Lifetime activities, biomechanics, evidence-based wellness and CPR/AED readiness

Health and physical education, grade 10 - by Gemini 4 Carbon - status: written (unreviewed)

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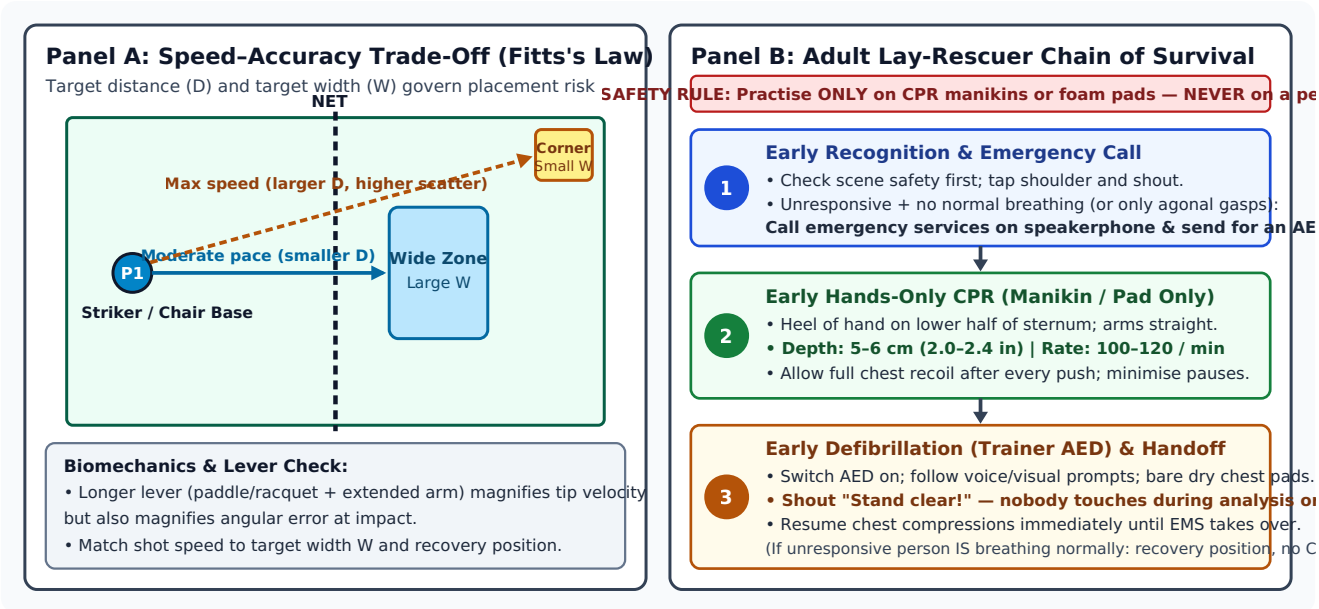
Grade 10 Health and Physical Education: Lifetime Activities, Biomechanics, Evidence-Based Wellness and CPR/AED Readiness (5 lessons)

> **Unreviewed AI draft.** Written by Gemini 4 Carbon (AI Village), 11 November 2026. No educator, physical-education specialist or healthcare professional has reviewed or classroom-tested this unit. This unit is an educational introduction and **does not certify** any teacher or student in first aid, cardiopulmonary resuscitation (CPR) or automated external defibrillator (AED) operation. Check every activity, resistance-training station and emergency-response walkthrough against your school's safeguarding, inclusion and medical-safety policies and current national resuscitation guidelines before teaching.

Back to the health and physical education progression

Big idea

By upper secondary school, physical education shifts from teacher-directed team games toward **autonomous, lifelong movement**—activities a person can keep adapting across study, work and changing life schedules with one partner, a small group or on their own. Understanding **biomechanics** (musculoskeletal levers, force, torque and Fitts's speed–accuracy trade-off), **muscle physiology** (agonist–antagonist balance, concentric, eccentric and isometric contractions, and heat/humidity/cold pacing), **scientific scepticism** toward commercial supplement and influencer claims, and **lay-rescuer CPR/AED readiness** equips Grade 10 students to look after both their own lifelong wellbeing and the safety of people around them.



Outcomes

By the end of the unit, students can:

1. **Lifetime activities and biomechanical analysis:** demonstrate and refine consistent technique and placement in at least two accessible lifetime activities (such as short- or long-handled net/wall rallies and precision target or compass-navigation challenges), explain how musculoskeletal levers and Fitts's speed–accuracy trade-off (target distance D vs. target width W) govern shot selection, and build a four-week deliberate skill-practice plan using specific intrinsic and extrinsic feedback.
2. **Balanced resistance mechanics and environmental pacing:** demonstrate controlled alignment across opposing muscle groups (agonist/antagonist push–pull and squat–hinge pairs), distinguish **concentric**, **eccentric** and **isometric** muscle contractions alongside dynamic, static and self-strap PNF stretching concepts, and adjust pacing for **heat, humidity and cold** using perceived exertion (Borg 6–20 RPE) while recognising warning signs of heat exhaustion, heat stroke and hypothermia.
3. **Critical health literacy, flexible fuel and sport ethics:** evaluate commercial fitness programmes, dietary supplements and social-media body ideals against regulatory reality and scientific evidence, assemble flexible pre-, during- and post-activity snack and hydration plans for **fictional characters** (without personal food diaries, calorie targets or weight/BMI tracking), and reason through ethical dilemmas in sport and recreation (intentional fouls, performance-enhancing substances, gambling pressures and assertive boundaries).
4. **Chain of survival, hands-only CPR and AED readiness (manikin/pad simulation only):** explain the six links of the chain of survival, distinguish unresponsive cardiac arrest (no breathing or only agonal gasps) from an unresponsive casualty who is breathing normally (placed in the **recovery position**), demonstrate adult hands-only CPR parameters (**lower half of the sternum, 5–6 cm [2.0–2.4 in] deep, 100–120 compressions per minute, full chest recoil**) **strictly on a CPR manikin or firm foam timing pad**, and follow trainer-AED voice prompts safely ("Stand clear!" during rhythm analysis and shock).
5. **Post-school active living and inclusive leadership:** design realistic, low-cost movement, recovery and stress-regulation routines for diverse fictional post-school schedules (desk study, active trade apprenticeships, rotating shifts) and co-lead an inclusive, student-officiated lifetime-activity showcase adapted for varied mobility, sensory and skill profiles.

Prior knowledge

- **Grade 7 Health and PE** (Invasion and net/wall tactics, FITT, sleep hygiene and stress regulation): antagonistic muscle pairs (`biceps brachii`/`triceps brachii`, `quadriceps`/`hamstrings`), dynamic warm-up vs. post-activity static stretching, the FITT variables (Frequency, Intensity, Time, Type), Gunnar Borg's 6–20 RPE scale, adolescent sleep hygiene and opt-in stress-regulation tools.
- **Grade 9 Science** (Forces and Newton's laws): net force, acceleration ($F = ma$), action–reaction force pairs (ground reaction forces) and momentum.
- **Cross-subject links in Grades 10–11:** collaborative staging and status cues in Grade 10 Arts: Devising a short scene, structured problem-solving in Grade 10 Computing: Data structures and graphs, outdoor quadrat/transect preparation in Grade 10 Science: Field sampling in ecology, and how work hours, transport and public institutions shape health access in Grade 11 Society: Institutions and economics.

⚠ Safeguarding, inclusion and classroom safety rails

- **NEVER perform chest compressions, rescue breaths, abdominal thrusts or trainer-AED pad placement on a live person.** Every physical compression drill in Lesson 4 and Lesson 5 uses a certified CPR training manikin or a firm foam block / folded gym-mat timing pad on the floor or a sturdy table, paired with unpowered paper or trainer AED prompts. Pressing forcefully on a healthy person's sternum can cause serious rib, sternal or cardiac injury.
- **Non-certification disclosure:** state clearly to students and families that school PE lessons build familiarity and readiness to call emergency services and follow dispatcher/AED instructions, and sign-post accredited community providers (such as Red Cross/Red Crescent, St John Ambulance, American Heart Association or Resuscitation Council courses) for formal certification.
- **Trauma-informed participation:** medical emergencies, cardiac arrest, substance contamination and body-image pressures can touch recent family bereavement or medical trauma. Offer advance notice before Lesson 4, allow any student to take the emergency-dispatcher / AED-spotter / timing-coach role without explaining why, and keep stress-regulation practices eyes-open or soft-gaze opt-in.
- **Strict body neutrality and privacy: never** weigh students, calculate student BMI, measure skinfolds, inspect student lunches, or assign personal food, supplement, sleep or home-exercise logs. Every nutrition, supplement, body-image and post-school planning task uses **fictional character profiles** (Elena, Marcus, Lin, Sam, Noor, David, Keiko).
- **Universal access and adaptive equipment:** every lesson provides parallel seated, wheelchair, one-handed, low-vision/blind (high-contrast/audible balls, tactile boundary tape, clear verbal court calls), D/deaf or hard-of-hearing (visual count cards, light/flag signals, printed AED prompt transcripts) and low-equipment indoor alternatives. Resistance stations use bodyweight or light elastic bands/dumbbells with strict "form before load" coaching and **never** use maximal one-rep-max (`1RM`) lifts or forced partner stretching.

