

Breach at Biosphere Station 7

An Online Instructional Escape Room Planned with the ADDIE Model

EDTC 814 — Project 2

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Overview at a Glance

Element	Description
Title	Breach at Biosphere Station 7
Target audience	Grade 7 Life Science students (approx. ages 12–13), general education class of 24–28 with inclusion support
Context	Middle school Life Science, Unit 3: Cell Structure and Function — review and formative assessment prior to the unit exam
Delivery	Fully online; primarily asynchronous with an optional synchronous launch and debrief
Duration	45–55 minutes
Grouping	Virtual teams of 3, with individual accountability built in
Core tools	Google Sites (hub), Google Forms (locks), Google Slides (interactive scene), Edpuzzle, Canva, Padlet

Learning Objectives

By the end of this escape room, students will be able to:

1. Identify the major cell organelles and match each to its primary function with at least 80% accuracy.
2. Distinguish between plant and animal cells by citing at least three structural differences.
3. Explain how the cell membrane regulates movement of materials through diffusion, osmosis, and active transport.
4. Predict what happens to a cell placed in hypotonic, hypertonic, and isotonic solutions, and justify the prediction using evidence.
5. Collaborate with peers to solve multi-step problems and communicate reasoning in writing.

1. Analysis

Target Learners

The intended learners are seventh-grade Life Science students in a public middle school. The class is heterogeneous: roughly a quarter of students receive accommodations through IEPs or 504 plans, several are multilingual learners at intermediate English proficiency, and reading levels range from about fourth to ninth grade. All students have one-to-one Chromebooks and daily access to the district Google Workspace and Canvas LMS. Most students are comfortable with Google Forms and Slides but have limited experience with self-directed, multi-step online tasks.

Learning Problem and Instructional Need

Unit assessment data from prior years shows a consistent pattern. Students memorize organelle names and definitions well enough to pass a matching quiz, but they struggle when asked to apply that knowledge. On the most recent unit exam, 71% of students correctly labeled a cell diagram, yet only 38% correctly predicted what would happen to a red blood cell placed in salt water and explained why. The gap is not vocabulary recall; it is transfer. Students are not connecting structure to function, and they are not reasoning about the cell as a dynamic system.

A second problem is engagement during review. Traditional review days — worksheets, Kahoot, study guides — produce compliance rather than thinking. Students who already know the material coast, and students who do not know it copy answers. The instructional need is a review activity that requires every student to reason, provides immediate feedback on incorrect thinking, and generates evidence the teacher can act on before the summative exam.

Prior Knowledge Learners Should Have

- Cells are the basic unit of all living things and that living things may be unicellular or multicellular.
- Basic organelle vocabulary from earlier lessons in the unit: nucleus, cell membrane, cytoplasm, mitochondria, chloroplast, cell wall, vacuole, ribosome, endoplasmic reticulum.
- The concept of a solution and of concentration, at an introductory level.
- How to use a microscope image or diagram to identify structures.
- Functional comfort with Google Forms, Google Slides, and their Canvas course.

Standards and Competencies

The activity aligns to the following performance expectations and practices:

- NGSS MS-LS1-2: Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.
- NGSS MS-LS1-1: Conduct an investigation to provide evidence that living things are made of cells.
- Science and Engineering Practice 6: Constructing Explanations.
- Crosscutting Concept: Structure and Function.
- ISTE Student Standard 1.5 (Computational Thinker) and 1.7 (Global Collaborator), addressed through the collaborative digital problem-solving format.

Why an Online Escape Room Fits This Topic

The escape room format is a strong match here for three reasons that are specific to this content, not just to novelty.

First, the cell is naturally a container with gates. The storyline of a sealed station whose systems have failed maps directly onto the biology: the membrane is a door that opens selectively, the mitochondria are the power supply, the nucleus is the control room. The narrative is not decoration draped over the content; it is an analogy students can reason inside of.

Second, escape rooms require correct answers to progress. A student cannot advance past the transport lock by guessing vaguely about “water moving.” The gating mechanism converts a low-stakes review into a task with genuine consequence, which is exactly the pressure missing from a worksheet.

