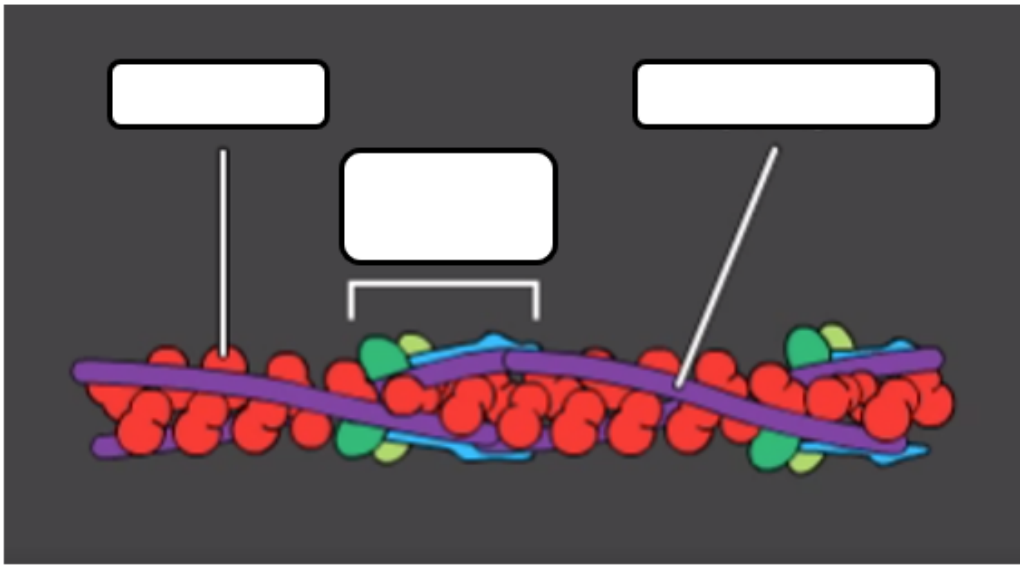
Movement	Agonist (Prime Mover)	Antagonist
Flexion at the Knee	**Quadriceps**	**Hamstrings**
Extension at the Knee		
Hip Flexion		**Gluteus Maximus**
Hip Extension		**Iliopsoas** (Hip Flexors)
Plantar Flexion		**Tibialis Anterior**
Dorsiflexion		**Gastrocnemius**

What is the role of synergists?

What is the origin and insertion points and how does this affect muscle relationships?

HL B.1.3.2—The sliding filament theory describes the interaction between myofilaments and the molecules responsible for sarcomere or muscle contraction.

- € Calcium
- € ATP
- € Actin
- € Myosin
- € Troponin
- € Tropomyosin



Draw and annotate a sarcomere below:

1. **Calcium (Ca^{2+})** 2. **ATP** **(Adenosine** **Triphosphate)** 3. **Actin** 4. **Myosin** 5. **Troponin** 6. **Tropomyosin**		A. Protein that binds to calcium and moves tropomyosin, allowing muscle contraction to occur. B. Protein filament that forms cross-bridges with actin to generate muscle contraction. C. The energy molecule required for myosin to detach from actin and reset for the next contraction. D. Protein filament that has binding sites for myosin heads and plays a role in contraction. E. Ion released from the sarcoplasmic reticulum to trigger muscle contraction. F. Protein that blocks actin binding sites in a resting muscle, preventing contraction.

Complete the sentences using the correct words from the word bank:
(Calcium, ATP, Actin, Myosin, Troponin, Tropomyosin)

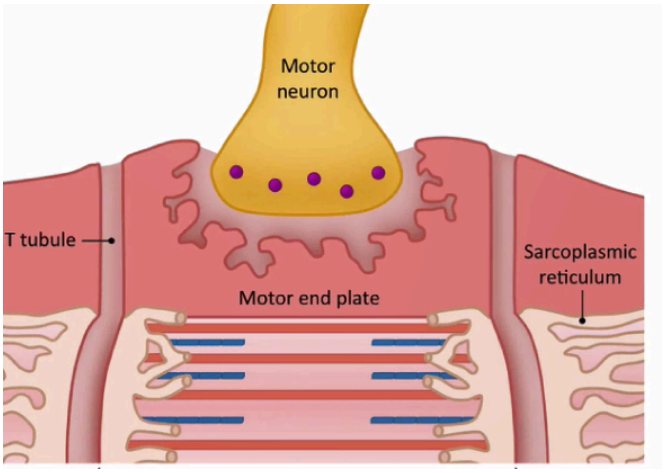
1. _____ is released from the sarcoplasmic reticulum and binds to _____ to expose the binding sites on _____.
2. _____ heads form cross-bridges with actin to generate force.
3. _____ moves to block or unblock the myosin-binding sites on actin filaments.
4. _____ provides the energy required for myosin to detach and reset for another contraction.

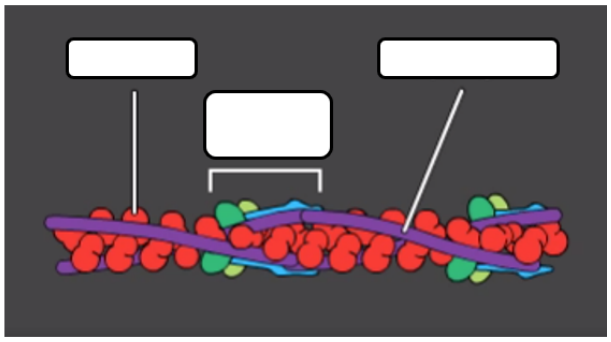
5. Explain the role of calcium ions in muscle contraction.

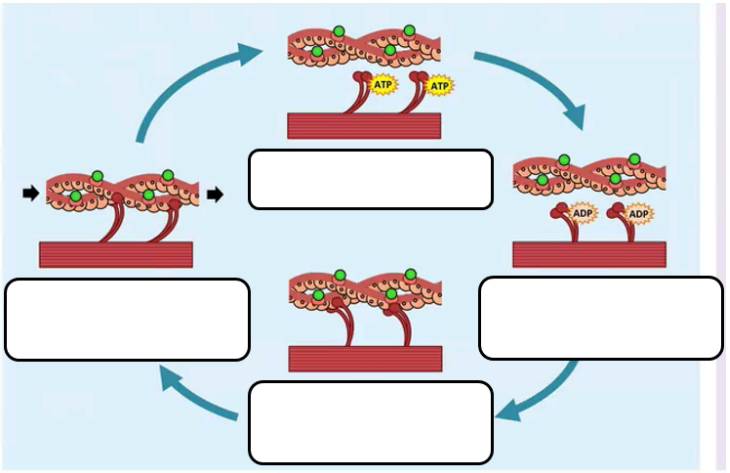
6. Describe the role of ATP in the sliding filament theory.