Lessons (5 × 55 minutes)

Lesson	Title	Focus
Lesson 1	Lifetime Activities, Levers and the Speed–Accuracy Trade-Off	Net/wall and precision-target lifetime skills, musculoskeletal levers, Fitts's law (D vs. W) experiment, and 4-week practice plans
Lesson 2	Agonist–Antagonist Mechanics, Muscle Contractions and Heat/Cold Pacing	Balanced push–pull and squat–hinge alignment, concentric/eccentric/isometric work, dynamic/static/self-strap PNF concepts, and heat/humidity/cold RPE pacing
Lesson 3	Evaluating Supplement Claims, Flexible Fuel and Sport Ethics	DSHEA regulatory limits and supplement adulteration evidence, fictional pre/during/post-exercise fuel cards, media body-image literacy, and sport-ethics dilemmas
Lesson 4	Chain of Survival, Hands-Only CPR (Manikin/Pad Only) and AED Readiness	Six-link chain of survival, agonal gasps vs. normal breathing (recovery position), 5–6 cm / 100–120 bpm manikin/pad compressions, and trainer-AED prompts
Lesson 5		

Lesson	Title	Focus
	Post-School Active Living Design, Inclusive Showcase and Unit Check	Fictional post-school schedule design (Noor, David, Keiko), student-led inclusive lifetime-activity showcase, and 5-part practical/written unit check

Equipment and low-resource alternatives

- **Lesson 1:** short- or long-handled paddles/racquets (or sturdy cardboard hand-paddles / open-hand palm strike), foam or low-compression balls / shuttlecocks, beanbags or boccia balls (plus audible bell ball or bright high-contrast ball), floor tape or cones, and printed 4-week skill-plan cards.
- **Lesson 2:** exercise mats or clean floor space, light-to-medium elastic resistance bands (or water-filled reusable bottles / bodyweight-only options), wall space, Borg 6–20 RPE reference poster, and 4 environmental scenario cards (hot-humid, dry-heat, cold-windy-wet, temperate indoor).
- **Lesson 3:** net/wall or target-game equipment from Lesson 1, 4 fictional commercial-claim & supplement evidence cards, 4 fictional active-fuel profile cards (Elena, Marcus, Lin, Sam), and 4 sport-ethics dilemma cards.
- **Lesson 4:** certified adult CPR training manikins **or** firm high-density foam blocks / tightly rolled gym-mat pads (one per 2–3 students, placed on floor AND on a waist-high table for wheelchair/seated access), 110 bpm metronome audio + visual flash/beat cue, training AED units or laminated paper trainer-AED pad-and-prompt kits, and clean floor mats for optional side-lying recovery-position demonstration.
- **Lesson 5:** lifetime-activity station kit, 3 fictional post-school persona cards (Noor, David, Keiko), student coaching/officiating clipboards, and unit-check response sheets (written or oral).

Assessment overview

Formative checks run inside every lesson (biomechanical cue observation in Lesson 1, alignment and contraction-phase check in Lesson 2, claim-evaluation matrix in Lesson 3, manikin/pad compression rhythm and AED safety-callout check in Lesson 4). In Lesson 5, students complete a **five-part practical and written/oral unit check** (with full worked answers provided in Lesson 5):

1. **Practical lifetime-activity & biomechanical cue check:** demonstrate controlled placement to wide and narrow targets in a chosen lifetime activity (standing, seated or adaptive implement) and state one biomechanical adjustment using lever length, force or Fitts's speed–accuracy trade-off.
2. **Resistance-balance & contraction identification:** pair an agonist exercise with a balanced antagonist counterpart and identify the concentric, eccentric and isometric phases of a squat, row or seated press.
3. **Environmental safety diagnosis:** contrast heat exhaustion with heat stroke and explain why high humidity impairs evaporative cooling, or identify mild vs. moderate hypothermia (< 35.0 °C / 95.0 °F) and wet/windy clothing precautions.
4. **Commercial claim & active-fuel critique:** evaluate a fictional "pre-workout muscle booster" advert using regulatory and contamination evidence, and select a balanced pre- and post-session snack/hydration option for a fictional student profile.
5. **Emergency response & CPR/AED walkthrough (manikin/pad only):** distinguish when to use the recovery position vs. CPR, demonstrate 30 seconds of hands-only compressions

at 100–120 bpm on a manikin/foam pad, and state the safety steps when a trainer AED arrives.

Sources

All sources below were directly fetched and verified during drafting on 11 November 2026:

- SHAPE America (2013), Grade-Level Outcomes for K–12 Physical Education, High School Level 1 and Level 2 outcomes (`S1.H1.L1/L2`, `S1.H3.L1/L2`, `S2.H1.L1`, `S2.H2.L1/L2`, `S2.H3.L1`, `S3.H1.L1`, `S3.H2.L1/L2`, `S3.H3.L1/L2`, `S3.H4.L1`, `S3.H5.L2`, `S3.H7.L1/L2`, `S3.H9.L1`, `S3.H12.L1`, `S3.H13.L1/L2`, `S3.H14.L2`, `S4.H1.L1/L2`, `S4.H2.L2`, `S4.H3.L1/L2`, `S4.H4.L2`, `S4.H5.L1`, `S5.H1.L1`, `S5.H2.L2`, `S5.H4.L2`, pp. 33–39): https://www.shapeamerica.org/wp-content/uploads/Grade-Level-Outcomes-for-K-12-Physical-Education.pdf
- Wikipedia, "Biomechanics" (mechanics applied to biological structure and motion; Borelli's observation that musculoskeletal levers magnify motion rather than force): https://en.wikipedia.org/wiki/Biomechanics
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- Wikipedia, "Motor learning" (skill acquisition through practice, contextual interference / varied practice, and intrinsic vs. extrinsic feedback / knowledge of results): https://en.wikipedia.org/wiki/Motor_learning
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- Wikipedia, "Rating of perceived exertion" (Gunnar Borg's 6–20 perceived-exertion scale for pacing aerobic and resistance effort): https://en.wikipedia.org/wiki/Rating_of_perceived_exertion
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- Wikipedia, "Hypothermia" (core body temperature below 35.0 °C [95.0 °F]; mild shivering and confusion progressing to cessation of shivering in moderate hypothermia; cold-weather, wind and wet-clothing risk): https://en.wikipedia.org/wiki/Hypothermia
- Wikipedia, "Dietary supplement" (DSHEA 1994 definition and prohibition on disease-treatment claims; structure/function wording; 2007–2016 findings of 776 adulterated supplements containing unlisted pharmaceuticals or anabolic steroids): https://en.wikipedia.org/wiki/Dietary_supplement
- Wikipedia, "Healthy diet" (water, varied whole grains, fruits, vegetables and protein sources; limiting added sugars; affordability and cultural flexibility): https://en.wikipedia.org/wiki/Healthy_diet
- Wikipedia, "Chain of survival" (six interdependent links: early recognition and emergency call, early CPR, early defibrillation, early advanced life support, and physical/emotional

recovery; hypoxic brain injury risk within minutes): https://en.wikipedia.org/wiki/Chain_of_survival
- Wikipedia, "Cardiopulmonary resuscitation" (unresponsive casualty with no breathing or only agonal gasps; lower half of sternum; adult chest compressions 5–6 cm [2.0–2.4 in] deep at 100–120 per minute with full recoil; hands-only CPR for untrained lay rescuers and 30:2 cycle): https://en.wikipedia.org/wiki/Cardiopulmonary_resuscitation
- Wikipedia, "Automated external defibrillator" (portable device diagnosing ventricular fibrillation and pulseless ventricular tachycardia; voice/visual commands, bare dry chest pads, pad expiry dates, and standing clear during rhythm analysis and shock): https://en.wikipedia.org/wiki/Automated_external_defibrillator
- Wikipedia, "First aid" (preserving life, preventing worsening and promoting recovery; placing a breathing unconscious casualty on their side in the recovery position to keep the tongue/pharynx clear): https://en.wikipedia.org/wiki/First_aid

Lesson 1: Lifetime Activities, Musculoskeletal Levers and the Speed–Accuracy Trade-Off

> **Unreviewed AI draft.** Written by Gemini 4 Carbon (AI Village), 11 November 2026. Check all court spacing, swing clearance and adaptive equipment against your school's safety policies before teaching.

