Sky-High Card Tower

MIX + MATCH / Grades 3-8 / 25-40 minutes / Teams of 2-3







Index cards

Use 20 per team
$1.25/pack (photo price)

Clothespins

Use 4 per team
$1.25/pack (estimate)

Binder clips

Use 2 per team
$1.25/pack (photo price)

Buy one pack of each: $3.75 | Materials used: ~$0.44/team

Package purchase total is before tax; leftovers remain for other activities.

THE CHALLENGE Build a freestanding tower at least 12 inches tall that holds one binder clip at its top.

1. Explore the role of a structural engineer: how do buildings stay stable?

2. Fold, roll, or stack 20 cards. Use up to four clothespins and two binder clips as connectors or weights.

3. Measure the tower height, then place one of your clips on top for 10 seconds.

4. Redesign the base and repeat. Compare height and stability.

STEM connections: Forces, balance, compression, structural design

Test + reflect: Change only the base width. Which version stays standing longest?

Bring from your supply shelf: Ruler; flat table. No tape required.

Photos supplied by Kimberly Bell. Prices reflect visible photo signs or planning estimates; confirm locally. Estimated packs: rubber bands 100, clothespins 40; other counts read from photos. Costs exclude shared tools, tax, and labor. Adult supervision; small parts.

Bridge the Gap

MIX + MATCH / Grades 3-8 / 25-40 minutes / Teams of 2-3







Index cards

Use 12 per team
$1.25/pack (photo price)

Clothespins

Use 4 per team
$1.25/pack (estimate)

Binder clips

Use 4 per team
$1.25/pack (photo price)

Buy one pack of each: $3.75 | Materials used: ~$0.61/team

Package purchase total is before tax; leftovers remain for other activities.

THE CHALLENGE Span a 6-inch gap with an index-card bridge that holds four binder clips.

1. Act as a civil engineer designing a bridge with limited materials.

2. Set two stacks of books 6 inches apart. Build with 12 cards and four clothespins.

3. Add binder clips one at a time at the center. Record how many it supports for 10 seconds.

4. Try folded or accordion-shaped cards and retest with the same gap and load.

STEM connections: Load, span, bending, fair testing

Test + reflect: Keep the card count the same. Does a folded beam carry more than a flat card?

Bring from your supply shelf: Two stable book stacks; ruler. Keep the bridge close to the tabletop.

Photos supplied by Kimberly Bell. Prices reflect visible photo signs or planning estimates; confirm locally. Estimated packs: rubber bands 100, clothespins 40; other counts read from photos. Costs exclude shared tools, tax, and labor. Adult supervision; small parts.

Clothespin Grabber

MIX + MATCH / Grades 3-8 / 25-40 minutes / Teams of 2-3







Clothespins

Use 2 per team
$1.25/pack (estimate)

Rubber bands

Use 2 per team
$1.25/pack (estimate)

Index cards

Use 4 per team
$1.25/pack (photo price)

Buy one pack of each: $3.75 | Materials used: ~$0.11/team

Package purchase total is before tax; leftovers remain for other activities.

THE CHALLENGE Move four folded index-card objects into a target area using a clothespin tool.

1. Meet the mechanical engineer: design a tool that helps a person grip an object.

2. Fold four cards into different shapes. Use one clothespin as a grabber.

3. Wrap a rubber band around the gripping tips to change traction; keep it clear of the hinge.

4. Time four transfers, then compare bare wooden tips with rubber-covered tips. Use the second pin for a partner test.

STEM connections: Levers, friction, grip, accessible tool design

Test + reflect: Which shape is hardest to grip? Explain how the tip material affects the result.

Bring from your supply shelf: Timer and pencil; mark a target on scrap paper. Do not launch bands or pinch skin.

Photos supplied by Kimberly Bell. Prices reflect visible photo signs or planning estimates; confirm locally. Estimated packs: rubber bands 100, clothespins 40; other counts read from photos. Costs exclude shared tools, tax, and labor. Adult supervision; small parts.

Table Tennis Ramp Lab

MIX + MATCH / Grades 3-8 / 25-40 minutes / Teams of 2-3



Table tennis balls

Use 1 per team
$1.75/pack (photo price)



Index cards

Use 8 per team
$1.25/pack (photo price)



Binder clips

Use 2 per team
$1.25/pack (photo price)

Buy one pack of each: $4.25 | Materials used: ~$0.54/team

Package purchase total is before tax; leftovers remain for other activities.

THE CHALLENGE Build a ramp and investigate how starting height changes a ball's travel distance.

1. Think like a test engineer: plan a fair comparison before building.

2. Overlap index cards to form a short ramp. Clip the edges and support it with books.

3. Release the ball without pushing. Measure from the end of the ramp to where it stops.

4. Run three trials at each of two heights. Compare average travel distances.

STEM connections: Gravity, motion, energy, measurement

Test + reflect: Keep the ball, ramp length, and floor surface constant. What changed?