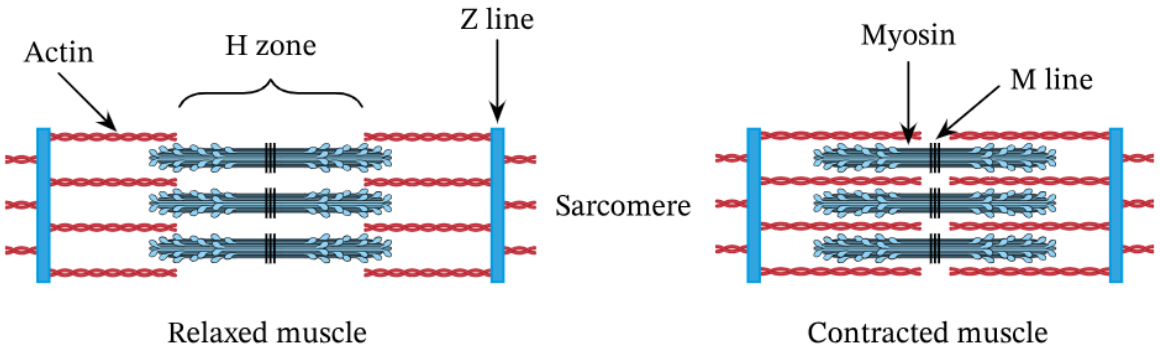
7. How do troponin and tropomyosin regulate muscle contraction?

Extension Question: What happens if ATP is no longer available in a muscle cell, and how does this relate to rigor mortis?


Motor
neuron
T tubule
Sarcoplasmic
reticulum
Motor end plate




ATP
ATP
ADP
ADP



Paste the statements in the correct order below

- An action potential propagated along a motor neuron arrives at the neuromuscular junction.
- This causes the release of the neurotransmitter acetylcholine into the synapse between the terminal axon of the motor neuron and the sarcolemma of the skeletal muscle.
- The acetylcholine binds to receptors on the sarcolemma, causing voltage-gated channels to open and Na^+ ions to flow into the muscle cells.
- This creates an action potential in the striated muscle.
- The action potential is further propagated along the sarcolemma of the skeletal muscle.
- The action potential moves into the interior of the muscle cell through folds called *t tubules*.
- The depolarization of the *t tubules* causes voltage-gated Ca^+ channels on the sarcoplasmic reticulum to open, causing an influx of Ca^+ ions into the sarcoplasm.
- Ca^+ ions bind to troponin which causes tropomyosin to move exposing the myosin binding sites (troponin and tropomyosin are regulatory proteins blocking the myosin binding sites).
- ATP attaches to the myosin heads breaking the cross-bridges between the myosin heads and actin binding sites
- The ATP undergoes a hydrolysis reaction forming ADP + P_i. This causes a positional change in the myosin head (cocked back).
- The myosin heads bind to actin filaments forming cross-bridges at a site one position further from the centre of the sarcomere

- When the ADP + P_i are released the myosin heads change conformational position, sliding the actin filaments towards the center of the Sarcomere. This is called the "power stroke".
- After the power stroke ATP again binds to the myosin head, causing it to detach from the actin filament ready for another cycle.

(c) Explain how skeletal muscle contracts. (8)

(skeletal) muscle is composed of myofibrils;
operational unit is a sarcomere;
viewed as a series of light and dark bands;
thin actin fibres;
thick myosin fibres;
arrival of action potential;
release of Ca^{2+};
from sarcoplasmic reticulum;
exposes binding sites of myosin fibres;
ATP used to break cross bridges between myosin and actin fibres;
hydrolysis of ATP resets myosin head;
causing sliding of actin and myosin; 8 max

*(Plus up to **[2]** for quality)*

A.3.1.1—The quality of training design and programme design are essential elements in developing a safe and effective programme for improving health or performance.

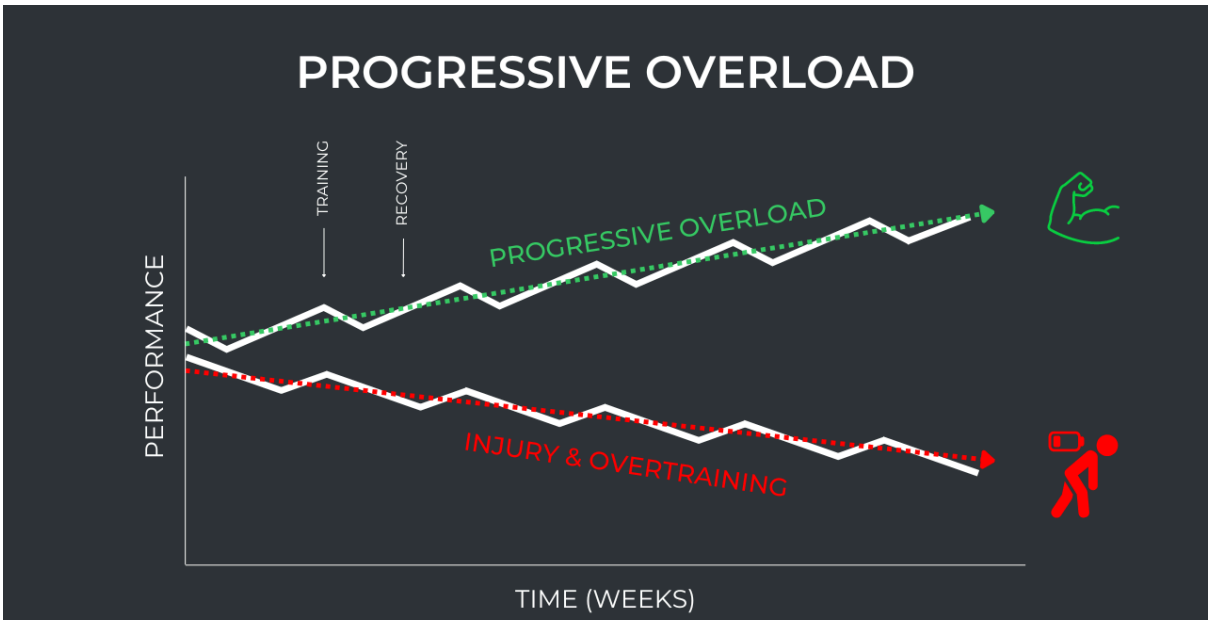
- € Common training principles direct programme design. These are:
- € specificity,
- € progressive overload (frequency, intensity and duration),
- € recovery (rest principle),
- € variety,
- € reversibility
- € periodisation.