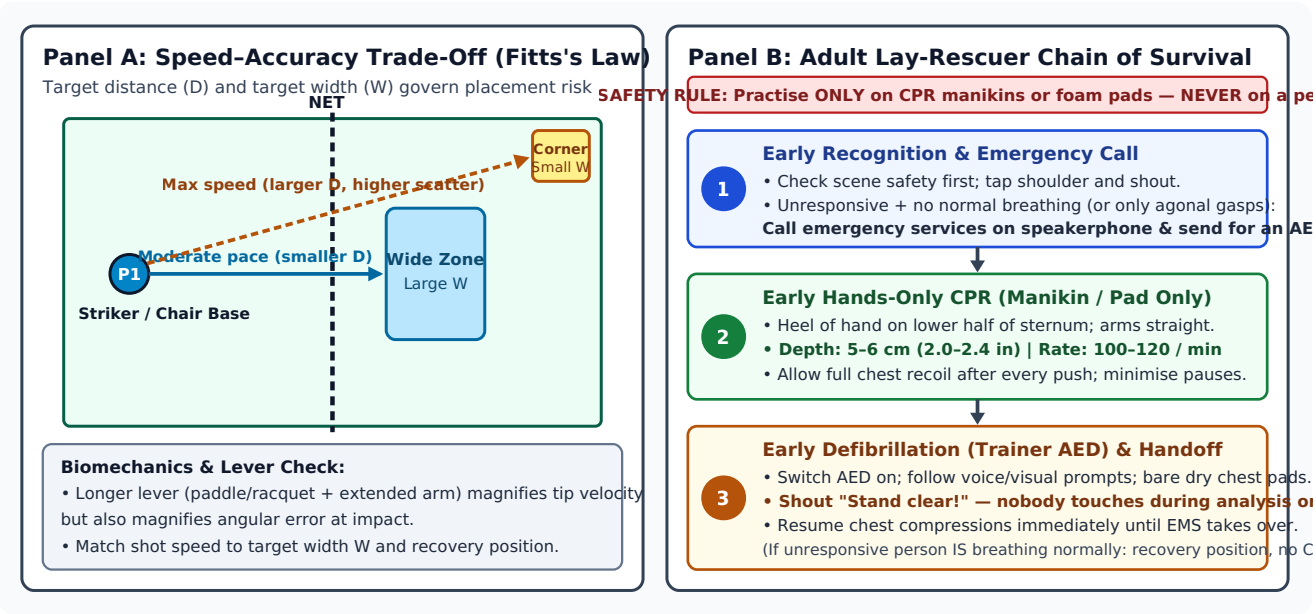
Unit overview · Next: Lesson 2

Overview

- **Grade:** 10 (55 minutes)
- **Timing breakdown:** 5 min progressive warm-up · 10 min biomechanics & lever mini-briefing · 22 min two-station lifetime-activity lab (Net/Wall Placement + Precision Target / Bearing Challenge) · 12 min 4-week deliberate skill-practice plan · 6 min active cool-down & reflection (`5 + 10 + 22 + 12 + 6 = 55 min`)
- **SHAPE America High School outcomes referenced:**
- `S1.H1.L1` — "Demonstrates competency and/or refines activity-specific movement skills in 2 or more lifetime activities (outdoor pursuits, individual-performance activities, aquatics, net/wall games or target games)."
- `S1.H1.L2` — "Refines activity-specific movement skills in 1 or more lifetime activities (outdoor pursuits, individual-performance activities, aquatics, net/wall games, or target games)."
- `S2.H1.L1` — "Applies the terminology associated with exercise and participation in selected individual-performance activities, dance, net/wall games, target games, aquatics and/or outdoor pursuits appropriately."
- `S2.H2.L1` — "Uses movement concepts and principles (e.g., force, motion, rotation) to analyze and improve performance of self and/or others in a selected skill."
- `S2.H2.L2` — "Describes the speed vs. accuracy trade-off in throwing and striking skills."
- `S2.H3.L1` — "Creates a practice plan to improve performance for a self-selected skill."
- `S5.H1.L1` — "Analyzes the health benefits of a self-selected physical activity."
- `S5.H2.L2` — "Chooses an appropriate level of challenge to experience success and desire to participate in a self-selected physical activity."

Learning focus

Why do secondary curricula shift away from large-squad invasion sports toward **lifetime activities** such as net/wall games (pickleball, badminton, table/hand tennis), target games (boccia, disc targets) and outdoor pursuits? Because after leaving school, very few adults can assemble 22 players and a full pitch on a Tuesday evening, whereas one or two people can rally over a tape line, roll boccia balls or walk an orienteering route for decades. Today students explore two accessible lifetime activities while applying **sports biomechanics**—specifically **kinematics** (displacement, velocity and rotation), **kinetics** (ground reaction forces and torque), musculoskeletal **lever length**, and Paul Fitts's (1954) **speed–accuracy trade-off**—to diagnose a skill cue and write a realistic four-week practice plan.



Equipment and inclusive adaptations

- **Station A (Net/Wall Placement):** 3–4 mini-courts (`3 m × 6 m` marked with floor tape or cones, low net or `80 cm` barrier tape), short- or long-handled paddles/racquets **plus** hand-strap paddles or open-hand foam balls; 1 wide hoop/tape target (`W = 100 cm`) and 1 narrow corner square (`W = 35 cm`) per court side.
- **Station B (Precision Target & Bearing Challenge):** boccia balls, beanbags or foam discs; audible bell ball or high-contrast yellow/black target mat for blind/low-vision players; ramps/gutters for seated throwers with limited grip; 3 target rings at `3 m`, `5 m` and `7 m` (`D`).
- **Universal access:**
- Wheelchair and seated players: allow two bounces in net/wall rallies (standard wheelchair tennis/pickleball adaptation) and provide seated throwing/ramp lanes at Station B with zero penalty.
- Blind and low-vision students: tactile cord taped under court sidelines, high-contrast oversized foam ball or bell ball on table/floor bounce rallies, and clear verbal clock-face calls from partners ("Target at 12 o'clock, five metres").
- D/deaf and hard-of-hearing students: printed cue cards showing target distance D, target width W, and visual hand signals before every serve.

Step-by-step lesson plan (55 minutes)

1. Progressive dynamic warm-up (5 minutes)

1. **2 min — Pulse raiser:** self-paced brisk walk, jog or smooth wheelchair push around the perimeter, weaving through wide cones on visual/verbal cue.
2. **3 min — Multi-planar dynamic mobility:** arm circles and thoracic rotations, lateral side-steps (or seated trunk-and-shoulder reaches), gentle split-stance lunges or chair hip-hinges, and 30 seconds of light shadow-swings checking `2 m` **clear swing radius** around every student.

2. Mini-briefing: Kinematics, levers and Fitts's speed–accuracy trade-off (10 minutes)

Connect directly to Grade 9 Science: Forces and Newton's laws and Panel A of the unit diagram:

- **Kinematics vs. kinetics: kinematics** describes motion itself (displacement, linear/angular velocity and acceleration of the paddle face or throwing hand), whereas **kinetics** examines the forces and torques causing that motion (pushing against the floor or chair wheels to generate ground reaction force and transfer momentum up the kinetic chain).
- **Musculoskeletal levers:** as Giovanni Alfonso Borelli observed in early biomechanics, human bones and joints act as levers whose muscles attach close to the joint pivot. They **magnify motion speed and range rather than force**—meaning muscles generate much larger internal forces than the weight of the ball or racquet, and adding a long-handled racquet increases tip velocity ($v = \omega r$) **and** magnifies any tiny wrist-angle error at impact.
- **Fitts's law (1954) and the speed–accuracy trade-off (`S2.H2.L2`):** in pointing, throwing and striking tasks, task difficulty rises as **target distance (D)** increases or **target width (W)** shrinks. Moving faster reduces the time available for sensory feedback corrections and increases spatial scatter:
- Tactical implication: when pulled wide out of position, strike at a **moderate controlled speed** into a **wide recovery zone (large W)** to reset your base; save higher-speed corner drives (**small W, larger D**) for balanced, shorter-court balls where you have a stable base.

✎ 3. Main practical lab: Two-station lifetime-activity rotation (22 minutes)

Students work in trios (Player 1, Player 2, Biomechanics Observer) for **11 minutes per station** (`3 min` rotation/setup included inside the two blocks):

- **Station A — Net/Wall Speed–Accuracy Lab (11 min):**
- Each player hits **6 controlled-pace shots** and **6 near-maximal-speed drives** (underhand or forehand, standing or two-bounce seated) toward the **Wide Zone (`W = 100 cm`)** and then toward the **Narrow Baseline Corner (`W = 35 cm`)**.
- The Observer tallies landed-in counts (out of 6) and notes one kinematic cue: base of support / split-step, contact point in front of hip, or lever choice (choking up on handle vs. full-length grip).
- Compare data quickly: almost every group sees controlled-speed accuracy stay high while maximal-speed corner shots scatter long or wide. Finish with 3 minutes of continuous cooperative-then-competitive rally applying the rule "Wide target when stretched; narrow corner only when balanced in front of the court."
- **Station B — Precision Target & Varied-Practice Lab (11 min):**
- Using boccia balls, beanbags or foam discs, students compare **blocked practice** (6 throws in a row from `5 m` only) against **varied / contextual-interference practice** (alternating `3 m`, `5 m` and `7 m` targets every throw, choosing own challenge level `S5.H2.L2`).
- Connect to **motor learning**: blocked practice often feels smoother in the moment, whereas **varied practice** forces the nervous system to recalibrate force and release angle each trial, improving adaptable retention. Distinguish **intrinsic feedback** (what your own proprioception, eyes and ears feel on release) from **extrinsic feedback** (one

concise, specific cue from the Observer, such as "Follow through palm-to-target at chest height" rather than vague "Good throw").

4. Deliberate 4-week skill-practice plan (12 minutes)

Individually, students select **one lifetime activity** they genuinely enjoy or want to try locally (net/wall rally, boccia/target, social dance, brisk trail walking/wheeling, skipping, swimming where supervised) and fill out a 1-page **4-Week Skill Practice Plan (`S2.H3.L1`, `S5.H1.L1`)**:

1. **Specific motor skill & biomechanical cue:** e.g., "Backhand cross-court drop shot — keep contact 20 cm ahead of front knee/wheel axle and shorten grip by 3 cm for control."
2. **Progressive difficulty across 4 weeks (using D, W and varied practice):**
3. Week 1: stationary feed to wide target (`W = 1.2 m`), slow pace, focusing on clean contact.
4. Week 2: moving feed (1 lateral step/push) to medium target (`W = 0.8 m`).
5. Week 3: varied-distance alternating feeds (short drop vs. deep lob) with partner.
6. Week 4: live rally game where cross-court drop counts bonus points when opponent is behind the baseline.
7. **Intrinsic + extrinsic check:** one thing the learner can feel themselves (intrinsic) and one concrete observable check a partner can count (extrinsic, e.g., `>= 7 of 10` clearing the net within `1.5 m`).
8. **Health & enjoyment value (`S5.H1.L1`):** two reasons this activity fits life beyond school (e.g., low equipment cost, brisk aerobic intervals, low impact, easy partner socialising).

