

UCLA-ALIGNED COURSE FIELD NOTES

PHYSICI 5

Issues in Human Physiology: Diet and Exercise

Human physiology, nutrition, exercise, chronic disease, evidence, and sustainable health decisions

How these notes are written. I wrote each chapter the way I wish the material had been explained the first time: the real idea, the point where I usually get stuck, the simplest mental model that still stays honest, and a worked decision instead of a polished answer appearing from nowhere. Every chapter closes with practice and a fully written solution. If a sentence sounds impressive but does not help me solve or explain something, it does not belong here.

Daniel Mastick

Curriculum map, working notes, practice, and solutions

Course map

Week	Core thread	What should be solid by the end
1	Homeostasis and physiological regulation	Reconstruct the model, work an application, test its assumptions, and explain the result in ordinary language.
2	Energy balance, metabolism, and body composition	Reconstruct the model, work an application, test its assumptions, and explain the result in ordinary language.
3	Carbohydrate, fat, protein, and micronutrients	Reconstruct the model, work an application, test its assumptions, and explain the result in ordinary language.
4	Cardiovascular and respiratory responses to exercise	Reconstruct the model, work an application, test its assumptions, and explain the result in ordinary language.
5	Skeletal muscle, strength, and adaptation	Reconstruct the model, work an application, test its assumptions, and explain the result in ordinary language.
6	Aerobic fitness, fatigue, and training design	Reconstruct the model, work an application, test its assumptions, and explain the result in ordinary language.
7	Obesity, diabetes, cardiovascular disease, and prevention	Reconstruct the model, work an application, test its assumptions, and explain the result in ordinary language.
8	Reading health evidence and building sustainable choices	Reconstruct the model, work an application, test its assumptions, and explain the result in ordinary language.
9	Integration studio	Combine several chapters in one case, preserve their assumptions, and reconcile the result across representations.
10	Cumulative review	Retrieve the full course map from memory and solve mixed problems without chapter labels.

Scope anchor: <https://catalog.registrar.ucla.edu/course/2025/PHYSICI5>. The sequence is aligned to the official catalog description and expanded into a practical ten-week study plan.

How I would use this packet

Treat each numbered section as one chapter. Read the formal explanation, pause at the student interpretation, and see whether the easy version still says the same thing. Rework the example without looking, then cover the solution in the chapter practice box. The cumulative set at the end is deliberately mixed: knowledge becomes durable when I have to choose the tool instead of being told which chapter I am in.

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CHAPTER 1 Homeostasis and physiological regulation

The idea

Human physiology maintains internal ranges through sensors, control centers, effectors, and mostly negative feedback. Set points are dynamic, organ systems interact, and adaptation differs from acute response.

Rebuild the chapter from first principles

The claim I need to own is this: Human physiology maintains internal ranges through sensors, control centers, effectors, and mostly negative feedback. Set points are dynamic, organ systems interact, and adaptation differs from acute response. I do not count that as learned just because the sentence looks familiar. I should be able to name the objects, state what changes and what stays fixed, recover the rule from the definitions, and explain why the result is allowed.

The move

My working sequence

1. **Translate.** Rewrite the prompt in the language of homeostasis and physiological regulation. List the known quantities, the unknown, the units or types, and any hidden constraint.
2. **Choose.** State the theorem, model, algorithm, accounting rule, or physical law before substituting values. This is where I make the assumption visible.
3. **Execute.** Work one justified step at a time and keep intermediate state readable enough that I can audit it later.
4. **Verify.** Check a boundary case, sign, unit, invariant, order of magnitude, or alternative derivation. Then translate the result back into an ordinary sentence.

Details I would refuse to skip

- **Definitions:** I should be able to define every technical noun in the chapter without using that same noun in the definition.
- **Assumptions:** I write the condition that makes the method legal beside the method itself. A correct procedure under the wrong assumptions is still a wrong answer.
- **Representation:** I move freely among words, equations or code, a diagram, and a small numerical example. If one representation disagrees with another, that disagreement is useful evidence.
- **Failure modes:** I keep the nearest counterexample in mind: the boundary where the rule changes, the invariant breaks, or the model stops matching reality.
- **Communication:** My final answer names what the result means and what it does not establish. I do not let notation do the explanatory work for me.

Sanity check

Closed-note check. Can I teach homeostasis and physiological regulation on a blank page, derive or reconstruct its main rule, work a fresh example, and diagnose a deliberately broken solution? If I can only recognize the finished work, I am not done.

How this chapter connects

I read this chapter as the bridge from the course foundations to energy balance, metabolism, and body composition. The earlier material supplies the language and constraints; this chapter adds a new reasoning move; the later material asks me to use that move without being told its name. That connection matters because exams and real projects mix chapters on purpose.

The full working model

- **Core claim.** Human physiology maintains internal ranges through sensors, control centers, effectors, and mostly negative feedback.
- **What moves.** Set points are dynamic, organ systems interact, and adaptation differs from acute response.
- **What keeps the answer honest.** The model becomes useful only when I can apply homeostasis and physiological regulation to an unfamiliar case and defend the assumptions.
- **Mastery standard.** I can define the objects, rebuild the rule, work a fresh case, compare alternatives, and diagnose a broken solution without relying on recognition.

How I actually think about it

I picture the body as overlapping control loops, not as separate textbook organs working alone.