Third, the format supports productive struggle with immediate feedback. When a Google Form rejects an answer, the student receives a targeted hint that redirects thinking rather than supplying the answer. This is the feedback loop that the traditional review day fails to deliver, and it is where misconceptions about

osmosis — the most persistent difficulty in this unit — can actually be surfaced and corrected before the exam.

2. Design

Theme and Storyline

Biosphere Station 7 is a research outpost studying plant and animal cells in low gravity. A micrometeorite has struck the station, and the automated containment system has sealed all interior doors. Life support is running on backup power. Students are the emergency response team, connecting remotely from mission control. To restore the station and unseal the doors, they must repair five failed systems — and each system happens to be modeled on a real cellular structure or process. The final door releases only when all five systems report green.

A countdown timer runs on the hub page. The timer creates urgency but does not lock students out; teams that exceed it are recorded as completing the mission with a “late rescue” status rather than a failure. This preserves the game feel without penalizing students who need more processing time.

Structure and Sequence

The escape room contains five gated challenges plus a final synthesis lock. Challenges 1 through 3 are unlocked linearly. Challenges 4 and 5 unlock together, allowing teams to divide labor and then reconvene. The final lock requires input from every prior stage.

#	Challenge	Objective Addressed	Approx. Time
1	Airlock Diagnostics — organelle identification	Obj. 1	8 min
2	Botany Bay vs. Crew Quarters — plant vs. animal cells	Obj. 2	8 min
3	The Membrane Gate — transport mechanisms	Obj. 3	10 min
4	Hydro Lab Emergency — tonicity prediction	Obj. 4	10 min
5	Power Core — energy and structure-function reasoning	Obj. 1, 3	8 min
—	Final Command Override — synthesis code	All	6 min

Grouping, Tools, and Rules

Grouping: Virtual teams of three, assigned by the teacher to balance reading level and prior performance. Teams communicate in a private Google Chat space or breakout room. Each student additionally submits an individual reflection, so the grade is not purely collective.

Digital tools: Google Sites (mission hub and navigation), Google Forms with response validation (the five locks), Google Slides with hyperlinked hotspots (the interactive station map), Edpuzzle (embedded osmosis video with checkpoint questions), Canva (station map graphic, badge images, clue cards), Padlet (final reflection wall), Canvas (single point of access and gradebook).

Rules displayed on the hub page:

6. Work only with your assigned team. Do not share codes with other teams.
7. You may use your notes, your textbook, and the station files linked in the room.
8. Every answer must be entered by the team — discuss before you submit.
9. Requesting a hint is allowed and costs nothing except thirty seconds on the clock.
10. When you disagree, write down both ideas before deciding. You will be asked about this later.

How students escape: The final Command Override form requires a six-character code assembled from one character earned at each of the five challenges plus a verification digit that students calculate from a synthesis question. Entering the correct code routes the team to a victory page with a Canva-designed mission badge, a certificate of station restoration, and the link to the individual reflection.

3. Development Plan

The following materials would be created before implementation. None are built as part of this plan; each is specified so that another designer could produce them.

Challenge 1 — Airlock Diagnostics

What students see: A Google Slides scene showing a cutaway of the station airlock with eight numbered components. Each number is a clickable hotspot linking to a short “diagnostic readout” card that describes a function in station terms (for example, “Unit 3: converts stored fuel into usable power for all station systems”).

What students do: Match each numbered station component to the correct organelle.

What students submit: A Google Form with eight dropdown items, one per component.

Expected responses: 1 = cell membrane, 2 = nucleus, 3 = mitochondria, 4 = ribosome, 5 = endoplasmic reticulum, 6 = Golgi apparatus, 7 = vacuole, 8 = cytoplasm.

Materials to create: One Canva station cutaway illustration, eight readout cards, one Google Slides deck with hotspot links, one validated Google Form. Hint text for each item that restates the function in simpler language without naming the organelle.