Training programs are designed using fundamental principles to ensure effectiveness and safety. These principles guide athletes and fitness enthusiasts in developing structured and progressive routines that maximize performance gains while minimizing risks.

1. **Specificity** – Training should be relevant to the sport or activity an individual is preparing for.

a.
b.
c.
d.
e.
f.

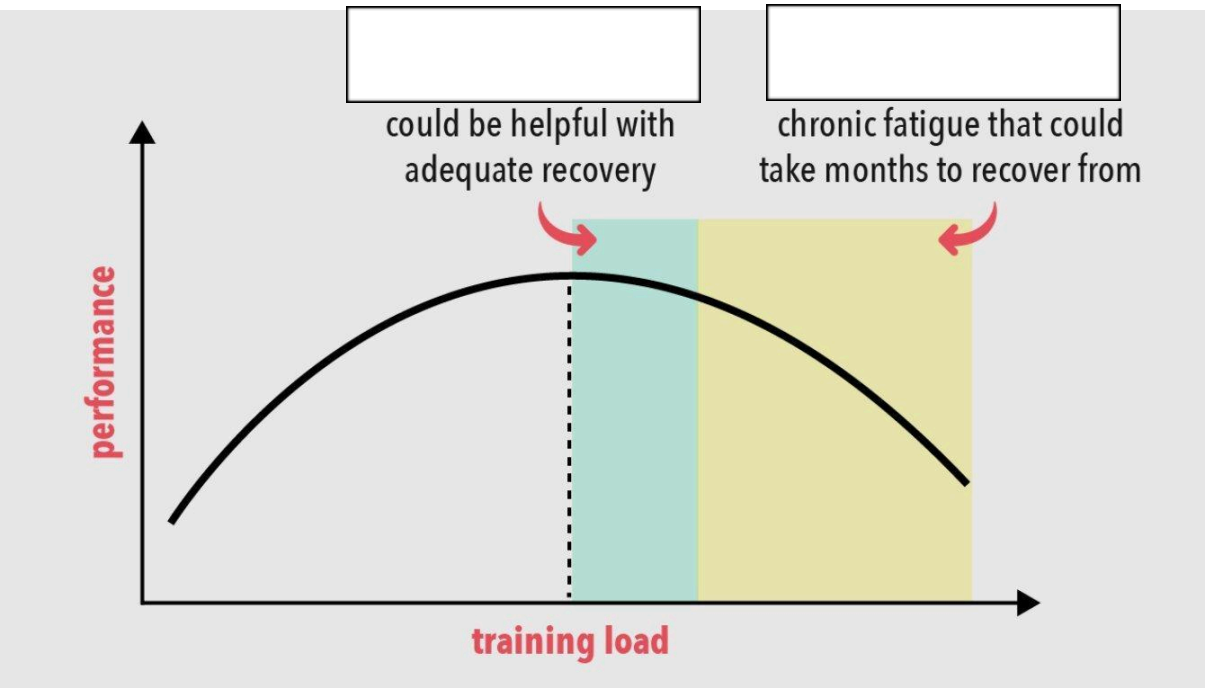
2. **Progressive Overload** – To improve fitness, the body must be gradually exposed to greater demands.



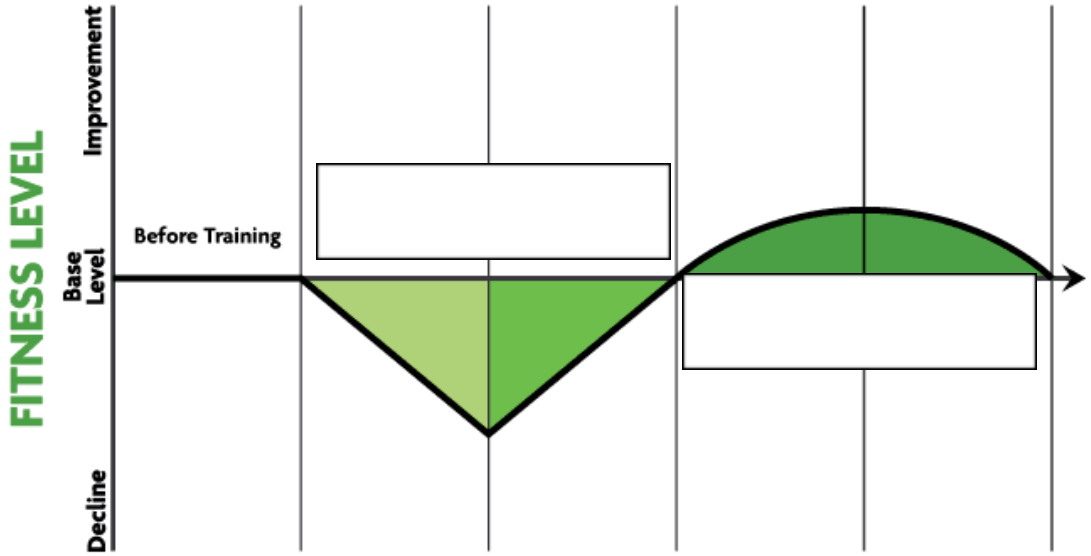
Increase	Decrease

3. **Recovery (Rest Principle)** – Adequate rest between sessions is essential for muscle repair, growth, and overall performance improvement. Without proper recovery, the risk of injury increases.