The easy version

Human physiology maintains internal ranges through sensors, control centers, effectors, and mostly negative feedback.

Worked example

Question. How does sweating illustrate negative feedback?

Walkthrough. Rising body temperature triggers sensors and hypothalamic control, sweating increases heat loss, and the response diminishes as temperature returns toward its regulated range.

Common miss

The fastest way to get this chapter wrong is to use the visible procedure without naming its assumption, units, time period, reference group, or boundary. I put that condition beside the work and verify the result independently.

Solved chapter practice

Practice 1. How does sweating illustrate negative feedback?

Solution. Rising body temperature triggers sensors and hypothalamic control, sweating increases heat loss, and the response diminishes as temperature returns toward its regulated range.

Practice 2. Explain homeostasis and physiological regulation to a classmate using one definition, one concrete example, one assumption, and one failure mode.

Solution. Begin with the core claim above, use the worked case as the concrete example, state the condition highlighted by the warning, and choose a failure where that condition does not hold. A complete explanation connects all four pieces instead of listing them.

Mastery practice A. Reconstruct homeostasis and physiological regulation from a blank page. Include the central definition, the governing rule, one required assumption, and one boundary case.

Solution. Start from the blue idea box, but rewrite it in my own words. Identify the objects and state, name the rule before using it, copy the relevant assumption from the details audit, and choose a boundary where that assumption becomes equality or fails. A complete solution explains why each part belongs; a list of vocabulary is not enough.

Mastery practice B. A classmate gets a polished-looking answer to a homeostasis and physiological regulation problem but never states a model or checks the result. Write the shortest useful review of that solution.

Solution. I would ask four concrete questions: What exactly are the inputs and desired output? Which rule licenses the main step? Which assumption could invalidate it? Which independent check supports the conclusion? If the answer cannot survive those four questions, I treat the numerical or verbal result as unverified.

CHAPTER 2 Energy balance, metabolism, and body composition

The idea

Energy intake and expenditure include basal metabolism, thermic effect, physical activity, and adaptive responses. ATP links nutrient oxidation to work; body mass change follows energy balance but appetite, composition, measurement, and environment shape the path.

Rebuild the chapter from first principles

The claim I need to own is this: Energy intake and expenditure include basal metabolism, thermic effect, physical activity, and adaptive responses. ATP links nutrient oxidation to work; body mass change follows energy balance but appetite, composition, measurement, and environment shape the path. I do not count that as learned just because the sentence looks familiar. I should be able to name the objects, state what changes and what stays fixed, recover the rule from the definitions, and explain why the result is allowed.

The move

My working sequence

1. **Translate.** Rewrite the prompt in the language of energy balance, metabolism, and body composition. List the known quantities, the unknown, the units or types, and any hidden constraint.
2. **Choose.** State the theorem, model, algorithm, accounting rule, or physical law before substituting values. This is where I make the assumption visible.
3. **Execute.** Work one justified step at a time and keep intermediate state readable enough that I can audit it later.
4. **Verify.** Check a boundary case, sign, unit, invariant, order of magnitude, or alternative derivation. Then translate the result back into an ordinary sentence.

Details I would refuse to skip

- **Definitions:** I should be able to define every technical noun in the chapter without using that same noun in the definition.
- **Assumptions:** I write the condition that makes the method legal beside the method itself. A correct procedure under the wrong assumptions is still a wrong answer.
- **Representation:** I move freely among words, equations or code, a diagram, and a small numerical example. If one representation disagrees with another, that disagreement is useful evidence.
- **Failure modes:** I keep the nearest counterexample in mind: the boundary where the rule changes, the invariant breaks, or the model stops matching reality.
- **Communication:** My final answer names what the result means and what it does not establish. I do not let notation do the explanatory work for me.

Sanity check

Closed-note check. Can I teach energy balance, metabolism, and body composition on a blank page, derive or reconstruct its main rule, work a fresh example, and diagnose a deliberately broken solution? If I can only recognize the finished work, I am not done.

How this chapter connects

I read this chapter as the bridge from homeostasis and physiological regulation to carbohydrate, fat, protein, and micronutrients. The earlier material supplies the language and constraints; this chapter adds a new reasoning move; the later material asks me to use that move without being told its name. That connection matters because exams and real projects mix chapters on purpose.

The full working model

- **Core claim.** Energy intake and expenditure include basal metabolism, thermic effect, physical activity, and adaptive responses.
- **What moves.** ATP links nutrient oxidation to work; body mass change follows energy balance but

appetite, composition, measurement, and environment shape the path.

- **What keeps the answer honest.** The model becomes useful only when I can apply energy balance, metabolism, and body composition to an unfamiliar case and defend the assumptions.
- **Mastery standard.** I can define the objects, rebuild the rule, work a fresh case, compare alternatives, and diagnose a broken solution without relying on recognition.

How I actually think about it

The energy equation is real, but the body's response changes both sides, so I avoid treating it like a fixed-rate bank account.

The easy version

Energy intake and expenditure include basal metabolism, thermic effect, physical activity, and adaptive responses.

Worked example

Question. Why may predicted weight loss from a constant calorie deficit overstate long-term change?

Walkthrough. Smaller body size and metabolic adaptation reduce expenditure, behavior changes, and adherence varies. Dynamic models better represent the slowing trajectory.

Common miss

The fastest way to get this chapter wrong is to use the visible procedure without naming its assumption, units, time period, reference group, or boundary. I put that condition beside the work and verify the result independently.