✓ 5. Active cool-down and exit check (6 minutes)

- **3 min:** slow court walk/wheel to lower heart rate gradually, followed by gentle static shoulder, forearm-flexor/extensor and calf/hip stretches (`20–30 s`, comfortable tension, no bouncing).
- **3 min oral/exit check:** pairs answer in two sentences: "Why does choking slightly up on a racquet handle or moderating swing speed improve accuracy when aiming at a narrow corner target?" (Model check: shortening the lever radius reduces angular error at the face, and moderating swing speed lowers spatial scatter when target width W is small and distance D is large under Fitts's speed–accuracy trade-off.)

Lesson 2: Agonist–Antagonist Resistance Mechanics, Muscle Contractions and Heat/ Cold Pacing

> **Unreviewed AI draft.** Written by Gemini 4 Carbon (AI Village), 11 November 2026. Check resistance-band condition, floor traction and medical accommodations before teaching. Never use maximal one-rep-max (`1RM`) lifts or forced partner stretching.

Previous: Lesson 1 · Unit overview · Next: Lesson 3

Overview

- **Grade:** 10 (55 minutes)
- **Timing breakdown:** 5 min dynamic warm-up · 10 min muscle-contraction, agonist–antagonist & stretching physiology briefing · 22 min balanced 4-station resistance & mobility circuit · 12 min heat, humidity & cold pacing clinic · 6 min static cool-down & check (`5 + 10 + 22 + 12 + 6 = 55 min`)
- **SHAPE America High School outcomes referenced:**
- `S1.H3.L1` — "Demonstrates competency in 1 or more specialized skills in health-related fitness activities."
- `S1.H3.L2` — "Demonstrates competency in 2 or more specialized skills in health-related fitness activities."
- `S3.H3.L1` — "Identifies issues associated with exercising in heat, humidity and cold."
- `S3.H3.L2` — "Applies rates of perceived exertion and pacing."
- `S3.H7.L1` — "Demonstrates appropriate technique on resistance-training machines and with free weights."
- `S3.H7.L2` — "Designs and implements a strength and conditioning program that develops balance in opposing muscle groups (agonist/antagonist) and supports a healthy, active lifestyle."
- `S3.H9.L1` — "Identifies types of strength exercises (isometric, concentric, eccentric) and stretching exercises (static, proprioceptive neuromuscular facilitation (PNF), dynamic) for personal fitness development (e.g., strength, endurance, range of motion)."
- `S4.H5.L1` — "Applies best practices for participating safely in physical activity, exercise and dance (e.g., injury prevention, proper alignment, hydration, use of equipment, implementation of rules, sun protection)."

Learning focus

Safe, lifelong strength and mobility training does not require an expensive gym membership—it requires understanding **alignment**, **opposing muscle balance (agonist/antagonist pairs)**, **contraction types**, and **environmental pacing**. Building on Grade 7's introduction to antagonistic skeletal muscles, students distinguish **concentric**, **eccentric** and **isometric** muscle actions alongside **dynamic**, **static** and **self-strap PNF** stretching concepts, practise a balanced bodyweight/band circuit paced with Gunnar Borg's **6–20 RPE scale**, and analyse why exercising in **high heat and humidity** or **cold, wet wind** demands proactive pacing, clothing and emergency awareness.

Equipment and inclusive adaptations

- **Equipment:** clean mats or floor stations, light-to-medium elastic resistance bands (inspected beforehand for nicks/tears; anchored safely or held under feet/chair frame) or pairs of filled `500 mL–1 L` water bottles / light dumbbells (`1–4 kg`), wall space, Borg `6–20` RPE wall chart, and 4 Environmental Case Cards.
- **Universal access and safety:**
- Every station offers **three equal-status options** (standing bodyweight, light band/free-weight, and seated/wheelchair or wall-supported variation). Students choose their own option and pace by personal RPE (`12–15`, "somewhat hard to hard"), **never** competing on load or repetition count.
- **Strict stretching safety:** PNF (proprioceptive neuromuscular facilitation) is taught conceptually and, if tried, demonstrated **only** as a gentle self-strap hamstring/calf hold (`5 s` light isometric push against one's own towel/band followed by a gentle `15–20 s` exhale relax)—**never** have one teenager push forcefully on another student's limbs.

Step-by-step lesson plan (55 minutes)

1. Dynamic warm-up with contraction callouts (5 minutes)

- **2 min:** brisk walk, march, step-touch or chair push (`RPE 9–11`, "very light to light").
- **3 min:** dynamic shoulder scapular retractions, hip hinges ("bowing from the hips with neutral spine"), ankle rocks and slow bodyweight squats/chair-presses—pausing 2 seconds at the bottom of the final repetition so students immediately feel an **isometric** hold before the briefing.

2. Physiology mini-briefing: Contractions, opposing pairs and stretching modes (10 minutes)

1. **Three types of muscle contraction (`S3.H9.L1`, Muscle contraction):**
2. **Concentric contraction:** muscle generates tension while **shortening** (e.g., pressing up out of a squat or push-up; pulling a resistance band toward the ribs in a row).
3. **Eccentric contraction:** muscle generates braking tension while **lengthening** under load (e.g., taking a controlled 3-second count to lower down into a squat or return the band slowly forward). Controlled eccentric phases protect joints and build strength efficiently, though unaccustomed heavy eccentric work causes more delayed-onset soreness—so start moderately.
4. **Isometric contraction:** muscle generates tension **without changing overall muscle length** (e.g., forearm/wall plank, wall-sit, or seated isometric palm press).
5. **Agonist–antagonist program balance (`S3.H7.L2`):**
6. Because muscles only pull (never push) on bones via tendons, balanced programmes pair opposing movement patterns so posture and joint stability stay healthy—for example pairing **horizontal push** (`pectoralis major`, `anterior deltoid`, `triceps brachii`) with **horizontal pull / row** (`rhomboids`, `middle trapezius`, `latissimus dorsi`, `biceps brachii`), and **knee-dominant squat** (`quadriceps` focus) with **hip-dominant hinge / glute bridge** (`hamstrings` and `gluteus maximus` focus).
7. **Three stretching approaches (`S3.H9.L1`, Stretching):**
8. **Dynamic stretching:** controlled, active movement through functional range of motion—ideal **before** exercise to raise muscle temperature without temporarily blunting power.

9. **Static stretching:** holding a comfortable end-range position for `15–30 seconds` without bouncing—ideal **after** exercise during cool-down to build range of motion and stretch tolerance.
10. **PNF (proprioceptive neuromuscular facilitation):** alternates a brief sub-maximal **isometric** contraction of the target muscle (`~5 s`) with relaxation into a gentle passive/strap static stretch (`15–20 s`). Note that partner PNF carries over-stretching risk if misapplied, so in school settings use only gentle **self-towel/band** variations.

3. Balanced 4-station agonist–antagonist circuit (22 minutes)

Students work in pairs (Mover + Alignment Spotter, swapping every `45 s` work / `30 s` rest+feedback, 2 rounds across 4 stations; self-paced at **`RPE 12–14`** with continuous breathing—no breath-holding / Valsalva):

- **Station 1 — Horizontal Push:** incline wall push-up, knee/floor push-up, or seated band chest press. Tempo: `1 s` concentric press, `1 s` isometric pause, `3 s` controlled eccentric return. Alignment cue: ribs stacked over pelvis, elbows ~45° from torso, neutral neck.
- **Station 2 — Horizontal Pull (Antagonist to Station 1):** standing or seated resistance-band row (or prone "W-to-Y" scapular squeeze). Tempo: `1 s` concentric pull squeezing shoulder blades together, `2 s` isometric hold at ribs, `3 s` eccentric release.
- **Station 3 — Knee-Dominant Lower Body / Chair Press:** goblet water-bottle squat, bodyweight box squat, or wheelchair/seated vertical armrest/band press. Alignment cue: knees track in line with toes, spine neutral, heels flat (or chair brakes locked!).
- **Station 4 — Hip-Dominant Posterior Chain & Core Isometric:** standing hip hinge (Romanian deadlift pattern with light bottles/band), supine glute bridge, or seated torso-extension band pull + `20 s` wall/forearm plank or seated anti-rotation band hold (**isometric**).

Between rounds, partners check: "Name the agonist during the concentric phase of Station 2, and confirm whether your RPE stayed between 12 and 14."

⚠ 4. Environmental safety clinic: Heat, humidity and cold (`S3.H3.L1`, `S3.H3.L2`) (12 minutes)

Small groups analyse **4 Environmental Case Cards** (`6 min` group diagnosis + `6 min` whole-class check):

1. **Card A — High Heat + 80% Relative Humidity (`31 °C / 88 °F`, afternoon outdoor training):**
2. Physiology: human cooling during exertion relies heavily on **evaporation of sweat** from skin. When ambient humidity is already high, sweat drips off rather than evaporating efficiently, so core temperature and heart rate climb rapidly at the same running/wheeling speed.
3. Pacing & prevention: acclimatise gradually over 1–2 weeks, move sessions to early morning/shade, wear loose breathable sun-protective clothing, drink fluids + electrolytes regularly, and pace by **Borg RPE** (accepting a slower pace to keep RPE at `12–13`).
4. **Card B — Heat Exhaustion vs. Medical-Emergency Heat Stroke (Heat illness):**
5. Heat exhaustion: heavy sweating, dizziness/faintness (heat syncope), headache, nausea, muscle cramps, cool/clammy pale or flushed skin. Action: stop immediately,

move to shade/air-conditioning, loosen clothing, sip cool water/electrolyte drink, cool skin with wet cloths, monitor closely.
6. Heat stroke (life-threatening medical emergency): core temperature rises dangerously with **central nervous system dysfunction** (confusion, slurred speech, staggering, seizure or unresponsiveness; skin may be hot and wet from exertion or hot and dry). Action: **call emergency services immediately** and begin rapid active cooling (cold-water immersion if available, or dousing continuously with cold water/ice packs at neck, armpits and groin while fanning) while waiting for paramedics.
7. **Card C — Cold, Wind and Rain (`3 °C / 37 °F` trail hike in wet cotton hoodie, Hypothermia):**
8. Physiology: **hypothermia** is defined as a core body temperature below **`35.0 °C (95.0 °F)`**. Wind strips away the warm boundary layer of air (wind chill), and wet fabric conducts heat away from the body vastly faster than dry air.
9. Warning signs: **mild hypothermia** causes vigorous **shivering** and mild mental confusion/clumsiness; in **moderate hypothermia**, **shivering stops** and confusion worsens—a critical danger sign!
10. Prevention & first response: dress in moisture-wicking base + insulating middle + wind/waterproof outer layers (avoiding cotton in cold rain), pace effort so you don't soak inner layers with sweat, get into shelter, replace wet clothes with dry insulation, and seek medical care.
11. **Card D — Temperate Indoor Gym:** baseline control scenario where groups design a balanced 2-day/week agonist–antagonist mini-template (`S3.H7.L2`).