Character earned: B

Challenge 2 — Botany Bay vs. Crew Quarters

What students see: Two side-by-side micrograph-style images: an onion cell and a human cheek cell, each labeled only with letters.

What students do: Identify which chamber is which and cite three structures present in the plant cell but absent in the animal cell.

What students submit: A Google Form with one multiple-choice item and one short-answer item requiring three named structures. Response validation accepts any ordering of cell wall, chloroplast, and large central vacuole.

Materials to create: Two labeled cell images (public-domain micrographs or Canva illustrations with alt text), one Google Form with regex validation, a hint that narrows the field by asking what a plant needs that an animal does not.

Character earned: I

Challenge 3 — The Membrane Gate

What students see: A three-minute Edpuzzle video on passive and active transport, with two embedded checkpoint questions. After the video, a scenario panel describes three substances attempting to cross the station's outer seal.

What students do: Classify each crossing as diffusion, osmosis, or active transport, and explain in one to two sentences why one of the three requires energy.

What students submit: Google Form: three dropdowns plus one short constructed response. The constructed response is not auto-graded; the form accepts any response of at least fifteen words and the teacher scores it afterward against a rubric. The lock releases on the three dropdowns.

Materials to create: Edpuzzle assignment with captions and transcript, three scenario cards, one Google Form, a two-level hint (level one restates the definition of concentration gradient; level two asks which direction each substance is moving relative to that gradient).

Character earned: O

Challenge 4 — Hydro Lab Emergency

What students see: Three sealed specimen tanks, each containing a cell placed in a different solution. Data cards give the solute concentration inside and outside each cell.

What students do: Predict whether each cell will swell, shrink, or remain unchanged, and identify each solution as hypotonic, hypertonic, or isotonic.

What students submit: A Google Form with three paired dropdown sets, plus a required justification for the tank they found most difficult.

Expected responses: Tank A (higher solute outside) = hypertonic, cell shrinks. Tank B (lower solute outside) = hypotonic, cell swells. Tank C (equal) = isotonic, no net change.

Materials to create: Three Canva tank graphics with concentration data, one Google Form, a hint reminding students that water moves toward the higher solute concentration, and a misconception-targeted feedback message that appears on incorrect submission addressing the common reversal error.

Character earned: 4

Challenge 5 — Power Core

What students see: A damaged reactor schematic and a short station log describing symptoms: systems slowing, transport across the outer seal failing, protein fabrication halted.

What students do: Determine which organelle failure explains all three symptoms and justify the choice by connecting the organelle's function to each symptom.

What students submit: One multiple-choice item (answer: mitochondria) and a three-part constructed response linking ATP production to each listed symptom.

Materials to create: Reactor schematic, station log text at two reading levels, Google Form, scoring rubric for the constructed response.

Character earned: 7

Final Command Override

What students see: A code entry terminal requesting a six-character override sequence.

What students do: Assemble B-I-O-4-7 from the earned characters, then determine the sixth character by answering the synthesis question: "Which single structure appears in every challenge you solved, because every process you repaired depends on it?" The answer, cell membrane, corresponds to the character M on the station key.

Correct code: BIO47M

Materials to create: Google Form with exact-match validation, station key graphic mapping structures to characters, victory page on Google Sites, Canva mission badge and certificate, and the individual reflection form.

Facilitator Materials

- Answer key with all lock codes, expected responses, and the synthesis logic.
- Hint script organized by challenge and by level, written as questions rather than answers.
- Team assignment roster with rationale for grouping.
- A monitoring dashboard: a Google Sheet linked to all five form responses, with conditional formatting that flags teams stalled on the same challenge for more than eight minutes.
- Rubrics for the two constructed responses and the reflection.
- A one-page technology troubleshooting guide for students and families.

4. Implementation Plan

Access and Launch

Students access the escape room through a single Canvas assignment page containing one button labeled “Enter Biosphere Station 7,” which opens the Google Site hub. Nothing else is linked, deliberately — a single entry point eliminates the most common source of confusion in online activities. Teams and their chat spaces are assigned in advance and listed on the hub.