Solved chapter practice

Practice 1. Why may predicted weight loss from a constant calorie deficit overstate long-term change?

Solution. Smaller body size and metabolic adaptation reduce expenditure, behavior changes, and adherence varies. Dynamic models better represent the slowing trajectory.

Practice 2. Explain energy balance, metabolism, and body composition to a classmate using one definition, one concrete example, one assumption, and one failure mode.

Solution. Begin with the core claim above, use the worked case as the concrete example, state the condition highlighted by the warning, and choose a failure where that condition does not hold. A complete explanation connects all four pieces instead of listing them.

Mastery practice A. Reconstruct energy balance, metabolism, and body composition from a blank page. Include the central definition, the governing rule, one required assumption, and one boundary case.

Solution. Start from the blue idea box, but rewrite it in my own words. Identify the objects and state, name the rule before using it, copy the relevant assumption from the details audit, and choose a boundary where that assumption becomes equality or fails. A complete solution explains why each part belongs; a list of vocabulary is not enough.

Mastery practice B. A classmate gets a polished-looking answer to a energy balance, metabolism, and body composition problem but never states a model or checks the result. Write the shortest useful review of that solution.

Solution. I would ask four concrete questions: What exactly are the inputs and desired output? Which rule licenses the main step? Which assumption could invalidate it? Which independent check supports the conclusion? If the answer cannot survive those four questions, I treat the numerical or verbal result as unverified.

CHAPTER 3 Carbohydrate, fat, protein, and micronutrients

The idea

Macronutrients supply energy and structural roles; vitamins, minerals, water, and fiber support regulation. Digestion, absorption, storage, glycemic response, essential nutrients, dietary pattern, and dose matter more than simple good-food labels.

Rebuild the chapter from first principles

The claim I need to own is this: Macronutrients supply energy and structural roles; vitamins, minerals, water, and fiber support regulation. Digestion, absorption, storage, glycemic response, essential nutrients, dietary pattern, and dose matter more than simple good-food labels. I do not count that as learned just because the sentence looks familiar. I should be able to name the objects, state what changes and what stays fixed, recover the rule from the definitions, and explain why the result is allowed.

The move

My working sequence

1. **Translate.** Rewrite the prompt in the language of carbohydrate, fat, protein, and micronutrients. List the known quantities, the unknown, the units or types, and any hidden constraint.
2. **Choose.** State the theorem, model, algorithm, accounting rule, or physical law before substituting values. This is where I make the assumption visible.
3. **Execute.** Work one justified step at a time and keep intermediate state readable enough that I can audit it later.
4. **Verify.** Check a boundary case, sign, unit, invariant, order of magnitude, or alternative derivation. Then translate the result back into an ordinary sentence.

Details I would refuse to skip

- **Definitions:** I should be able to define every technical noun in the chapter without using that same noun in the definition.
- **Assumptions:** I write the condition that makes the method legal beside the method itself. A correct procedure under the wrong assumptions is still a wrong answer.

- **Representation:** I move freely among words, equations or code, a diagram, and a small numerical example. If one representation disagrees with another, that disagreement is useful evidence.
- **Failure modes:** I keep the nearest counterexample in mind: the boundary where the rule changes, the invariant breaks, or the model stops matching reality.
- **Communication:** My final answer names what the result means and what it does not establish. I do not let notation do the explanatory work for me.

Sanity check

Closed-note check. Can I teach carbohydrate, fat, protein, and micronutrients on a blank page, derive or reconstruct its main rule, work a fresh example, and diagnose a deliberately broken solution? If I can only recognize the finished work, I am not done.

How this chapter connects

I read this chapter as the bridge from energy balance, metabolism, and body composition to cardiovascular and respiratory responses to exercise. The earlier material supplies the language and constraints; this chapter adds a new reasoning move; the later material asks me to use that move without being told its name. That connection matters because exams and real projects mix chapters on purpose.

The full working model

- **Core claim.** Macronutrients supply energy and structural roles; vitamins, minerals, water, and fiber support regulation.
- **What moves.** Digestion, absorption, storage, glycemic response, essential nutrients, dietary pattern, and dose matter more than simple good-food labels.
- **What keeps the answer honest.** The model becomes useful only when I can apply carbohydrate, fat, protein, and micronutrients to an unfamiliar case and defend the assumptions.
- **Mastery standard.** I can define the objects, rebuild the rule, work a fresh case, compare alternatives, and diagnose a broken solution without relying on recognition.

How I actually think about it

I judge a diet by the full pattern, adequacy, and sustainability rather than one demonized nutrient.

The easy version

Macronutrients supply energy and structural roles; vitamins, minerals, water, and fiber support regulation.

Worked example

Question. What happens to excess glucose after a carbohydrate-rich meal?

Walkthrough. Insulin promotes cellular uptake and glycogen storage; once immediate and glycogen needs are met, additional energy can contribute to fat synthesis and storage.

Common miss

The fastest way to get this chapter wrong is to use the visible procedure without naming its assumption, units, time period, reference group, or boundary. I put that condition beside the work and verify the result independently.

Solved chapter practice

Practice 1. What happens to excess glucose after a carbohydrate-rich meal?

Solution. Insulin promotes cellular uptake and glycogen storage; once immediate and glycogen needs are met, additional energy can contribute to fat synthesis and storage.

