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Free Lesson Plan — Teacher Edition

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6-8 Sustainable Engineering Design Challenge — Weekly Lesson Plan

GRADE LEVEL	SUBJECT	WEEK OF
6-8	Sustainable Engineering …	_____

Unit Overview

A five-session engineering design challenge where students target one real waste stream in their classroom, school or cafeteria, then prototype and iterate twice. Uses the NGSS engineering design loop with explicit Define-Develop-Optimize phases. Ends with a Friday design review using a real industry critique format.

Standards Alignment

NGSS MS-ETS1-1 through MS-ETS1-4; UN SDG 12 Responsible Consumption

Global Standards Mapping

United States:
NGSS MS-ETS1-1 through MS-ETS1-4; UN SDG 12 Responsible Consumption

United Kingdom:
Key Stage 3 (Years 7–9, ages 11–14)

Australia / NZ:
Years 7–8 (AC v9.0) · NZ Levels 4–5

IB Programme:
MYP — Years 1–3 (ages 11–14)

Canada (Ontario):
Ontario Intermediate Division (Grades 7–8)

Singapore / India:
MOE Secondary 1–2 · NCERT Classes 6–8

EU/EEA note: EU/EEA: GDPR-compliant — no student PII collected; teacher use only

Companion Student Handout — ready to photocopy

Each lesson plan ships with a separate "Student Edition" PDF — daily I-can goals, vocabulary blanks, work space, and exit-ticket boxes. No teacher prep. Print and hand out.

Session 1

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Learning Objective

Students will be able to define a measurable design problem from observed waste, with clear constraints and one success criterion.

Standards Alignment

NGSS MS-ETS1-1

Materials Needed

- Clipboards
- Stopwatches
- Waste-audit observation sheet
- Sticky-note-able problem-statement template

Lesson Flow

Opening / Hook (5-10 min):

"In the next 10 minutes, walk this hallway and the cafeteria entry. Count one wasteful thing."

Direct Instruction (15-20 min):

MS-ETS1-1 problem-statement frame: For [user], [the current state] is [bad outcome] because [cause]. Success means [measurable change].

Guided Practice (10-15 min):

Triads draft using the frame for the waste stream they observed.

Independent Practice (10-15 min):

Each team finalizes their statement with at least one number in the success criterion.

Closing / Exit Ticket (5 min):

Gallery walk; teams add one critique sticky to one other team.

Differentiation

For struggling learners:

Provide a partially-completed organizer with the first row modeled and 2-3 sentence stems specific to engineering.

For advanced learners:

Add a transfer prompt: apply today's idea to a context outside engineering and defend the move in 3 sentences.

For ELL students:

Pre-teach 4 key terms with a visual glossary; offer the sentence frame "I notice that ___, which suggests ___ because ___."

For IEP students:

Reduce the response set by half; offer choice between a written, oral (recorded on Flip), or sketch response — same rubric.

Session 2

6-8 Sustainable Engineering Design Challenge — Weekly Lesson Plan

Learning Objective

Students will be able to brainstorm 8+ solutions and choose one using a 2-axis decision matrix (impact × feasibility).

Standards Alignment

NGSS MS-ETS1-2

Materials Needed

- Decision-matrix template
- Markers

Lesson Flow

Opening / Hook (5-10 min):

"Bad ideas first." 90-second team brainstorm of 5 deliberately bad solutions. Loosens up.

Direct Instruction (15-20 min):

Walk decision-matrix logic: high impact × high feasibility wins. Show how to honestly score feasibility (this week, with what we have).

Guided Practice (10-15 min):

Teams generate 8+ solutions, score on the matrix, defend their pick to a sister team.

Independent Practice (10-15 min):

Each team writes a one-paragraph chosen-solution rationale.

Closing / Exit Ticket (5 min):

Whip-around: one solution that almost won and why it didn't.

Differentiation

For struggling learners:

Provide a partially-completed organizer with the first row modeled and 2-3 sentence stems specific to engineering.

For advanced learners:

Add a transfer prompt: apply today's idea to a context outside engineering and defend the move in 3 sentences.

For ELL students:

Pre-teach 4 key terms with a visual glossary; offer the sentence frame "I notice that ___, which suggests ___ because ___."