The launch is a ten-minute synchronous session. The teacher plays a ninety-second briefing video establishing the storyline, walks through the hub navigation live, demonstrates how to request a hint, and answers logistical questions. Teams then move into breakout rooms or, in the asynchronous version, begin on their own schedule. The briefing video is posted so that absent students receive the identical introduction.

Movement Through the Room

Each challenge lives on its own hub page. Completing a lock reveals the next page link and the earned character, which students record on a provided team log. The team log is important: it makes the accumulating code visible and gives students a shared artifact to point at when they disagree. Challenges 4 and 5 appear simultaneously so teams can split and reconvene, which introduces a genuine collaboration decision rather than a scripted one.

Instructor Support Without Giving Answers

The teacher monitors the response dashboard rather than watching students work. When the sheet flags a stalled team, the teacher joins that breakout room or sends a chat message. Support follows a fixed escalation:

11. Ask what the team has already ruled out and why.
12. Restate the clue in different language, or point to the specific station file that contains the needed information.
13. Offer the level-one hint, which reframes the question conceptually.
14. Offer the level-two hint, which narrows the answer space without stating the answer.
15. If a team is still stuck after ten minutes on one challenge, provide a bypass code and note it for follow-up instruction. Progress is preserved; the gap is recorded.

The teacher never confirms or denies a proposed answer directly. The form does that. This keeps the feedback mechanism consistent and keeps the teacher in the role of thinking partner.

Time Management

Segment	Time
Synchronous briefing and navigation walkthrough	10 min
Challenges 1–3	26 min
Challenges 4–5	18 min
Final override and victory page	6 min
Individual reflection	8 min
Whole-group debrief (synchronous)	10 min

In the asynchronous version, the activity opens Monday and closes Thursday, with the debrief held Friday. Students see the estimated time per challenge on the hub so they can plan their sessions.

Accessibility Considerations

- All images carry descriptive alt text; no answer is retrievable from an image alone, so screen reader users are never disadvantaged.
- The Edpuzzle video includes accurate captions and a downloadable transcript.
- Color is never the sole carrier of meaning; the tank graphics use both color and pattern, with concentration values stated in text.
- Text is provided at two reading levels for the station logs and scenario cards, toggled by a link labeled “Simplified station log.”
- Contrast meets WCAG AA; fonts are set at a minimum of 16 pixels and are not overridden by the theme.
- The countdown timer can be hidden by any student who finds it stressful, and no score depends on it.
- Extended-time accommodations are honored by the asynchronous window; the room does not expire.
- Keyboard navigation works throughout — hotspots are real links, not drag-and-drop interactions, which are the most common accessibility failure in escape room builds.

Backup Plan for Technology Problems

- If a Google Form fails to load, each challenge page includes a fallback link to a Microsoft Form with identical content.
- If Edpuzzle is unavailable, the transcript and a static infographic covering the same content are linked directly beneath the video.
- A printable PDF version of all five challenges with a manual answer sheet is available for students with connectivity failures; codes are checked by the teacher instead of by the form.
- Students who lose progress can resume at any challenge using their team log; because completion is tracked per form and not per session, no work is lost by a browser crash.
- Teacher contact method and expected response time are posted on the hub for asynchronous participants.

Delivery Mode

The activity is designed to run in both modes. The recommended configuration is blended: synchronous launch and debrief with asynchronous work time in between. This preserves the shared framing and the collective closure while giving students flexibility and reducing the bandwidth demands of a full class period on video.

5. Evaluation Plan

Assessing Student Learning

Evaluation draws on four evidence streams rather than a single completion measure, because completion alone would tell me only that a team found the codes, not that individuals understand the content.