Practice 2. Explain carbohydrate, fat, protein, and micronutrients to a classmate using one definition, one concrete example, one assumption, and one failure mode.

Solution. Begin with the core claim above, use the worked case as the concrete example, state the condition highlighted by the warning, and choose a failure where that condition does not hold. A complete explanation connects all four pieces instead of listing them.

Mastery practice A. Reconstruct carbohydrate, fat, protein, and micronutrients from a blank page. Include the central definition, the governing rule, one required assumption, and one boundary case.

Solution. Start from the blue idea box, but rewrite it in my own words. Identify the objects and state, name the rule before using it, copy the relevant assumption from the details audit, and choose a boundary where that assumption becomes equality or fails. A complete solution explains why each part belongs; a list of vocabulary is not enough.

Mastery practice B. A classmate gets a polished-looking answer to a carbohydrate, fat, protein, and micronutrients problem but never states a model or checks the result. Write the shortest useful review of that solution.

Solution. I would ask four concrete questions: What exactly are the inputs and desired output? Which rule licenses the main step? Which assumption could invalidate it? Which independent check supports the conclusion? If the answer cannot survive those four questions, I treat the numerical or verbal result as unverified.

CHAPTER 4 Cardiovascular and respiratory responses to exercise

The idea

Cardiac output equals heart rate times stroke volume, while ventilation and gas exchange deliver oxygen and remove carbon dioxide. Exercise changes blood flow, arteriovenous oxygen difference, and perceived effort; training improves delivery and extraction.

Rebuild the chapter from first principles

The claim I need to own is this: Cardiac output equals heart rate times stroke volume, while ventilation and gas exchange deliver oxygen and remove carbon dioxide. Exercise changes blood flow, arteriovenous oxygen difference, and perceived effort; training improves delivery and extraction. I do not count that

as learned just because the sentence looks familiar. I should be able to name the objects, state what changes and what stays fixed, recover the rule from the definitions, and explain why the result is allowed.

The move

My working sequence

1. **Translate.** Rewrite the prompt in the language of cardiovascular and respiratory responses to exercise. List the known quantities, the unknown, the units or types, and any hidden constraint.
2. **Choose.** State the theorem, model, algorithm, accounting rule, or physical law before substituting values. This is where I make the assumption visible.
3. **Execute.** Work one justified step at a time and keep intermediate state readable enough that I can audit it later.
4. **Verify.** Check a boundary case, sign, unit, invariant, order of magnitude, or alternative derivation. Then translate the result back into an ordinary sentence.

Details I would refuse to skip

- **Definitions:** I should be able to define every technical noun in the chapter without using that same noun in the definition.
- **Assumptions:** I write the condition that makes the method legal beside the method itself. A correct procedure under the wrong assumptions is still a wrong answer.
- **Representation:** I move freely among words, equations or code, a diagram, and a small numerical example. If one representation disagrees with another, that disagreement is useful evidence.
- **Failure modes:** I keep the nearest counterexample in mind: the boundary where the rule changes, the invariant breaks, or the model stops matching reality.
- **Communication:** My final answer names what the result means and what it does not establish. I do not let notation do the explanatory work for me.

Sanity check

Closed-note check. Can I teach cardiovascular and respiratory responses to exercise on a blank page, derive or reconstruct its main rule, work a fresh example, and diagnose a deliberately broken solution? If I can only recognize the finished work, I am not done.

How this chapter connects

I read this chapter as the bridge from carbohydrate, fat, protein, and micronutrients to skeletal muscle, strength, and adaptation. The earlier material supplies the language and constraints; this chapter adds a new reasoning move; the later material asks me to use that move without being told its name. That connection matters because exams and real projects mix chapters on purpose.

The full working model

- **Core claim.** Cardiac output equals heart rate times stroke volume, while ventilation and gas exchange deliver oxygen and remove carbon dioxide.
- **What moves.** Exercise changes blood flow, arteriovenous oxygen difference, and perceived effort; training improves delivery and extraction.
- **What keeps the answer honest.** The model becomes useful only when I can apply cardiovascular and respiratory responses to exercise to an unfamiliar case and defend the assumptions.
- **Mastery standard.** I can define the objects, rebuild the rule, work a fresh case, compare alternatives, and diagnose a broken solution without relying on recognition.

How I actually think about it

I connect breathing, circulation, and muscle use as one oxygen-transport story.

The easy version

Cardiac output equals heart rate times stroke volume, while ventilation and gas exchange deliver oxygen and remove carbon dioxide.

Worked example

Question. If heart rate is 150 beats/min and stroke volume is 100 mL/beat, find cardiac output.
Walkthrough. Cardiac output is 15,000 mL/min, or 15 L/min. Interpretation still depends on body size, workload, and measurement conditions.

Common miss

The fastest way to get this chapter wrong is to use the visible procedure without naming its assumption, units, time period, reference group, or boundary. I put that condition beside the work and verify the result independently.

Solved chapter practice

Practice 1. If heart rate is 150 beats/min and stroke volume is 100 mL/beat, find cardiac output.
Solution. Cardiac output is 15,000 mL/min, or 15 L/min. Interpretation still depends on body size, workload, and measurement conditions.

Practice 2. Explain cardiovascular and respiratory responses to exercise to a classmate using one definition, one concrete example, one assumption, and one failure mode.