Why is recovery important?



What is overreaching?



What is overtraining?

Signs and Symptoms of Overtraining

_____ Recovery – Happens between sets or intervals during a workout. For example, rest periods in weightlifting or jogging between sprints.

_____ Recovery – Occurs in the hours after a workout, focusing on refueling energy stores, repairing muscles, and hydrating.

_____ Recovery – Involves planned rest days or deload weeks, allowing deeper physiological repair and preventing burnout.

Evaluation of recovery techniques such as myofascial release, wearing compression garments, thermotherapy.

Research and discuss the scientific justification behind each of these recovery methods

1. Foam Rolling (myofascial release)

2. Suction Cupping

3. Wearing compression garments

4. Ice Baths and Saunas (thermotherapy)

Sleep Research Task:

Objective:

Understand the stages of sleep, recommended sleep durations, and their impact on recovery and performance in sports.

Task Instructions:

Part 1: Research and Summarise

1. Read the information provided on the **stages of sleep** and summarise each stage in your own words.
2. Explain why REM sleep is important for **muscle recovery, memory consolidation, and reaction time** in athletes.

Part 2: Data Analysis

3. Using the sleep duration recommendations, create a bar chart or table comparing the sleep needs of different age groups, including **elite athletes**.
4. Track your own sleep for three nights, recording the total hours slept and any factors that may have affected your rest (e.g., screen time, stress, caffeine intake, training load). Reflect on how your sleep quality might impact your **physical performance and recovery**.

Part 3: Creative Application

5. Design a **Sleep Recovery Plan** for an athlete preparing for a major competition. Include at least **three strategies** from the tips section and explain how they can optimise recovery and performance.
6. Create a short infographic or social media post that educates athletes on the importance of sleep for **injury prevention, muscle repair, and peak performance**.

€ Overreaching and overtraining are possible consequences of poorly designed or poorly maintained programmes

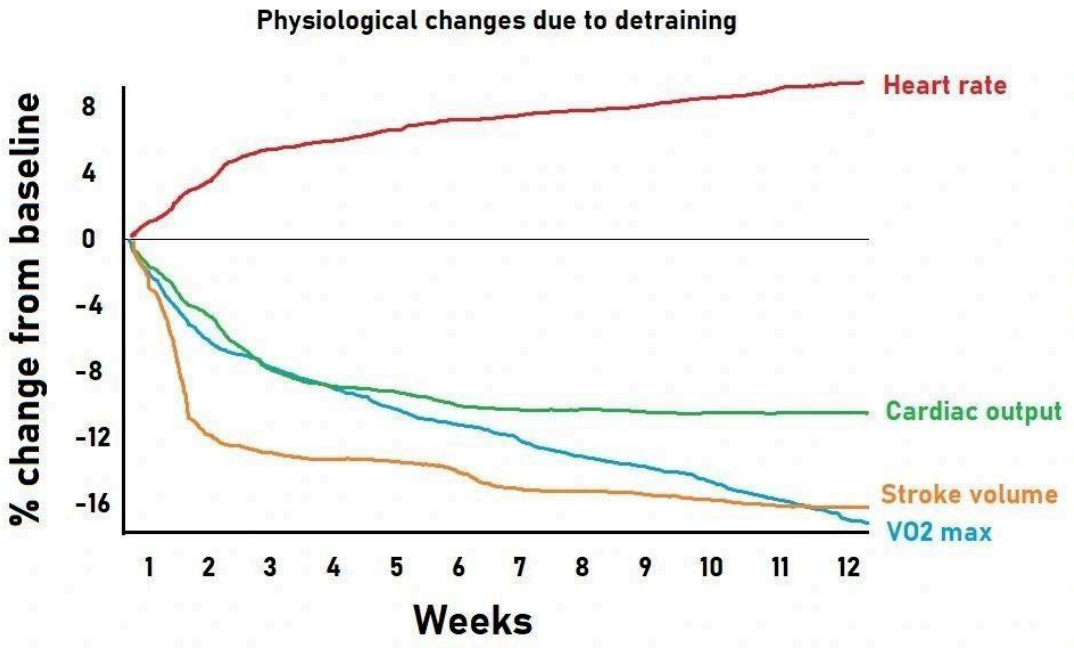
Term		Definition		Example		Drawing
Training		The process of regular physical activity aimed at improving performance, fitness, or skills. It involves progressively increasing intensity, duration, and frequency to promote physiological adaptations.		Example: A person running or lifting weights with gradual increases in intensity.		
Overtraining		A condition that occurs when an athlete trains beyond the body's ability to recover, leading to a decrease in performance, fatigue, and sometimes injury. It's typically caused by excessive intensity and insufficient rest.		Example: A runner looking fatigued with a decrease in performance, showing tiredness or stress.		
Undertraining		The insufficient or inadequate amount of training, often leading to poor performance due to a lack of adaptation. This could be from too little intensity, volume, or consistency in exercise.		Example: A person doing minimal or no exercise, lacking improvement in skills or performance.		
Overreaching		A short-term phase of intense training where performance temporarily declines but can lead to greater improvements after adequate recovery. It's often used strategically for athletes to push limits.		Example: An athlete performing intense, focused training with a brief period of decreased performance, followed by recovery.		

4. **Variety** – Incorporating different exercises and training methods prevents boredom and plateaus in progress. It also ensures that multiple muscle groups and skills are developed.

What is variety principle of program design?

5. **Reversibility** – Fitness levels decline when training is stopped or reduced. Regular training is necessary to maintain fitness gains and prevent detraining effects.