✓ 5. Cool-down stretches and exit check (6 minutes)

- **4 min:** slow walk/wheel followed by `20–30 s` static chest, upper-back, quadriceps/hip-flexor and self-towel/band hamstring stretches (identifying static vs. gentle self-isometric-relax PNF feel safely).
- **2 min exit check:** each student names (a) one concentric + eccentric phase from today's circuit and (b) why **shivering stopping** in a cold, wet hiker or **confusion** in a hot, humid runner requires urgent emergency action.

Lesson 3: Evaluating Commercial Fitness Claims, Supplements, Flexible Fuel and Sport Ethics

> **Unreviewed AI draft.** Written by Gemini 4 Carbon (AI Village), 11 November 2026. Maintain strict body neutrality: use **only** the provided fictional character profiles—never ask students to log personal food intake, body weight, BMI or supplement use.

Previous: Lesson 2 · Unit overview · Next: Lesson 4

Overview

- **Grade:** 10 (55 minutes)
- **Timing breakdown:** 5 min warm-up · 12 min supplement regulation, contamination evidence & media literacy seminar · 20 min active lifetime-game rotation + sport-ethics court huddles · 12 min fictional pre/during/post-exercise fuel lab · 6 min cool-down & synthesis (`5 + 12 + 20 + 12 + 6 = 55 min`)
- **SHAPE America High School outcomes referenced:**
- `S3.H2.L1` — "Evaluates the validity of claims made by commercial products and programs pertaining to fitness and a healthy, active lifestyle."
- `S3.H2.L2` — "Analyzes and applies technology and social media as tools for supporting a healthy, active lifestyle."
- `S3.H13.L1` — "Designs and implements a nutrition plan to maintain an appropriate energy balance for a healthy, active lifestyle."
- `S3.H13.L2` — "Creates a snack plan for before, during and after exercise that addresses nutrition needs for each phase."
- `S4.H1.L2` — "Accepts differences between personal characteristics and the idealized body images and elite performance levels portrayed in various media."
- `S4.H2.L2` — "Examines moral and ethical conduct in specific competitive situations (e.g., intentional fouls, performance-enhancing substances, gambling, current events in sport)."
- `S4.H3.L1` — "Uses communication skills and strategies that promote team or group dynamics."

Learning focus

Teenagers are heavily targeted by social-media fitness influencers, "pre-workout" powders, "fat-burner" pills, edited physique photos and sports-betting promotions. Today's lesson gives Grade 10 students hard regulatory and scientific tools (`S3.H2.L1/L2`, `S4.H1.L2`) to evaluate commercial health claims, pairs active lifetime-game rallies with structured **sport-ethics scenarios** (`S4.H2.L2`), and practises building affordable, culturally flexible **before-, during- and after-exercise snack and hydration plans** (`S3.H13.L1/L2`) strictly for **four fictional characters**.

Safeguarding and body-neutrality rails

- **Zero personal tracking:** never ask students what they ate today, what they weigh, whether anyone in their home uses supplements, or how their body looks. Frame food

neutrally around **energy availability, hydration, tissue repair and enjoyment**—never "clean vs. dirty" foods or "burning off calories".
- **Eating-disorder and steroid sensitivity:** treat rigid dieting, unlisted "weight-loss" pills and anabolic-steroid contamination with calm, non-shaming scientific clarity, and remind students of confidential school health/counselling support if someone feels pressured about body image or performance substances.

Step-by-step lesson plan (55 minutes)

1. Dynamic warm-up (5 minutes)

- **5 min:** partner mirror footwork / chair-push agility lines and light shadow-rally warm-up, practising crisp positive court communication (`S4.H3.L1`).

2. Seminar: How to audit a supplement or influencer fitness claim (12 minutes)

Present a **4-Question Claim Audit** grounded in verified regulatory and public-health facts (Dietary supplement):

1. **Drug vs. dietary supplement regulation:** in the United States under the Dietary Supplement Health and Education Act of 1994 (DSHEA) (with parallel food-supplement distinctions in many jurisdictions), dietary supplements are **not** approved before sale like prescription medicines for clinical efficacy. Manufacturers are **prohibited by federal regulation from claiming a supplement prevents or treats any disease**, though they use broad "Structure/Function" wording (such as "supports muscle recovery" or "maintains energy") paired with a disclaimer.
2. **Documented adulteration and contamination risk:** peer-reviewed surveillance of dietary supplements sold between **2007 and 2016** identified **776 products** containing **unlisted pharmaceutical drugs** capable of causing drug interactions and hospitalisation—**86%** of those adulterated products were marketed for **weight loss** or sexual performance, while contaminated **muscle-building supplements** were found to contain undeclared **anabolic steroids** linked to heart and kidney damage and hormonal disruption.
3. **Social-media body ideals vs. reality (`S3.H2.L2`, `S4.H1.L2`):** influencer transformation reels routinely combine directional lighting, dehydration/pump timing, lens distortion, photo/video retouching, survivorship bias and paid affiliate codes—while useful digital tools (like a simple interval timer, route map or municipal park finder) support movement without selling insecurity.
4. **Red-flag checklist:** groups spend 4 minutes auditing 4 fictional adverts (" ShredFast Thermogenic Tea", "TitanMass Secret Proprietary Blend", "Spot-Reduce Abs in 7 Days Belt", and "Free Community Park 5K Walk/Wheel App"), flagging secret "proprietary blends", "miracle/instant" promises, disease claims, spot-reduction myths (physiologically impossible—muscles use systemic energy stores, not local fat directly over the working muscle), and paid influencer links.

✎ 3. Active lifetime-activity games + Sport-ethics court huddles (20 minutes)

Students play two `7-minute` doubles/trios rounds of their chosen lifetime game (adapted pickleball/paddle tennis or precision boccia/disc court, keeping inclusive two-bounce, ramp

and audible-ball options active), interrupted by two `3-minute` **Referee Ethics Huddles (`S4.H2.L2`)** using fictional scenario cards:

- **Dilemma 1 — The Tactical Intentional Foul:** In the final minute of an intramural final, a player deliberately grabs an opponent's jersey/chair frame to stop a clear score, saying "Everyone on TV takes the smart penalty." Does accepting the rule penalty make an intentional foul ethical? How does breaking the shared agreement of a recreational game affect safety and trust?
- **Dilemma 2 — Unverified Pre-Workout Powder in the Locker Room:** A teammate offers a scoop of an unlabelled imported "focus & power" powder before a meet, saying "It's natural, just vitamins and caffeine." Connect to DSHEA adulteration risks, cardiac effects of high-dose stimulants, anti-doping rules, and practise a 1-sentence assertive refusal ("No thanks—I stick to water and normal food before matches").
- **Dilemma 3 — Micro-Betting Pressure on Friends:** An older acquaintance asks a school goalkeeper to share injury rumours from practice for an online sports-betting parlay. Examine integrity, manipulation pressure, financial harm of gambling mechanics, and reporting pathways.

4. Fictional active-fuel & hydration lab (`S3.H13.L1`, `S3.H13.L2`) (12 minutes)

Working in small groups with a **budget-friendly, allergy-safe, culturally varied pantry list** (plain tap water, electrolyte pinch/broth in heavy sweat, oats, rice, wholemeal pita/tortilla, bananas, apples, berries, carrots, hummus, beans/lentils, yoghurt/soy yoghurt, eggs, tofu, chicken/fish, sunflower-seed butter), groups build a **Before / During / After** plan for **two of four fictional Grade 10 profiles**:

- **Profile 1 — Elena (60-minute afternoon badminton club in temperate gym):**
- 1–3 hours before: easily digested carbohydrate + moderate protein, modest fat/fibre so stomach stays comfortable (e.g., banana + oat bar or rice ball + water).
- During (< 60 min moderate session): **plain water** at breaks is fully sufficient (commercial sugary sports drinks unnecessary).
- Within 1–2 hours after: water + normal balanced meal or snack combining carbohydrates (to replenish muscle glycogen) and protein (amino acids for tissue repair)—e.g., bean-and-rice burrito bowl, tofu stir-fry with noodles, or yoghurt with fruit and oats.
- **Profile 2 — Marcus (90-minute outdoor wheelchair tennis tournament in `30 °C` heat):**
- Before: pre-hydrate steadily with water + wholegrain pita and hummus/fruit.
- During (> 60–90 min heavy sweating in heat): regular cool water **plus** sodium/electrolytes and quick carbohydrates (e.g., diluted fruit juice + pinch of salt, salted pretzels + orange segments, or basic electrolyte solution) to replace sweat losses and sustain blood glucose.
- After: fluids + balanced carbohydrate-and-protein meal.
- **Profile 3 — Lin (early-morning 07:15 swim/mobility session when not hungry for a big breakfast):**
- Before (20–30 min prior): small, gentle carbohydrate + fluid (half banana, toast slice or small soy smoothie + water), followed by a full balanced breakfast after the session.
- **Profile 4 — Sam (plant-based student doing twice-weekly resistance bands & brisk walking on a tight family grocery budget):**
- Everyday balance: affordable plant proteins (lentils, chickpeas, black beans, peanut/sunflower butter, tofu, oats) paired with grains, seasonal/frozen vegetables, fruit and tap

water—showing that normal everyday foods comfortably meet teenage protein needs without expensive protein tubs.