Solution. Begin with the core claim above, use the worked case as the concrete example, state the condition highlighted by the warning, and choose a failure where that condition does not hold. A complete explanation connects all four pieces instead of listing them.

Mastery practice A. Reconstruct cardiovascular and respiratory responses to exercise from a blank page. Include the central definition, the governing rule, one required assumption, and one boundary case.

Solution. Start from the blue idea box, but rewrite it in my own words. Identify the objects

and state, name the rule before using it, copy the relevant assumption from the details audit, and choose a boundary where that assumption becomes equality or fails. A complete solution explains why each part belongs; a list of vocabulary is not enough.

Mastery practice B. A classmate gets a polished-looking answer to a cardiovascular and respiratory responses to exercise problem but never states a model or checks the result. Write the shortest useful review of that solution.

Solution. I would ask four concrete questions: What exactly are the inputs and desired output? Which rule licenses the main step? Which assumption could invalidate it? Which independent check supports the conclusion? If the answer cannot survive those four questions, I treat the numerical or verbal result as unverified.

CHAPTER 5 Skeletal muscle, strength, and adaptation

The idea

Muscle force arises from motor-unit recruitment, firing rate, fiber properties, length-tension, and contraction type. Resistance training drives neural and structural adaptation; overload, specificity, recovery, and progression organize safe programming.

Rebuild the chapter from first principles

The claim I need to own is this: Muscle force arises from motor-unit recruitment, firing rate, fiber properties, length-tension, and contraction type. Resistance training drives neural and structural adaptation; overload, specificity, recovery, and progression organize safe programming. I do not count that as learned just because the sentence looks familiar. I should be able to name the objects, state what changes and what stays fixed, recover the rule from the definitions, and explain why the result is allowed.

The move

My working sequence

1. **Translate.** Rewrite the prompt in the language of skeletal muscle, strength, and adaptation. List the known quantities, the unknown, the units or types, and any hidden constraint.
2. **Choose.** State the theorem, model, algorithm, accounting rule, or physical law before substituting values. This is where I make the assumption visible.
3. **Execute.** Work one justified step at a time and keep intermediate state readable enough that I can audit it later.
4. **Verify.** Check a boundary case, sign, unit, invariant, order of magnitude, or alternative derivation. Then translate the result back into an ordinary sentence.

Details I would refuse to skip

- **Definitions:** I should be able to define every technical noun in the chapter without using that same noun in the definition.
- **Assumptions:** I write the condition that makes the method legal beside the method itself. A correct procedure under the wrong assumptions is still a wrong answer.
- **Representation:** I move freely among words, equations or code, a diagram, and a small numerical example. If one representation disagrees with another, that disagreement is useful evidence.
- **Failure modes:** I keep the nearest counterexample in mind: the boundary where the rule changes, the invariant breaks, or the model stops matching reality.
- **Communication:** My final answer names what the result means and what it does not establish. I do not let notation do the explanatory work for me.

Sanity check

Closed-note check. Can I teach skeletal muscle, strength, and adaptation on a blank page, derive or reconstruct its main rule, work a fresh example, and diagnose a deliberately broken solution? If I can only recognize the finished work, I am not done.

How this chapter connects

I read this chapter as the bridge from cardiovascular and respiratory responses to exercise to aerobic fitness, fatigue, and training design. The earlier material supplies the language and constraints; this chapter adds a new reasoning move; the later material asks me to use that move without being told its name. That connection matters because exams and real projects mix chapters on purpose.

The full working model

- **Core claim.** Muscle force arises from motor-unit recruitment, firing rate, fiber properties, length-tension, and contraction type.
- **What moves.** Resistance training drives neural and structural adaptation; overload, specificity, recovery, and progression organize safe programming.
- **What keeps the answer honest.** The model becomes useful only when I can apply skeletal muscle, strength, and adaptation to an unfamiliar case and defend the assumptions.
- **Mastery standard.** I can define the objects, rebuild the rule, work a fresh case, compare alternatives, and diagnose a broken solution without relying on recognition.

How I actually think about it

Soreness is not the target. I track whether the body can produce more useful force with good technique over time.

The easy version

Muscle force arises from motor-unit recruitment, firing rate, fiber properties, length-tension, and contraction type.

Worked example

Question. Why do early strength gains occur before large muscle growth?

Walkthrough. Neural adaptations improve recruitment, coordination, and skill, allowing more force from existing tissue before substantial hypertrophy develops.

Common miss

The fastest way to get this chapter wrong is to use the visible procedure without naming its assumption, units, time period, reference group, or boundary. I put that condition beside the work and verify the result independently.

Solved chapter practice

Practice 1. Why do early strength gains occur before large muscle growth?

Solution. Neural adaptations improve recruitment, coordination, and skill, allowing more force from existing tissue before substantial hypertrophy develops.

Practice 2. Explain skeletal muscle, strength, and adaptation to a classmate using one definition, one concrete example, one assumption, and one failure mode.

Solution. Begin with the core claim above, use the worked case as the concrete example, state the condition highlighted by the warning, and choose a failure where that condition does not hold. A complete explanation connects all four pieces instead of listing them.

Mastery practice A. Reconstruct skeletal muscle, strength, and adaptation from a blank page. Include the central definition, the governing rule, one required assumption, and one boundary case.

Solution. Start from the blue idea box, but rewrite it in my own words. Identify the objects and state, name the rule before using it, copy the relevant assumption from the details audit, and choose a boundary where that assumption becomes equality or fails. A complete solution explains why each part belongs; a list of vocabulary is not enough.