<u>Reversibility Principle Data Analysis</u>



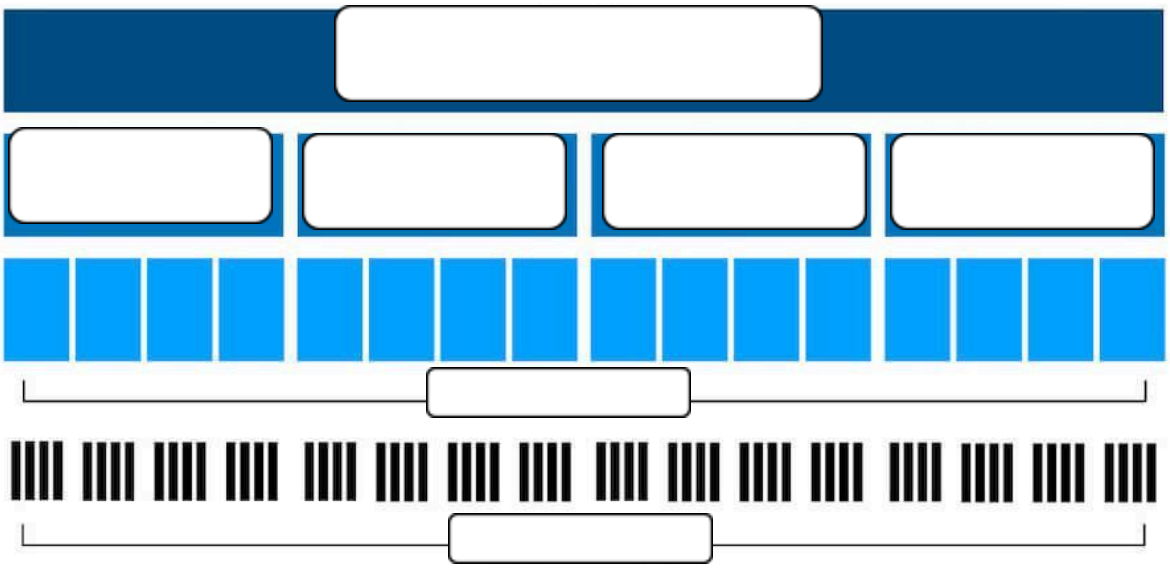
1. (4 marks)Describe the trendline and relationship for each:
2. (2 marks) Define detraining and explain how it affects cardiovascular performance.
3. (2 marks) Describe the trend observed in VO_2 max over the 12-week detraining period.
4. (2 marks) Explain why stroke volume decreases significantly during detraining.
5. (3 marks) Using the graph, compare and contrast the changes in heart rate and stroke volume over the 12-week period.
6. (3 marks) Calculate the approximate percentage decrease in VO_2 max after 6 weeks of detraining and explain its significance for endurance athletes.
7. (2 marks) Identify the physiological factor that stabilizes the earliest in the detraining process and suggest why this might occur.
8. (4 marks) Discuss the implications of detraining for a marathon runner who takes a break from training due to injury.

9. (4 marks) Suggest and justify two training strategies an athlete can use to minimize the effects of detraining.
10. (2 marks) Explain why trained athletes experience a more rapid decline in cardiovascular fitness compared to untrained individuals when they stop training.
11. (3 marks) Explain how an athlete should use progressive overload to regain cardiovascular fitness after a period of detraining.
12. (3 marks) Describe two physiological adaptations that occur when progressive overload is reintroduced after 12 weeks of detraining.

€ Measuring baseline values and progress are important components of design.

Term		Description		Examples
Fitness Assessments		Conduct initial tests to determine starting fitness levels.		VO2 max test, strength tests, flexibility assessments.
Body Composition Analysis		Use tools to track changes in body fat and muscle mass.		BMI calculations, skinfold measurements, bioelectrical impedance.
Performanc e Tracking		Monitor improvements in physical attributes over time.		Timed runs, weightlifting records, agility drills.
Heart Rate Monitoring		Assess cardiovascular fitness by measuring heart rate metrics.		Resting heart rate, maximum heart rate, recovery heart rate.
Training Logs		Maintain a record of workout details and progress.		Journals tracking intensity, frequency, and duration.
Wearable Technology		Use fitness trackers to measure activity and health metrics.		Smartwatches, step counters, calorie trackers.
Regular Progress Reviews		Reassess fitness milestones and adjust training plans accordingly.		Periodic evaluations, goal-setting sessions, fitness reassessments.

6. **Periodisation** – This involves structuring training into distinct phases (e.g., preparation, competition, recovery) to optimise performance at key times and prevent overtraining.



Program: **Basketball Training Program**	Strengths and Weaknesses
Macrocycle (6 Months): Off-Season to Peak Performance Meso 1 (Weeks 1-8) - Strength & Conditioning Focus (Off-Season) ● Monday: Strength Training (Squats, Deadlifts, Lunges) + Core Work (Planks, Russian Twists) ● Tuesday: Dribbling Drills (Only Stationary Dribbling, No Game-Like Scenarios) + Agility Ladder ● Wednesday: Rest & Active Recovery (Foam Rolling, Stretching) ● Thursday: Sprint Intervals (10x40m) + Shooting Drills (Only Free Throws, No In-Game Shooting Drills) ● Friday: Full-Court Scrimmage (No Tactical Focus) + Strength Training (Pull-ups, Bench Press, Medicine Ball Throws) ● Saturday: Light Recovery Workout (Yoga, Mobility Work) ● Sunday: Rest	
Meso 2 (Weeks 9-16) - Pre-Season Focus (Skill Development & Game Fitness) ● Monday: Shooting & Footwork Drills (Only Static Jump Shots, No Defensive Pressure) + Defensive Drills ● Tuesday: Tactical Drills + Small-Sided Games (3v3, 5v5) ● Wednesday: Recovery (Pool Session, Mobility Drills) ● Thursday: Strength Training (Reduced Load, No Sport-Specific Work) + Basic Ball Handling ● Friday: Team Strategy, Fast Break Drills + Scrimmage ● Saturday: Low-Intensity Skills Work (Only Layups, No Defensive Work) + Free Throws ● Sunday: Rest	
Meso 3 (Weeks 17-24) - In-Season Performance Optimization (Overreaching Phase) ● Monday: Tactical Adjustments + Film Analysis + Light Shooting Work ● Tuesday: Speed & Agility Drills + Game Situations (Pick & Roll, Defensive Schemes) ● Wednesday: Strength Training (No Adjustments for Fatigue) + Sprint Work (No Recovery, Leading to Fatigue) ● Thursday: Game-Day Simulation Drills (Situational Plays, Endgame Scenarios) + Extra Conditioning Drills (Unnecessary High Volume) ● Friday: Team Strategy & Competition Prep + Shooting Drills ● Saturday: Rest ● Sunday: Match Day	