For IEP students:

Reduce the response set by half; offer choice between a written, oral (recorded on Flip), or sketch response — same rubric.

Session 3

6-8 Sustainable Engineering Design Challenge — Weekly Lesson Plan

Learning Objective

Students will be able to prototype version 1 with materials at hand and identify the failure points before testing.

Standards Alignment

NGSS MS-ETS1-2; MS-ETS1-3

Materials Needed

- Cardboard, tape, markers, recycled materials
- Prototype-sketch sheet

Lesson Flow

Opening / Hook (5-10 min):

"Version 1 is supposed to fail. That's data."

Direct Instruction (15-20 min):

Show two prototypes — one over-built (precious), one minimum-viable. The MVP teaches faster.

Guided Practice (10-15 min):

Teams sketch first, then build. Walk room — push 'what's the smallest thing you can build today that proves this works?'

Independent Practice (10-15 min):

Build v1.

Closing / Exit Ticket (5 min):

Each team predicts: 'Our v1 will probably fail at ___.'

Differentiation

For struggling learners:

Provide a partially-completed organizer with the first row modeled and 2-3 sentence stems specific to engineering.

For advanced learners:

Add a transfer prompt: apply today's idea to a context outside engineering and defend the move in 3 sentences.

For ELL students:

Pre-teach 4 key terms with a visual glossary; offer the sentence frame "I notice that ___, which suggests ___ because ___."

For IEP students:

Reduce the response set by half; offer choice between a written, oral (recorded on Flip), or sketch response — same rubric.

Session 4

6-8 Sustainable Engineering Design Challenge — Weekly Lesson Plan

Learning Objective

Students will be able to test v1, gather one kind of quantitative + one kind of qualitative data, and make ONE substantive change.

Standards Alignment

NGSS MS-ETS1-3; MS-ETS1-4

Materials Needed

- v1 prototypes
- Test-data sheet
- Materials for v2 changes

Lesson Flow

Opening / Hook (5-10 min):

"You get one change. Choose it from data, not from feelings."

Direct Instruction (15-20 min):

Quant data = a number that changed. Qual data = what users said. Walk through how to weigh them.

Guided Practice (10-15 min):

Teams test v1 in context; collect both kinds of data.

Independent Practice (10-15 min):

Make the one change!' v2.

Closing / Exit Ticket (5 min):

Each team logs the change + why.

Differentiation

For struggling learners:

Provide a partially-completed organizer with the first row modeled and 2-3 sentence stems specific to engineering.

For advanced learners:

Add a transfer prompt: apply today's idea to a context outside engineering and defend the move in 3 sentences.

For ELL students:

Pre-teach 4 key terms with a visual glossary; offer the sentence frame "I notice that ___, which suggests ___ because ___."

For IEP students:

Reduce the response set by half; offer choice between a written, oral (recorded on Flip), or sketch response — same rubric.

Session 5

6-8 Sustainable Engineering Design Challenge — Weekly Lesson Plan

Learning Objective

Students will be able to present v2 in a structured design review and incorporate one piece of critique.

Standards Alignment

NGSS MS-ETS1-4; CCSS SL.7.4

Materials Needed

- Design-review format card (problem, solution, evidence, ask)
- Critique cards

Lesson Flow

Opening / Hook (5-10 min):

Show how an industry design review runs: 5 min pitch, 5 min critique, no defensiveness.

Direct Instruction (15-20 min):

Set ground rules: presenters listen and write critique down silently; respond after the timer.

Guided Practice (10-15 min):

Two reviews per round; rotate.

Independent Practice (10-15 min):

Each team picks ONE piece of critique to act on next week and writes it down.

Closing / Exit Ticket (5 min):

Public commitment: one critique, one action, one date.

Differentiation

For struggling learners:

Provide a partially-completed organizer with the first row modeled and 2-3 sentence stems specific to engineering.

For advanced learners:

Add a transfer prompt: apply today's idea to a context outside engineering and defend the move in 3 sentences.

For ELL students:

Pre-teach 4 key terms with a visual glossary; offer the sentence frame "I notice that ___, which suggests ___ because ___."

For IEP students:

Reduce the response set by half; offer choice between a written, oral (recorded on Flip), or sketch response — same rubric.

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