Mastery practice B. A classmate gets a polished-looking answer to a skeletal muscle, strength, and adaptation problem but never states a model or checks the result. Write the shortest useful review of that solution.

Solution. I would ask four concrete questions: What exactly are the inputs and desired output? Which rule licenses the main step? Which assumption could invalidate it? Which independent check supports the conclusion? If the answer cannot survive those four questions, I treat the numerical or verbal result as unverified.

CHAPTER 6 Aerobic fitness, fatigue, and training design

The idea

Aerobic capacity reflects oxygen delivery and use; thresholds, economy, substrate use, heat, hydration, and fatigue limit performance. Frequency, intensity, time, type, progression, and recovery turn physiology into a training plan.

Rebuild the chapter from first principles

The claim I need to own is this: Aerobic capacity reflects oxygen delivery and use; thresholds, economy, substrate use, heat, hydration, and fatigue limit performance. Frequency, intensity, time, type, progression, and recovery turn physiology into a training plan. I do not count that as learned just because the sentence looks familiar. I should be able to name the objects, state what changes and what stays fixed, recover the rule from the definitions, and explain why the result is allowed.

The move

My working sequence

1. **Translate.** Rewrite the prompt in the language of aerobic fitness, fatigue, and training design. List the known quantities, the unknown, the units or types, and any hidden constraint.
2. **Choose.** State the theorem, model, algorithm, accounting rule, or physical law before substituting values. This is where I make the assumption visible.
3. **Execute.** Work one justified step at a time and keep intermediate state readable enough that I can audit it later.
4. **Verify.** Check a boundary case, sign, unit, invariant, order of magnitude, or alternative derivation. Then translate the result back into an ordinary sentence.

Details I would refuse to skip

- **Definitions:** I should be able to define every technical noun in the chapter without using that same noun in the definition.
- **Assumptions:** I write the condition that makes the method legal beside the method itself. A correct procedure under the wrong assumptions is still a wrong answer.
- **Representation:** I move freely among words, equations or code, a diagram, and a small numerical example. If one representation disagrees with another, that disagreement is useful evidence.
- **Failure modes:** I keep the nearest counterexample in mind: the boundary where the rule changes, the invariant breaks, or the model stops matching reality.
- **Communication:** My final answer names what the result means and what it does not establish. I do not let notation do the explanatory work for me.

Sanity check

Closed-note check. Can I teach aerobic fitness, fatigue, and training design on a blank page, derive or reconstruct its main rule, work a fresh example, and diagnose a deliberately broken solution? If I can only recognize the finished work, I am not done.

How this chapter connects

I read this chapter as the bridge from skeletal muscle, strength, and adaptation to obesity, diabetes, cardiovascular disease, and prevention. The earlier material supplies the language and constraints; this chapter adds a new reasoning move; the later material asks me to use that move without being told its name. That connection matters because exams and real projects mix chapters on purpose.

The full working model

- **Core claim.** Aerobic capacity reflects oxygen delivery and use; thresholds, economy, substrate use, heat, hydration, and fatigue limit performance.
- **What moves.** Frequency, intensity, time, type, progression, and recovery turn physiology into a training plan.
- **What keeps the answer honest.** The model becomes useful only when I can apply aerobic fitness, fatigue, and training design to an unfamiliar case and defend the assumptions.
- **Mastery standard.** I can define the objects, rebuild the rule, work a fresh case, compare alternatives, and diagnose a broken solution without relying on recognition.

How I actually think about it

My shorthand for this chapter is: a hard workout is a dose, and recovery determines whether that dose becomes adaptation or accumulated fatigue.

The easy version

Aerobic capacity reflects oxygen delivery and use; thresholds, economy, substrate use, heat, hydration, and fatigue limit performance.

Worked example

Question. Why can two people with the same VO₂ max perform differently?

Walkthrough. Movement economy, lactate or ventilatory threshold, pacing, heat tolerance, skill, and motivation affect how much capacity becomes sustained performance.

Common miss

The fastest way to get this chapter wrong is to use the visible procedure without naming its assumption, units, time period, reference group, or boundary. I put that condition beside the work and verify the result independently.

Solved chapter practice

Practice 1. Why can two people with the same VO₂ max perform differently?

Solution. Movement economy, lactate or ventilatory threshold, pacing, heat tolerance, skill, and motivation affect how much capacity becomes sustained performance.

Practice 2. Explain aerobic fitness, fatigue, and training design to a classmate using one definition, one concrete example, one assumption, and one failure mode.

Solution. Begin with the core claim above, use the worked case as the concrete example, state the condition highlighted by the warning, and choose a failure where that condition does not hold. A complete explanation connects all four pieces instead of listing them.

Mastery practice A. Reconstruct aerobic fitness, fatigue, and training design from a blank page. Include the central definition, the governing rule, one required assumption, and one boundary case.

Solution. Start from the blue idea box, but rewrite it in my own words. Identify the objects and state, name the rule before using it, copy the relevant assumption from the details audit, and choose a boundary where that assumption becomes equality or fails. A complete solution explains why each part belongs; a list of vocabulary is not enough.

Mastery practice B. A classmate gets a polished-looking answer to a aerobic fitness, fatigue, and training design problem but never states a model or checks the result. Write the shortest useful review of that solution.