Program: **Soccer Training Program Macrocycle (6 Months): Base Building to Peak Performance**	Strengths and Weaknesses
Meso 1 (Weeks 1-8) - Pre-Season Conditioning & Strength Focus ● Monday: Aerobic Base Training (Long Run 6-10km, No Sport-Specific Work) + Core Work ● Tuesday: Strength Training (Squats, Deadlifts, Step-Ups) + Sprint Drills (No Ball Involved) ● Wednesday: Dribbling & Passing Drills (No Defensive Pressure) + Tactical Play (Small-Sided Games) ● Thursday: Rest & Recovery (Stretching, Hydrotherapy) ● Friday: Speed & Agility Drills (Cone Drills, Ladders, No Game-Specific Context) + Shooting Drills ● Saturday: Recovery (Stretching, Massage) + Tactical Review ● Sunday: Rest	
Meso 2 (Weeks 9-16) - In-Season Performance & Tactical Refinement (Overtraining Phase) ● Monday: Tactical Training (Set Pieces, Positional Play) + Light Jogging (3km) ● Tuesday: Shooting Drills (Only Stationary Shots, No Dynamic Play) + Passing Patterns ● Wednesday: Strength Training (Too Intense for In-Season) + Sprint Intervals (No Rest Periods) ● Thursday: Recovery Session (Should Be More Frequent But Is Missing) ● Friday: Full Match Simulation + Fitness Drills (Excessive Volume Close to Match Day) ● Saturday: Extra Tactical Work (Leading to Fatigue) ● Sunday: Match Day	
Meso 3 (Weeks 17-24) - Peak Performance & Maintenance ● Monday: Match Recovery Session + Pool Work ● Tuesday: Tactical Adjustments + Positional Training ● Wednesday: Rest & Recovery ● Thursday: Strength Maintenance (Lower Load) + Sprint Work ● Friday: Game-Specific Drills + Scrimmage ● Saturday: Low-Intensity Mobility Work ● Sunday: Match Day	

Program: **Soccer Training Program Macrocycle (6 Months): Base Building to Peak Performance**	Strengths and Weaknesses
Meso 1 (Weeks 1-8) - Pre-Season Conditioning & Strength Focus ● Monday: Aerobic Base Training (Long Run 6-10km, No Sport-Specific Work) + Core Work ● Tuesday: Strength Training (Squats, Deadlifts, Step-Ups) + Sprint Drills (No Ball Involved) ● Wednesday: Dribbling & Passing Drills (No Defensive Pressure) + Tactical Play (Small-Sided Games) ● Thursday: Rest & Recovery (Stretching, Hydrotherapy) ● Friday: Speed & Agility Drills (Cone Drills, Ladders, No Game-Specific Context) + Shooting Drills ● Saturday: Recovery (Stretching, Massage) + Tactical Review ● Sunday: Rest	
Meso 2 (Weeks 9-16) - In-Season Performance & Tactical Refinement (Overtraining Phase) ● Monday: Tactical Training (Set Pieces, Positional Play) + Light Jogging (3km) ● Tuesday: Shooting Drills (Only Stationary Shots, No Dynamic Play) + Passing Patterns ● Wednesday: Strength Training (Too Intense for In-Season) + Sprint Intervals (No Rest Periods) ● Thursday: Recovery Session (Should Be More Frequent But Is Missing) ● Friday: Full Match Simulation + Fitness Drills (Excessive Volume Close to Match Day) ● Saturday: Extra Tactical Work (Leading to Fatigue) ● Sunday: Match Day	
Meso 3 (Weeks 17-24) - Peak Performance & Maintenance ● Monday: Match Recovery Session + Pool Work ● Tuesday: Tactical Adjustments + Positional Training ● Wednesday: Rest & Recovery ● Thursday: Strength Maintenance (Lower Load) + Sprint Work ● Friday: Game-Specific Drills + Scrimmage ● Saturday: Low-Intensity Mobility Work ● Sunday: Match Day	

Program: **Marathon Training Program** Macrocycle (6 Months): Base Building to Peak Performance	Strengths and Weaknesses
Meso 1 (Weeks 1-8) - Base Building & Aerobic Endurance ● Monday: Easy Run (5-10km) + Strength Training (Upper Body Focus, Not Running-Specific) ● Tuesday: Tempo Run (3-6km) + Flexibility Work ● Wednesday: Rest & Recovery (Foam Rolling, Stretching) ● Thursday: Long Run (10-15km) + Hydration Strategies ● Friday: Recovery Run (Too Fast to Be Effective) + Yoga ● Saturday: Interval Training (Short 100m Sprints, Not Marathon-Specific) + Strength Training (Leg Press Instead of Functional Strength) ● Sunday: Rest	
Meso 2 (Weeks 9-16) - Peak Training Volume & Speed Work ● Monday: Long Run (15-20km) + Core Stability Work ● Tuesday: Hill Sprints (6x200m, Too Short for Marathon Training) + Strength Training (Too Intense for Running Focus) ● Wednesday: Rest ● Thursday: Speed Intervals (Too Fast for Endurance Runners) + Stride Mechanics ● Friday: Recovery Run (4-6km, Should Be Slower for True Recovery) + Hydration & Fueling Plan ● Saturday: Half-Marathon Simulation (Overreaching, Should Be Spaced Out More) ● Sunday: Rest	
Meso 3 (Weeks 17-24) - Tapering & Race Preparation ● Monday: Reduced Long Run (10-15km) + Light Recovery Work ● Tuesday: Short Sprints (6x100m, Not Relevant for Marathon) + Strength Maintenance (Reduced Load) ● Wednesday: Rest & Active Recovery (Stretching, Massage) ● Thursday: Speed Drills (Too Fast for Tapering Phase) + Breathing Techniques ● Friday: Recovery Run (3-5km) + Visualization & Mental Prep ● Saturday: Rest & Light Jogging	

• Sunday: Marathon Race Day	

1. What principle ensures that training aligns with the specific requirements of an activity or sport?

   a) Variety
   b) Specificity
   c) Reversibility
   d) Periodisation

2. How can progressive overload be applied?

   a) By keeping training intensity the same throughout
   b) By reducing the duration of training sessions
   c) By gradually increasing frequency, intensity, or duration
   d) By taking long breaks between workouts

3. What happens if training stops or significantly decreases?

   a) Muscles grow stronger
   b) Fitness levels decline
   c) Energy levels increase
   d) Training variety increases

4. Why is recovery an essential part of a training program?

5. How does variety help prevent performance plateaus?

6. Explain how periodisation benefits athletes during competition season.

7. Write a short paragraph explaining how you would apply these training principles to a sport or physical activity of your choice.