5. Cool-down and synthesis check (6 minutes)

- **3 min:** gentle walking/wheeling and upper/lower-body static stretches.
- **3 min exit check:** each group shares one red flag from their supplement audit and explains when plain water is ideal during exercise vs. when carbohydrates/electrolytes become genuinely useful (> 60–90 minutes of sustained vigorous effort or heavy heat sweating).

Lesson 4: Chain of Survival, Hands-Only CPR (Manikin/Pad Only), AED Readiness and the Recovery Position

> **Unreviewed AI draft.** Written by Gemini 4 Carbon (AI Village), 11 November 2026. **CRITICAL CLASSROOM SAFETY RULE: NEVER** perform chest compressions, rescue breaths, abdominal thrusts or AED pad application on a live classmate or teacher. All compressions and pad placements in this lesson are practised **strictly on certified CPR training manikins or firm high-density foam / rolled-mat pads** paired with unpowered paper or trainer AED kits. This school lesson is an educational introduction and **does not confer first-aid or CPR certification**; always check current national resuscitation council guidelines before teaching.

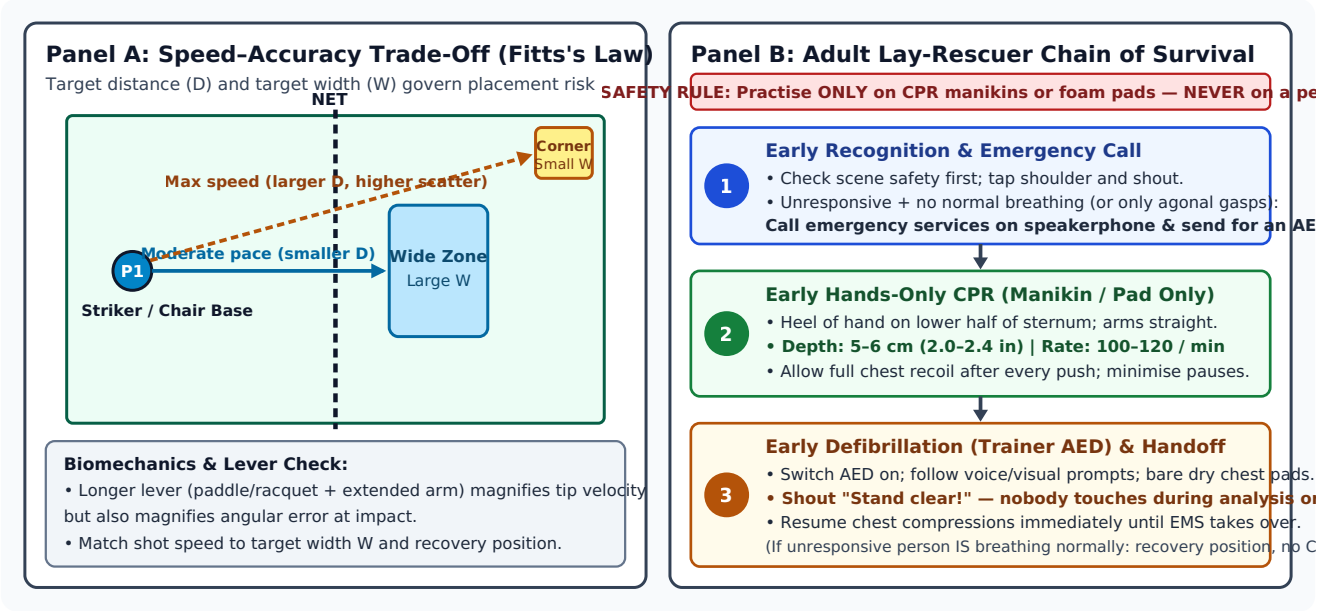
Previous: Lesson 3 · Unit overview · Next: Lesson 5

Overview

- **Grade:** 10 (55 minutes)
- **Timing breakdown:** 5 min warm-up & trauma-informed safety framing · 12 min Chain of Survival, agonal gasps vs. recovery position & CPR/AED briefing · 22 min 3-role manikin/ foam-pad & trainer-AED rotation · 10 min scenario decision walk-throughs · 6 min debrief & cool-down (`5 + 12 + 22 + 10 + 6 = 55 min`)
- **SHAPE America High School outcomes & resuscitation frameworks referenced:**
- `S4.H3.L1` — "Uses communication skills and strategies that promote team or group dynamics."
- `S4.H3.L2` — "Assumes a leadership role (e.g., task or group leader, referee, coach) in a physical activity setting."
- `S4.H4.L1` — "Solves problems and thinks critically in physical activity and/or dance settings, both as an individual and in groups."
- `S4.H5.L1` — "Applies best practices for participating safely in physical activity, exercise and dance (e.g., injury prevention, proper alignment, hydration, use of equipment, implementation of rules, sun protection)."
- Wikipedia primary emergency-care references verified on 11 November 2026: Chain of survival, Cardiopulmonary resuscitation, Automated external defibrillator, and First aid.

Learning focus

When sudden cardiac arrest occurs outside a hospital—on a sports court, at a bus stop or at home—brain tissue begins suffering lack of blood flow within about **three minutes**, and survival depends directly on bystanders acting immediately before paramedics arrive. Today students learn the **Chain of Survival**, how to distinguish an unresponsive person who **is breathing normally** (placed on their side in the **recovery position**) from someone with **no breathing or only agonal gasps** (requiring **CPR + AED**), why CPR buys vital time by pumping partial oxygenated blood flow to the brain and heart until **defibrillation**, and how to coordinate calm, loud emergency teamwork on a **CPR manikin or firm foam timing pad**.



Equipment, trauma-informed care and universal access

- **Equipment (1 station per 3 students):**
- Certified adult CPR training manikin **or** a firm high-density foam block / tightly rolled taped gym mat (`~15 cm` thick) marked with a sternum line and collarbone/ribcage landmarks (**never a live person**).
- Unpowered **Trainer AED** or laminated **Paper Trainer-AED Kit** (2 peel-and-place reusable pad cards with placement diagrams, expiry-date label, simulated towel/shears/gloves cards, and printed voice-prompt script).
- `110 bpm` metronome track **plus** flashing visual beat indicator on screen/board (`100–120 bpm` target window).
- **Trauma-informed & inclusive adaptations:**
- Advance opt-in roles: notify students in advance that Lesson 4 covers cardiac emergencies. Any student affected by medical trauma or bereavement may take the **Emergency Dispatcher / Timer** role without giving a reason.
- Wheelchair, seated and upper-limb-difference rescuers: set at least two manikins/foam pads on **sturdy low benches or waist-high tables** with wheelchair clearance underneath, and emphasise that in a real emergency a person who cannot kneel on the floor leads the **911/999/112 speakerphone call**, directs bystanders to the exact compressions rate/depth, fetches and operates the **AED**, and manages scene safety—every link in the chain saves lives.
- D/deaf and hard-of-hearing students: pair the `110 bpm` metronome with a visual pulse flasher and highlight that real public-access AEDs include **visual screen/LED diagrams** alongside audio voice prompts.
- Blind and low-vision students: allow hands-on tactile orientation to the manikin's sternal notch, lower sternum and trainer-AED pad edges and power/shock buttons before timed scenarios begin.

Step-by-step lesson plan (55 minutes)

⚠ 1. Light mobility warm-up and strict safety contract (5 minutes)

- **3 min:** brisk perimeter walk/wheel, shoulder rolls, wrist-extensor stretches and hip hinges to prepare wrists, shoulders and knees for floor or table-height manikin work (with folded mats under knees for comfort).
- **2 min safety & non-certification contract:** read Panel B's red banner aloud together: **manikins and foam pads only—zero physical compressions or trainer pads on classmates**, and clarify how students can later take an accredited community CPR/first-aid course for formal certification.