Solution. I would ask four concrete questions: What exactly are the inputs and desired output? Which rule licenses the main step? Which assumption could invalidate it? Which independent check supports the conclusion? If the answer cannot survive those four questions, I treat the numerical or verbal result as unverified.

CHAPTER 7 Obesity, diabetes, cardiovascular disease, and prevention

The idea

Chronic disease emerges from genetics, behavior, environment, social conditions, and physiology. Insulin resistance, blood pressure, lipids, inflammation, and body-fat distribution are risk pathways; diet and exercise reduce risk without guaranteeing outcomes.

Rebuild the chapter from first principles

The claim I need to own is this: Chronic disease emerges from genetics, behavior, environment, social conditions, and physiology. Insulin resistance, blood pressure, lipids, inflammation, and body-fat distribution are risk pathways; diet and exercise reduce risk without guaranteeing outcomes. I do not count that as learned just because the sentence looks familiar. I should be able to name the objects, state what changes and what stays fixed, recover the rule from the definitions, and explain why the result is allowed.

The move

My working sequence

1. **Translate.** Rewrite the prompt in the language of obesity, diabetes, cardiovascular disease, and prevention. List the known quantities, the unknown, the units or types, and any hidden constraint.
2. **Choose.** State the theorem, model, algorithm, accounting rule, or physical law before substituting values. This is where I make the assumption visible.
3. **Execute.** Work one justified step at a time and keep intermediate state readable enough that I can audit it later.
4. **Verify.** Check a boundary case, sign, unit, invariant, order of magnitude, or alternative derivation. Then translate the result back into an ordinary sentence.

Details I would refuse to skip

- **Definitions:** I should be able to define every technical noun in the chapter without using that same noun in the definition.
- **Assumptions:** I write the condition that makes the method legal beside the method itself. A correct procedure under the wrong assumptions is still a wrong answer.
- **Representation:** I move freely among words, equations or code, a diagram, and a small numerical example. If one representation disagrees with another, that disagreement is useful evidence.
- **Failure modes:** I keep the nearest counterexample in mind: the boundary where the rule changes, the invariant breaks, or the model stops matching reality.
- **Communication:** My final answer names what the result means and what it does not establish. I do not let notation do the explanatory work for me.

Sanity check

Closed-note check. Can I teach obesity, diabetes, cardiovascular disease, and prevention on a blank page, derive or reconstruct its main rule, work a fresh example, and diagnose a deliberately broken solution? If I can only recognize the finished work, I am not done.

How this chapter connects

I read this chapter as the bridge from aerobic fitness, fatigue, and training design to reading health evidence and building sustainable choices. The earlier material supplies the language and constraints; this chapter adds a new reasoning move; the later material asks me to use that move without being told its name. That connection matters because exams and real projects mix chapters on purpose.

The full working model

- **Core claim.** Chronic disease emerges from genetics, behavior, environment, social conditions, and physiology.
- **What moves.** Insulin resistance, blood pressure, lipids, inflammation, and body-fat distribution are

risk pathways; diet and exercise reduce risk without guaranteeing outcomes.

- **What keeps the answer honest.** The model becomes useful only when I can apply obesity, diabetes, cardiovascular disease, and prevention to an unfamiliar case and defend the assumptions.
- **Mastery standard.** I can define the objects, rebuild the rule, work a fresh case, compare alternatives, and diagnose a broken solution without relying on recognition.

How I actually think about it

Risk factors change probability, not moral worth or destiny. I separate health evidence from stigma.

The easy version

Chronic disease emerges from genetics, behavior, environment, social conditions, and physiology.

Worked example

Question. How does regular aerobic exercise improve glucose control?

Walkthrough. Muscle contraction increases glucose uptake and repeated training improves insulin sensitivity and metabolic capacity, helping lower glucose exposure even without dramatic weight loss.

Common miss

The fastest way to get this chapter wrong is to use the visible procedure without naming its assumption, units, time period, reference group, or boundary. I put that condition beside the work and verify the result independently.

Solved chapter practice

Practice 1. How does regular aerobic exercise improve glucose control?

Solution. Muscle contraction increases glucose uptake and repeated training improves insulin sensitivity and metabolic capacity, helping lower glucose exposure even without dramatic weight loss.

Practice 2. Explain obesity, diabetes, cardiovascular disease, and prevention to a classmate using one definition, one concrete example, one assumption, and one failure mode.

Solution. Begin with the core claim above, use the worked case as the concrete example, state the condition highlighted by the warning, and choose a failure where that condition does not hold. A complete explanation connects all four pieces instead of listing them.

Mastery practice A. Reconstruct obesity, diabetes, cardiovascular disease, and prevention from a blank page. Include the central definition, the governing rule, one required assumption, and one boundary case.

Solution. Start from the blue idea box, but rewrite it in my own words. Identify the objects and state, name the rule before using it, copy the relevant assumption from the details audit, and choose a boundary where that assumption becomes equality or fails. A complete solution explains why each part belongs; a list of vocabulary is not enough.

Mastery practice B. A classmate gets a polished-looking answer to a obesity, diabetes, cardiovascular disease, and prevention problem but never states a model or checks the result. Write the shortest useful review of that solution.

Solution. I would ask four concrete questions: What exactly are the inputs and desired output? Which rule licenses the main step? Which assumption could invalidate it? Which independent check supports the conclusion? If the answer cannot survive those four questions, I treat the numerical or verbal result as unverified.