1. **Which of the following statements about body composition analysis is MOST accurate?**

   A) BMI is the most reliable method for assessing an individual's fat-to-muscle ratio.
   B) Skinfold measurements provide an exact percentage of body fat with no margin of error.
   C) Bioelectrical impedance measures body composition by assessing the resistance of electrical currents in the body.
   D) Performance tracking is a more effective method of measuring body composition than any of the above.

2. **An athlete's resting heart rate has decreased over a 6-month training period. What does this MOST likely indicate?**
   A) The athlete's cardiovascular fitness has declined.
   B) The athlete is experiencing overtraining syndrome.
   C) The athlete has improved their cardiovascular efficiency.
   D) The athlete has developed a higher maximum heart rate.

3. **A coach wants to evaluate an athlete's endurance improvements over time. Which combination of assessment tools would be MOST effective?**

   A) VO2 max test and resting heart rate measurement.
   B) Skinfold measurements and BMI calculation.
   C) Weightlifting records and flexibility assessments.
   D) Step count tracking and body composition analysis.

4. Analysis Question: How might an athlete's VO2 max results influence their training program, and what adjustments could be made based on poor results?

5. Application Question: If an individual wants to track both their strength and endurance improvements, which assessment methods should they combine, and why?

6. Evaluation Question: Wearable technology has become increasingly popular for fitness tracking. What are the benefits and limitations of relying on these devices compared to traditional assessment methods?

- € Macrocycles, mesocycles and microcycles impact athletic performance. An athlete's adaptive responses to training will depend on the intensity and methods (anaerobic and aerobic) of training utilised,

Types of Training Task: Create an informative and visually appealing factsheet that explains different types of training methods. Your factsheet should include key information, examples, and benefits of each training type.

Task Instructions:

1. **Title & Introduction**
    - Give your factsheet a clear title (e.g., *"Understanding Types of Training"*)
    - Write a short introduction explaining why training methods are important for fitness and performance.
2. **Include the Following Types of Training:**
    - **Continuous Training** (e.g., long-distance running, swimming)
    - **Interval Training** (e.g., sprint intervals, HIIT)
    - **Resistance Training** (e.g., weightlifting, bodyweight exercises)
    - **Flexibility Training** (e.g., yoga, stretching routines)
    - **Fartlek Training** (e.g., varied-speed running, cycling)
    - **Circuit Training** (e.g., gym circuits, bodyweight exercise stations)
    - **Plyometric Training** (e.g., box jumps, explosive movements)
3. **For Each Training Type, Include:**
    - A brief **definition**
    - At least **one example** of how it's used
    - The **main benefits** (e.g., improves endurance, builds strength, enhances flexibility)
    - Who might use this type of training (e.g., sprinters, endurance athletes, weightlifters)
4. **Design & Presentation:**
    - Use **headings, bullet points, and bold text** to organize your factsheet.
    - Include **images, diagrams, or graphs** where possible.
    - Ensure your work is **clear, concise, and engaging.**

Extension Challenge:

- Compare two training methods and explain which would be best for an athlete preparing for a 400m race.

€ inter-individual differences such as genetics (responders versus non-responders).
€ Training programmes need to consider:
€ the individual's current level of fitness
€ age
€ sex differences (including reproductive status
€ hormonal changes during the menstrual cycle, based on an arbitrary natural 28-day cycle (a diagram of the menstrual cycle is found in the SEHS data booklet)
€ the phase of the macrocycle.

Scenario:

You are a **personal trainer** designing a **year-long** training program for a **competitive athlete** in a specific sport of your choice (e.g., sprinter, endurance runner, swimmer, football player, weightlifter). Your goal is to optimize their **performance** while applying key **principles of training** in a safe and effective manner.

Task Breakdown:

1. **Describe Each Principle of Training (10 marks)**
    - Define and explain the **six key training principles**:
        - **Specificity**
        - **Progressive overload (frequency, intensity, duration)**
        - **Recovery (rest principle)**
        - **Variety**
        - **Reversibility**
        - **Periodisation**
    - Provide **practical examples** of how each principle applies to training.
2. **Apply the Principles to Your Athlete (10 marks)**
    - Choose an **athlete and sport** (e.g., an elite marathon runner, a high-performance weightlifter, a semi-professional football player).
    - Describe their **age, sex, current fitness level, and training background**.
    - Identify the **energy system** predominantly used in their sport (aerobic vs anaerobic).
    - Explain how each **principle of training** applies to their sport and individual needs.
3. **Design a Periodised Training Program (15 marks)**
    - Create a **macrocycle (one year)** and divide it into **mesocycles** (e.g., off-season, pre-season, competition phase, recovery phase).
    - Design **one detailed microcycle (one week)** within a chosen mesocycle.
    - Provide **justifications** for training choices, considering:
        - The **phase of the macrocycle**
        - Athlete's **fitness level, sex, and age**

- Importance of **progressive overload, recovery, and variety**
- Consideration of **inter-individual differences (responders vs. non-responders)**
- Adjustments for **hormonal changes in female athletes (if applicable)**

4. **Measuring Progress & Adjustments (5 marks)**
    - Explain **baseline assessments** you would use (e.g., VO2 max, strength tests, flexibility tests).
    - Describe how you would **track progress** and adjust the training program over time.