Evidence Source	What It Shows	How It Is Reviewed
Form response data (all five locks)	Which items were missed and how many attempts each lock required	Item analysis in the linked Google Sheet; any item missed by more than 40% of teams is flagged for reteaching
Constructed responses (Challenges 3 and 5)	Quality of reasoning connecting structure to function	Scored against a three-point rubric: claim, evidence, reasoning
Individual reflection form	Individual understanding independent of the team result	Read for misconceptions; two items are content questions, not opinion questions
Padlet debrief wall	Collaborative reasoning and disagreement resolution	Reviewed for patterns; not individually graded

Evidence That the Objective Was Met

The objective is met if at least 80% of students independently answer the tonicity transfer item on the individual reflection correctly, and if the mean rubric score on the Challenge 5 constructed response reaches 2.5 of 3. Team completion of the escape room is not by itself evidence of learning; a team can escape while one member watches. The individual reflection is the load-bearing measure.

Evaluating Collaboration

Collaboration is assessed indirectly and honestly. Rather than asking students to rate teammates, which produces unreliable data at this age, the reflection asks each student to describe one moment when the team disagreed and what resolved it. Responses that describe reasoning — “we went back to the data card and saw the numbers” — indicate functional collaboration. Responses that describe deference — “we just used whatever she said” — indicate the opposite, and inform future group assignments.

Student Reflection Questions

16. Which challenge was hardest for your team, and what finally made it click?
17. A cell is placed in a solution and shrinks. What does that tell you about the solution, and why? (Content item)
18. Name one organelle and explain how its structure makes its job possible. (Content item)
19. Describe a moment when your team disagreed. How did you decide who was right?
20. What is one thing you understand now that you did not understand before today?
21. If you got stuck, what did you do about it?

Revision Plan

After the first implementation, I would revise on the basis of three signals. First, timing data: if the median team spends more than twelve minutes on any single challenge, that challenge is either unclear or misplaced in the sequence, and I would rewrite the clue rather than lower the difficulty. Second, hint request frequency: a challenge where nearly every team requests a hint has a clarity problem, while a challenge where no team requests a hint is probably too easy to be doing work. Third, the individual reflection content items: if students who escaped successfully still miss the tonicity item, then the team structure is masking individual gaps, and I would add a brief individual checkpoint between Challenges 3 and 4.

I would also survey students directly on whether the storyline helped or distracted. My assumption that the station analogy supports reasoning is a design hypothesis, not a fact, and it is worth testing.

Reflection on the Design Process

The ADDIE model was most useful to me at the point where I was most tempted to skip ahead. My instinct with an escape room is to start with the theme — the sealed station, the countdown, the badge — because that part is fun to invent. Beginning with Analysis forced me to name the actual problem first, and the actual problem turned out to be narrower than I expected. Students were not failing to memorize organelles; they were failing to reason about osmosis. Once that was written down, it constrained everything after it. Challenge 4 exists because of that data, and it earns the most time in the room.

The puzzle most tightly bound to the objective is the Hydro Lab tonicity challenge. It cannot be solved by recall, by elimination, or by pattern-matching a diagram. A student has to compare two concentrations, decide which direction water moves, and predict a consequence. That is precisely the reasoning the exam data showed was missing, which is why it is the one challenge I would not simplify even if timing data suggested it runs long.

The hardest part of designing for the online format was accepting that I cannot see confusion. In a physical classroom I read faces; online I read a spreadsheet. That is why the monitoring dashboard and the tiered hint script exist — they are compensations for lost peripheral information, not enhancements. The related risk is unequal participation: three students in a chat space can very easily become one student solving and two watching, and no amount of thematic polish fixes that. The individual reflection and the disagreement question are my attempt to make that visible, though I suspect the more durable fix is smaller teams or a required rotation of who submits each lock. That is the first thing I would test in a second version.

Development and Implementation planning also changed the design in a way I did not anticipate. Writing out the accessibility requirements eliminated drag-and-drop puzzles entirely, which I had originally planned for the organelle matching challenge. Drag-and-drop is more satisfying and less accessible. Choosing hyperlinked hotspots instead made the room work for every student and cost almost nothing in engagement — a trade I only noticed because ADDIE made me plan implementation before I fell in love with a prototype.