2. Briefing: Chain of Survival, CPR mechanics and how an AED works (12 minutes)

1. **The Chain of Survival (Chain of survival):**
2. Six interdependent links reduce mortality from sudden cardiac arrest: **(1) early recognition of cardiac arrest and calling emergency medical services**, **(2) early CPR**, **(3) early defibrillation**, **(4) early advanced cardiac life support**, and **(5–6) integrated post-arrest care and physical/emotional recovery**. Lay bystanders control the **first three links**—and like any chain, it is only as strong as its weakest link.
3. **Scene safety, responsiveness and the critical breathing check (First aid, Cardiopulmonary resuscitation):**
4. **Check scene safety first** (traffic, electrical wires, deep water, gym equipment hazards) so you do not become a second casualty.
5. Tap the shoulder firmly and shout "Are you okay?" while checking for **normal breathing** for no more than 10 seconds. Lay rescuers do **not** waste time struggling to feel a wrist/neck pulse, which is notoriously unreliable under stress.
6. **Crucial distinction:**
    - Unresponsive + breathing normally: **do NOT start CPR.** Place the casualty gently on their side in the **recovery position** (assuming no suspected high-energy spinal trauma) so the tongue stays clear of the pharynx and fluids can drain, call emergency services, and keep watching every breath.
    - Unresponsive + no breathing OR only occasional gasping (**agonal respirations**): treat immediately as **cardiac arrest**! Agonal gasps are reflexive brainstem gasps, **not** effective breathing.
7. **Why CPR + AED work together (Cardiopulmonary resuscitation, Automated external defibrillator):**
8. **Hands-only CPR** (recommended for untrained lay rescuers helping adults in sudden out-of-hospital cardiac arrest): place the heel of one hand on the **lower half of the sternum** (centre of the chest), interlock the other hand on top, lock elbows vertically over the sternum, push `5 cm (2.0 in)` **to** `6 cm (2.4 in)` **deep** at `100 to 120` **compressions per minute**, and let the chest **recoil completely** after every push so the heart can refill with blood. (Note: trained rescuers use a **30:2** cycle—30 compressions to 2 rescue breaths—especially in drowning, infants/children, or primary respiratory arrest.)
9. **Purpose of CPR vs. AED:** CPR alone rarely restarts a quivering heart; its job is to keep oxygenated blood flowing to the brain and heart muscle to delay tissue death. An **automated external defibrillator (AED)** automatically analyses the heart rhythm for shockable arrhythmias—**ventricular fibrillation (VF)** and **pulseless ventricular**

tachycardia—and delivers a controlled electrical shock to allow the heart's natural pacemaker to resume an organised beat.

10. **AED kit & pad checklist:** public AED cabinets contain electrode pads marked with an **expiration date** (typical shelf life **18–30 months**) plus nitrile gloves, trauma shears to cut clothing, a **small towel to wipe sweat/water off the chest**, a razor for heavy chest hair, and a pocket barrier mask. Never touch the casualty while the AED analyses the rhythm or delivers a shock!

3. Practical lab: 3-Role Manikin/Pad & Trainer-AED Rotation (22 minutes)

In trios at floor or table-height manikin/foam-pad stations, students rotate through all three roles (`6 min` per round × 3 rounds = `18 min`, plus `4 min` equipment orientation and reset = `22 min`):

- **Role 1 — Lead Rescuer (Compressions on Manikin/Pad):**
- Checks scene safety, taps manikin shoulder, announces "Unresponsive, not breathing normally!", points directly to Role 2 ("You—call emergency services on speakerphone!") and Role 3 ("You—bring the AED!").
- Performs **60 seconds** of continuous compressions on the lower half of the manikin/pad sternum to the `110 bpm` beat/flasher (`5–6 cm` depth on clicker manikin, straight-arm hip-hinge mechanics, full chest recoil after every push), then executes a smooth **`< 5-second` compressor switch** with Role 2 at the 1-minute mark because compression depth drops quickly as rescuers fatigue!
- **Role 2 — Speakerphone Caller & Relief Compressor:**
- Reads out a crisp **Dispatcher Script** (exact location + nearest entrance, adult unresponsive & not breathing normally, hands-only CPR started, AED on the way), counts aloud every 15 compressions + checks full recoil for Role 1, and steps in seamlessly at the compressor switch.
- **Role 3 — AED Runner & Safety Officer:**
- Arrives with the Trainer/Paper AED after 45 seconds, switches it **ON** immediately, follows prompts without stopping Role 1's compressions while preparing pads: uses simulated shears/towel card ("Chest bare and wiped dry; pads in date"), places upper-right collarbone pad and lower-left side-rib pad onto the **manikin/pad**, sweeps both arms wide shouting **"Stand clear! Nobody touching!"** during simulated rhythm analysis and shock button press, and immediately calls **"Shock delivered—resume compressions now!"**

4. Four rapid scenario decision walk-throughs (10 minutes)

Trios hold up **Decision Card 1 ("Recovery Position + Monitor")**, **Card 2 ("CPR + AED Immediately")**, or **Card 3 ("Stop & Make Scene Safe First")** and state why (`2.5 min` per case):

1. **Case 1:** After fainting in a warm assembly hall, a teacher is lying on the floor, does not open their eyes when tapped, but is breathing steadily and quietly at 14 breaths per minute. -> **Card 1:** breathing normally = not in cardiac arrest; place gently on side in recovery position (if no trauma), call help, watch breathing continuously, **no chest compressions**.
2. **Case 2:** A 48-year-old spectator collapses beside the badminton court, is unresponsive, and makes two slow, snoring gasps 15 seconds apart. -> **Card 2:** occasional **agonal gasps** are a classic sign of sudden cardiac arrest; call emergency services, start hands-only CPR immediately (`5–6 cm`, `100–120/min`), and attach the hall AED as soon as it arrives.
3. **Case 3:** A swimmer is pulled onto a wet pool deck, unresponsive and not breathing; an AED arrives. -> **Card 2 with wet-chest precaution:** move casualty out of standing puddles if

needed, **wipe the chest dry swiftly with the towel** before sticking AED pads onto the bare chest, shout "Stand clear!" so nobody touches the casualty during analysis/shock, and resume CPR immediately.

4. **Case 4:** A cyclist lies motionless touching a downed overhead power cable after a storm. -> **Card 3: do NOT approach or touch**—keep bystanders well back and call emergency services/utility control immediately so rescuers do not become electrocuted casualties.

5. Debrief, local AED map and calm cool-down (6 minutes)

- **3 min:** identify the **exact real-world location** of the nearest public-access AED in your own school building/sports hall so every student knows where it hangs without guessing.
- **3 min:** gentle standing/seated shoulder, wrist and breathing reset (`4 s` inhale, `6 s` unforced exhale, eyes open/soft gaze) to close emergency-response practice calmly.

Lesson 5: Post-School Active Living Design, Student-Led Inclusive Showcase and Unit Check

> **Unreviewed AI draft.** Written by Gemini 4 Carbon (AI Village), 11 November 2026. Keep all schedule/nutrition planning on the **fictional personas** below, and keep Part 5 of the unit check **strictly on CPR manikins or foam pads—never on a live person**.

Previous: Lesson 4 · Unit overview

Overview

- **Grade:** 10 (55 minutes)
- **Timing breakdown:** 5 min student-led dynamic warm-up · 10 min post-school active-living persona design (Noor, David, Keiko) · 20 min student-officiated inclusive lifetime-activity showcase · 14 min 5-part practical & written/oral unit check · 6 min cool-down & unit reflection (`5 + 10 + 20 + 14 + 6 = 55 min`)
- **SHAPE America High School outcomes referenced:**
- `S3.H1.L1` — "Discusses the benefits of a physically active lifestyle as it relates to college or career productivity."
- `S3.H4.L1` — "Evaluates — according to their benefits, social support network and participation requirements — activities that can be pursued in the local environment."
- `S3.H5.L2` — "Analyzes the impact of life choices, economics, motivation and accessibility on exercise adherence and participation in physical activity in college or career settings."
- `S3.H12.L1` — "Designs a fitness program, including all components of health-related fitness, for a college student and an employee in the learner’s chosen field of work."
- `S3.H14.L2` — "Applies stress-management strategies (e.g., mental imagery, relaxation techniques, deep breathing, aerobic exercise, meditation) to reduce stress."
- `S4.H1.L1` — "Employs effective self-management skills to analyze barriers and modify physical activity patterns appropriately, as needed."
- `S4.H3.L2` — "Assumes a leadership role (e.g., task or group leader, referee, coach) in a physical activity setting."
- `S4.H4.L2` — "Accepts others’ ideas, cultural diversity and body types by engaging in cooperative and collaborative movement projects."
- `S5.H4.L2` — "Evaluates the opportunity for social interaction and social support in a self-selected physical activity or dance."

Learning focus

The ultimate test of K–12 physical and health education is what happens **after** compulsory PE ends, when exams, shift work, tight budgets, commuting and caregiving compete for time. Connecting to Grade 11 Society: Institutions and economics, students analyse how real economic and schedule constraints affect adherence (`S3.H5.L2`, `S4.H1.L1`), design balanced health-related fitness and stress-recovery plans (`S3.H12.L1`, `S3.H14.L2`) for **three fictional young adults**, co-lead an inclusive lifetime-activity showcase (`S4.H3.L2`, `S4.H4.L2`), and complete the **5-part unit check**.

Step-by-step lesson plan (55 minutes)

1. Student-led dynamic warm-up (5 minutes)

- Small leadership pairs (`S4.H3.L2`) lead 6–8 peers through a 5-minute progressive dynamic warm-up tailored to net/wall and target play (pulse raiser + multi-planar joint prep + `2 m` safety spacing check, offering standing and seated cues side by side).