Criteria	1–2 (Limited)	3–4 (Basic)	5–6 (Proficient)	7–8 (Excellent)	9–10 (Outstanding)
A. Explanation of Training Principles (10 marks)	Minimal or inaccurate explanation of training principles. Examples are missing or irrelevant.	Some principles explained correctly, but with limited depth or clarity. Examples may be vague.	Most principles well-explained with clear and relevant examples, though some minor inaccuracies.	All principles are thoroughly explained with detailed, precise, and relevant examples.	Outstanding explanation of all principles with excellent real-world examples demonstrating deep understanding.
B. Application to Athlete's Needs (10 marks)	Athlete's profile lacks key details. Training principles are applied superficially or inaccurately.	Athlete's profile includes some relevant details but lacks depth. Training principles applied inconsistently.	Athlete's profile is well-developed with relevant details. Training principles applied with clear and logical justifications.	Athlete's profile is detailed and comprehensive. Training principles are precisely applied with strong justifications.	Exceptional athlete profile with deep insight. Training principles applied with expert justifications based on scientific reasoning.
C. Periodized Training Plan (Macro, Meso, Micro) (15 marks)	Macrocycle lacks structure, mesocycles unclear, or microcycle missing. Weak or no justifications.	Basic macrocycle and mesocycles included. Microcycle may lack specificity. Justifications are vague.	Well-structured macrocycle, clear mesocycles, and a detailed microcycle. Justifications are logical and relevant.	Comprehensive macrocycle, clearly defined mesocycles, and a detailed, sport-specific microcycle. Justifications strongly apply training principles.	Outstanding periodized plan with deeply thought-out phases. The microcycle is exceptionally detailed and justified, integrating scientific principles of training.
D. Measuring Progress & Adjustments (5 marks)	No baseline measures identified, or they are irrelevant. No explanation of progress tracking.	Some baseline measures provided, but tracking and adjustments are vague or unclear.	Relevant baseline measures identified. Basic explanation of tracking and adapting training.	Clear and well-justified baseline measures. Progress tracking and adjustments are logical.	Excellent selection of baseline measures with strong justifications. Progress tracking is detailed and scientific, showing deep understanding of adaptation

					and performance progression.

A.3.2.2—Prescribing exercise for health and sporting performance needs careful consideration and planning.

- € Exercise intensity should progress appropriately to avoid injury risk. For physical and mental health, the appropriateness of certain exercises for specific target groups needs to be considered. These include children and adolescents, older adults and individuals who are pregnant.

1. What is the basic contractile unit of a muscle fibre?
   a) Sarcolemma
   b) Myofibril
   c) Sarcomere
   d) Mitochondria

2. Which type of muscle contraction occurs when the muscle shortens while generating force?
   a) Eccentric
   b) Isometric
   c) Concentric
   d) Isokinetic

3. What is the role of ATP in muscle contraction?
   a) Provides energy for the power stroke
   b) Binds to actin to initiate contraction
   c) Blocks calcium release
   d) Prevents muscle contraction

4. Which of the following is responsible for transmitting signals from the nervous system to the muscles?
   a) Axon terminal
   b) Motor neuron
   c) Sarcoplasmic reticulum
   d) Synaptic cleft

5. Slow-twitch muscle fibres are best suited for:
   a) Sprinting
   b) Weightlifting
   c) Long-distance running
   d) Powerlifting

6. What neurotransmitter is released at the neuromuscular junction?
   a) Dopamine
   b) Acetylcholine
   c) Serotonin
   d) Norepinephrine

7. What is the function of troponin in muscle contraction?
   a) Provides energy
   b) Binds to myosin heads

c) Regulates calcium binding
d) Forms cross-bridges

8. Which type of muscle contraction involves no change in muscle length?
   a) Concentric
   b) Eccentric
   c) Isometric
   d) Isotonic

9. What is the main function of the sarcoplasmic reticulum?
   a) Store and release calcium
   b) Generate ATP
   c) Transmit nerve impulses
   d) Produce actin

10. Which protein forms the thick filament in a sarcomere?
    a) Actin
    b) Myosin
    c) Tropomyosin
    d) Troponin

11. Which type of motor unit is primarily recruited for endurance activities?
    a) Type I
    b) Type IIa
    c) Type IIb
    d) All equally

12. What happens during the power stroke of muscle contraction?
    a) Myosin heads bind to actin
    b) ATP binds to myosin
    c) Myosin pulls actin toward the M-line
    d) Calcium binds to tropomyosin

13. What determines the force of a muscle contraction?
    a) Number of motor units recruited
    b) Length of the muscle fibre
    c) Type of motor neuron
    d) Number of mitochondria

14. Fast-twitch fibres rely primarily on which energy system?
    a) Aerobic respiration
    b) Glycolysis and ATP-PC system
    c) Oxidative phosphorylation
    d) Electron transport chain

15. What is the role of calcium in muscle contraction?
    a) Blocks ATP binding
    b) Binds to troponin, exposing actin sites
    c) Provides energy
    d) Stops contraction

16. What is an example of an eccentric contraction?
    a) Lifting a weight
    b) Lowering a weight
    c) Holding a weight still
    d) Stretching a muscle

17. Which characteristic is associated with Type IIb muscle fibres?
    a) High endurance
    b) High force production
    c) High oxygen capacity
    d) High mitochondrial density

18. Which structure transmits electrical signals deep into the muscle fibre?
    a) Sarcolemma
    b) T-tubules
    c) Sarcoplasmic reticulum
    d) Actin filaments

19. What is the role of ATPase in muscle contraction?
    a) Releases calcium
    b) Hydrolyses ATP for energy
    c) Binds to actin
    d) Inhibits contraction

20. What happens during the relaxation phase of muscle contraction?
    a) Calcium is reabsorbed
    b) Myosin remains bound to actin
    c) ATP is depleted
    d) Cross-bridges form

21. Which of the following has the smallest motor unit recruitment threshold?
    a) Type I fibres
    b) Type IIa fibres
    c) Type IIb fibres
    d) All the same

22. What determines the speed of a muscle contraction?
    a) The number of motor units
    b) The type of muscle fibres recruited
    c) The amount of myoglobin
    d) The size of the muscle

23. Which muscle fibre type has the highest capillary density?
    a) Type I
    b) Type IIa
    c) Type IIb
    d) Type III

24. What is the primary function of the H-zone in a sarcomere?
    a) Contains only actin filaments
    b) Shortens during contraction
    c) Contains only myosin filaments
    d) Prevents muscle fatigue

25. Which enzyme is responsible for breaking down acetylcholine at the neuromuscular junction?
    a) ATPase
    b) Acetylcholinesterase
    c) Myosin kinase
    d) Troponin kinase

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