CHAPTER 8 Reading health evidence and building sustainable choices

The idea

Health claims require study design, comparison groups, effect sizes, uncertainty, adherence, harms, conflicts, and population fit. Randomized trials and observational studies answer different questions; a useful recommendation balances evidence, access, preference, and sustainability.

Rebuild the chapter from first principles

The claim I need to own is this: Health claims require study design, comparison groups, effect sizes, uncertainty, adherence, harms, conflicts, and population fit. Randomized trials and observational studies answer different questions; a useful recommendation balances evidence, access, preference, and sustainability. I do not count that as learned just because the sentence looks familiar. I should be able to name the objects, state what changes and what stays fixed, recover the rule from the definitions, and explain why the result is allowed.

The move

My working sequence

1. **Translate.** Rewrite the prompt in the language of reading health evidence and building sustainable choices. List the known quantities, the unknown, the units or types, and any hidden constraint.
2. **Choose.** State the theorem, model, algorithm, accounting rule, or physical law before substituting values. This is where I make the assumption visible.
3. **Execute.** Work one justified step at a time and keep intermediate state readable enough that I can audit it later.
4. **Verify.** Check a boundary case, sign, unit, invariant, order of magnitude, or alternative derivation. Then translate the result back into an ordinary sentence.

Details I would refuse to skip

- **Definitions:** I should be able to define every technical noun in the chapter without using that same noun in the definition.

- **Assumptions:** I write the condition that makes the method legal beside the method itself. A correct procedure under the wrong assumptions is still a wrong answer.
- **Representation:** I move freely among words, equations or code, a diagram, and a small numerical example. If one representation disagrees with another, that disagreement is useful evidence.
- **Failure modes:** I keep the nearest counterexample in mind: the boundary where the rule changes, the invariant breaks, or the model stops matching reality.
- **Communication:** My final answer names what the result means and what it does not establish. I do not let notation do the explanatory work for me.

Sanity check

Closed-note check. Can I teach reading health evidence and building sustainable choices on a blank page, derive or reconstruct its main rule, work a fresh example, and diagnose a deliberately broken solution? If I can only recognize the finished work, I am not done.

How this chapter connects

I read this chapter as the bridge from obesity, diabetes, cardiovascular disease, and prevention to the cumulative course model. The earlier material supplies the language and constraints; this chapter adds a new reasoning move; the later material asks me to use that move without being told its name. That connection matters because exams and real projects mix chapters on purpose.

The full working model

- **Core claim.** Health claims require study design, comparison groups, effect sizes, uncertainty, adherence, harms, conflicts, and population fit.
- **What moves.** Randomized trials and observational studies answer different questions; a useful recommendation balances evidence, access, preference, and sustainability.
- **What keeps the answer honest.** The model becomes useful only when I can apply reading health evidence and building sustainable choices to an unfamiliar case and defend the assumptions.
- **Mastery standard.** I can define the objects, rebuild the rule, work a fresh case, compare alternatives, and diagnose a broken solution without relying on recognition.

How I actually think about it

I ask whether the headline reports a relative or absolute effect and whether people like me were actually studied.

The easy version

Health claims require study design, comparison groups, effect sizes, uncertainty, adherence, harms, conflicts, and population fit.

Worked example

Question. A risk falls from 2 percent to 1 percent. Compare relative and absolute reduction.

Walkthrough. The relative reduction is 50 percent, while the absolute reduction is 1 percentage point. Both are correct, but the absolute change better communicates baseline scale.

Common miss

The fastest way to get this chapter wrong is to use the visible procedure without naming its assumption, units, time period, reference group, or boundary. I put that condition beside the work and verify the result independently.

Solved chapter practice

Practice 1. A risk falls from 2 percent to 1 percent. Compare relative and absolute reduction.

Solution. The relative reduction is 50 percent, while the absolute reduction is 1 percentage point. Both are correct, but the absolute change better communicates baseline scale.

Practice 2. Explain reading health evidence and building sustainable choices to a classmate using one definition, one concrete example, one assumption, and one failure mode.

Solution. Begin with the core claim above, use the worked case as the concrete example, state the condition highlighted by the warning, and choose a failure where that condition does not hold. A complete explanation connects all four pieces instead of listing them.

Mastery practice A. Reconstruct reading health evidence and building sustainable choices from a blank page. Include the central definition, the governing rule, one required assumption, and one boundary case.

Solution. Start from the blue idea box, but rewrite it in my own words. Identify the objects and state, name the rule before using it, copy the relevant assumption from the details audit, and choose a boundary where that assumption becomes equality or fails. A complete solution explains why each part belongs; a list of vocabulary is not enough.

Mastery practice B. A classmate gets a polished-looking answer to a reading health evidence and building sustainable choices problem but never states a model or checks the result. Write the shortest useful review of that solution.

Solution. I would ask four concrete questions: What exactly are the inputs and desired output? Which rule licenses the main step? Which assumption could invalidate it? Which independent check supports the conclusion? If the answer cannot survive those four questions, I treat the numerical or verbal result as unverified.

Cumulative study plan

I use this packet in three passes. First I reconstruct each model and work its examples without looking. Second I mix chapters so the tool is no longer named for me. Third I explain a complete case aloud, including assumptions, units, uncertainty, failure modes, and what evidence would change my conclusion.