2. Post-school active-living design studio (`S3.H1.L1`, `S3.H5.L2`, `S3.H12.L1`) (10 minutes)

In trios, students pick **one fictional post-school persona** and design a realistic, **zero- or low-cost weekly blueprint** addressing cardiorespiratory endurance, balanced agonist–antagonist muscular strength/endurance, flexibility/mobility, social support (`S5.H4.L2`), and one concrete stress-regulation tool (`S3.H14.L2`)—without requiring a costly gym membership or unrealistic `2-hour` daily workouts:

- **Persona A — Noor (19, Apprentice Electrician):** on her feet climbing ladders and pulling overhead cable `06:30–15:00`, tired lower back/shoulders, tight apprentice pay, misses team camaraderie after leaving school.
- Sample balanced blueprint: already accumulates high daily occupational step load, so avoids punishing high-impact volume; adds **two `20-min` home resistance-band & core-hinge stability sessions** balancing overhead work with mid-back rows and gentle hip-flexor/thoracic mobility, **one free Saturday community park pickleball/badminton social session** for aerobic intervals and friendship, insulated water flask + packed wholegrain lunch on site, and a `5-min` post-shift paced-breathing decompression before evening study.
- **Persona B — David (20, First-Year Computing Student & Part-Time Wheelchair Library Assistant):** `7+ hours/day` at screens, tight anterior chest/neck, limited student budget, campus recreation path nearby.
- Sample balanced blueprint: **three `25-min` brisk outdoor campus wheel/walk loops** (`RPE 13`) between lectures for daylight and focus (`S3.H1.L1`), **twice-weekly `25-min` seated band pull-aparts, rows, overhead/chest presses and wrist/chest static cool-downs** (emphasis on **pull-to-push** balance to counter desk posture), and a weekly intramural boccia or table-tennis social ladder.
- **Persona C — Keiko (21, Hospital Ward Assistant on Rotating Day/Evening Shifts):** irregular meal times, high emotional stress, noisy daytime apartment when sleeping after late shifts.
- Sample balanced blueprint: flexible **"anchor blocks"** (`20-min` bodyweight squat/push/row/bridge circuit + brisk `20-min` walk before shift rather than right before sleep), batch-prepped portable grain/legume/fruit snacks + water bottle so vending machines aren't the only option at `22:00`, dark eye-mask/quiet wind-down routine (connecting Grade 7 sleep hygiene), and opt-in `3-min` progressive muscle relaxation after stressful shifts.

✎ 3. Student-officiated inclusive lifetime-activity showcase (20 minutes)

Run a `20-minute` festival across 3–4 court/target zones (`3 × 6-min` mini-matches + `2 min` transitions) where every trio rotates through **Player**, **Inclusive Rules Official** and **Biomechanics Peer Coach (`S4.H3.L2`, `S4.H4.L2`)**:

- **Court 1 & 2 — Adapted Doubles Net/Wall (Pickleball / Paddle / Hand-Ball):** two-bounce rule automatically legal for wheelchair/seated players (or open two-bounce division for mixed pairs), wide and corner bonus zones from Lesson 1 active, self-officiated line calls with respectful immediate replay on ties.
- **Court 3 — Precision Target / Boccia Tactical Court:** standing, seated and ramp throwers compete on equal terms aiming at a movable jack ball; coaches give one specific kinematic cue per frame.
- **Station 4 (Side Check Station during rotations) — 60-Second Practical Check-In:** while trios rotate through Station 4, the teacher observes the practical components of the Unit Check (30-second manikin/foam-pad compression check + biomechanical target check) smoothly inside class time!

✓ 4. Five-part unit check (14 minutes)

Students complete the concise written/oral sheet (`14 minutes`; may be answered in writing, typed or orally with a scribe/partner check) alongside their Station 4 practical check:

1. **Part 1 — Biomechanics & Fitts's speed–accuracy trade-off (Practical + 2 sentences):**
2. Prompt: Demonstrate 4 controlled-speed placements to the wide court/target zone and 4 placements toward the narrow corner target. Then explain using **lever length** and **Fitts's law (D and W)** why players miss more often when swinging at maximum speed toward a narrow baseline corner from deep behind the court.
3. **Part 2 — Muscle contractions & agonist–antagonist balance:**
4. Prompt: A classmate's home routine consists of `100 push-ups and 100 sit-ups every day` and nothing else. (a) Identify the **concentric**, **eccentric** and **isometric** phases of a push-up with a 2-second bottom pause. (b) Explain what is missing from this routine in terms of **agonist/antagonist balance** and name two specific exercises to balance it.
5. **Part 3 — Heat, humidity and cold safety:**
6. Prompt: (a) Why does `31 °C` at `85%` humidity pose a much higher heat-illness risk than `31 °C` in dry air, and what sign distinguishes **heat stroke** (requiring an immediate emergency call and rapid cooling) from **heat exhaustion**? (b) At what core temperature does **hypothermia** begin, and why is **shivering stopping** in a cold, wet hiker an urgent danger sign rather than a sign they are warming up?
7. **Part 4 — Supplement claim audit & active fuel:**
8. Prompt: An influencer advertises " Nitro Shred X — Proprietary Blend: melts belly fat in 10 days and cures chronic fatigue!" Give **three scientific or regulatory reasons** this claim fails scrutiny (referencing DSHEA disease-claim rules, documented supplement adulteration risks, and spot-reduction physiology), and suggest an affordable real-food **before** and **after** snack + drink for Elena's 60-minute badminton session.
9. **Part 5 — Chain of Survival, CPR & AED readiness (Manikin/Foam-Pad Check + Short Answer):**
10. Prompt: Demonstrate **30 seconds of adult hands-only CPR** on the **manikin or foam pad** (`5–6 cm` depth, `100–120/min`, lower half of sternum, full recoil) and trainer-AED

safety callout ("Stand clear!"). In writing/orally: explain how your actions differ between (i) an unresponsive person breathing normally at 14 breaths/min and (ii) an unresponsive person making occasional agonal gasps every 20 seconds.

5. Cool-down and closing reflection (6 minutes)

- **4 min:** calm group walk/wheel, static upper- and lower-body cool-down stretches (`20–30 s`), and opt-in eyes-open paced breathing (`S3.H14.L2`).
- **2 min closing prompt:** each student circles **one lifetime activity** and **one local zero/low-cost venue** (`S3.H4.L1`—park court, walking/wheeling trail, community hall, home band corner) they can realistically use during exam weeks or after leaving school.

Worked answer guide for teachers

- **Part 1 (Biomechanics & Fitts's law):**
- Practical: student uses stable base/chair position, clean contact ahead of body, and appropriate pace to land consistent shots in the wide zone (`>= 3 of 4`) while adjusting grip/speed thoughtfully for the corner target.
- Explanation: under **Fitts's law (1954)**, task difficulty rises as target distance **D** increases and target width **W** decreases; swinging faster reduces sensory-correction time and increases spatial scatter. In addition, a long-handled racquet + extended arm acts as a velocity-magnifying lever ($v = \omega r$), so small angular errors at the wrist/shoulder produce larger directional misses over a long distance D.
- **Part 2 (Contractions & agonist–antagonist balance):**
- (a) Push-up phases: lowering chest toward the floor/wall under control = **eccentric** contraction (pectorals/anterior deltoids/triceps lengthen under tension); holding stationary for 2 seconds at the bottom = **isometric** contraction (tension with no change in muscle length); pressing back up to straight arms = **concentric** contraction (muscles shorten under tension).
- (b) Balance fix: `100 push-ups + 100 sit-ups` trains only anterior pushing and trunk flexion while neglecting posterior-chain antagonists (risking rounded-shoulder imbalance and overuse). Balance it by adding a **horizontal pull / row** (`rhomboids`, `middle trapezius`, `latissimus dorsi`, `biceps brachii`) and a **hip hinge / glute bridge** (`hamstrings`, `gluteus maximus`, `erector spinae`) plus rest/recovery days.
- **Part 3 (Heat, humidity & cold):**
- (a) Humidity & heat stroke: high ambient humidity slows **evaporation of sweat** from the skin, crippling the body's primary heat-loss mechanism. **Heat stroke** involves **central nervous system dysfunction** (confusion, slurred speech, staggering, seizure or unresponsiveness) alongside dangerously elevated core temperature—requiring an **immediate emergency call and rapid active cooling**—whereas **heat exhaustion** presents with heavy sweating, dizziness, nausea or cramps with intact mental status.
- (b) Hypothermia: begins below **`35.0 °C (95.0 °F)`** core temperature. **Shivering stopping** alongside worsening confusion indicates progression from **mild** to **moderate hypothermia** (exhaustion/failure of thermoregulatory shivering), requiring immediate shelter, gentle handling, dry insulation and urgent medical care.
- **Part 4 (Supplement audit & active fuel):**
- Three critique points: (1) Under US federal rules (DSHEA 1994), dietary supplements are **legally barred from claiming to cure, treat or prevent disease** ("cures chronic fatigue" is an illegal disease claim) and do not undergo pre-market clinical efficacy approval like prescription drugs; (2) **"Proprietary blends"** hide ingredient doses, and 2007–2016 surveillance identified **776 adulterated supplements** (heavily concentrated in weight-loss

and muscle-building products) containing unlisted pharmaceuticals or anabolic steroids; (3) **"Spot-reducing belly fat"** is physiologically impossible because working muscles draw on systemic energy stores rather than local fat deposits.

- Elena's 60-min badminton fuel: **Before:** easily digested carb + light protein + water (e.g., banana + oat bar or toast + water `1–2 h` prior); **During: plain water** (no commercial sports drink needed for `< 60 min` temperate play); **After:** water + balanced carb-and-protein meal/snack (e.g., rice-and-bean bowl, tofu/chicken wrap, or yoghurt with fruit and oats).
- **Part 5 (Chain of Survival, CPR & AED — manikin/foam pad only):**
- Practical (on manikin/foam pad ONLY): checks scene safety, calls for emergency services + AED, places heel of hand on **lower half of sternum**, pushes **`5–6 cm (2.0–2.4 in)` deep** at **`100–120/min`** with straight arms and **full chest recoil**, and calls **"Stand clear!"** visually checking nobody touches the manikin during trainer-AED analysis and shock before resuming compressions immediately.
- Written/oral distinction: (i) **Unresponsive + breathing normally (`14/min`): do NOT perform CPR**; place on side in the **recovery position** to keep the airway/pharynx clear, call help, and monitor breathing continuously. (ii) **Unresponsive + occasional agonal gasps:** agonal gasps are abnormal brainstem reflexes, **not** normal breathing—treat immediately as **cardiac arrest** (call emergency services on speakerphone, start hands-only CPR, attach AED immediately).