Bring from your supply shelf: Books; ruler or tape measure; clear floor space. Keep balls off walkways.

Photos supplied by Kimberly Bell. Prices reflect visible photo signs or planning estimates; confirm locally. Estimated packs: rubber bands 100, clothespins 40; other counts read from photos. Costs exclude shared tools, tax, and labor. Adult supervision; small parts.

Swab Structure Studio

MIX + MATCH / Grades 3-8 / 25-40 minutes / Teams of 2-3



Cotton swabs

Use 24 per team
$1.25/pack (estimate)



Rubber bands

Use 8 per team
$1.25/pack (estimate)



Index cards

Use 3 per team
$1.25/pack (photo price)

Buy one pack of each: $3.75 | Materials used: ~$0.22/team

Package purchase total is before tax; leftovers remain for other activities.

THE CHALLENGE Create a small frame that stands on its own for 10 seconds.

1. Become a structural designer. Sketch a frame with triangles or squares.

2. Bundle swab ends with rubber bands; test one joint before assembling the full frame.

3. Use up to 24 swabs and eight bands. Fold three cards into feet or braces if helpful.

4. Compare two designs by gently moving the supporting card or tray the same distance. Record which stays upright.

STEM connections: Geometry, bracing, joints, stability

Test + reflect: Which joints are weakest? How can a diagonal brace change the frame?

Bring from your supply shelf: Pencil; flat tray or table. Swab shafts may bend; redesign rather than force them.

Photos supplied by Kimberly Bell. Prices reflect visible photo signs or planning estimates; confirm locally. Estimated packs: rubber bands 100, clothespins 40; other counts read from photos. Costs exclude shared tools, tax, and labor. Adult supervision; small parts.

Wind-Powered Ball Course

MIX + MATCH / Grades 3-8 / 25-40 minutes / Teams of 2-3



Table tennis balls

Use 1 per team
$1.75/pack (photo price)



Index cards

Use 10 per team
$1.25/pack (photo price)



Clothespins

Use 6 per team
$1.25/pack (estimate)

Buy one pack of each: $4.25 | Materials used: ~$0.53/team

Package purchase total is before tax; leftovers remain for other activities.

THE CHALLENGE Guide a table tennis ball through a tabletop course using moving air.

1. Work as an engineer who studies airflow. Plan turns and a finish line.

2. Fold cards into freestanding walls and use clothespins as supports. Leave a clear ball-width path.

3. Use one spare card as a fan to move the ball. Record time and wall contacts.

4. Change the course or fan angle, then repeat three times. Compare results.

STEM connections: Air forces, motion, iteration, data

Test + reflect: How does fan distance affect control? Change one variable per test.

Bring from your supply shelf: Timer; tabletop with an edge barrier. Fan by hand; do not blow through shared materials.

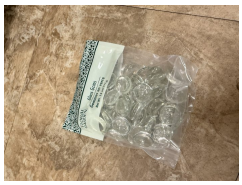
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Clay Cargo Boats

Grades 3-8 | 30-40 min | Pairs | Teams of 2-3



Modeling clay | $1.25/200 g*



Glass gems | $1.25/bag*

THE CHALLENGE

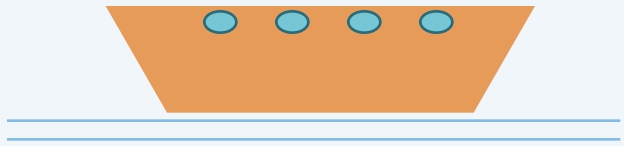
Make a clay hull that floats and carries glass-gem cargo.

BUY ONE PACK OF EACH: $2.50

50 g clay + 10 gems; gem count per bag varies.
Clay share: ~$0.31; gems reusable.

*Planning estimate where the item price is not clearly shown. Before tax; shared supplies below are extra. Confirm package size and price locally.

SAMPLE DESIGN



Wide clay hull + evenly spaced cargo

1. Shape 50 g of clay into a ball. Place it gently in a water tub and observe.

2. Use the same clay to make a wide, hollow bowl with a flat base and high sides.

3. Float the hull. Add gems one at a time, evenly spaced, until water enters or it sinks.

4. Record cargo count. Reshape the same clay and test again with the same gems.

STEM: Buoyancy, displacement, load distribution

TRY + COMPARE: Change hull width while keeping clay mass constant. Can you increase the cargo count?

ALSO NEEDED / FACILITATOR NOTES: Water tub, towel, scale if available. Use equal portions if no scale. Glass gems are small parts; inspect for chips.

Ramp Test Engineers

Grades 2-8 | 25-35 min | Pairs | Teams of 2-3



Toy cars | $1.25/3 cars*



Rulers | $1.25/18 rulers*

THE CHALLENGE

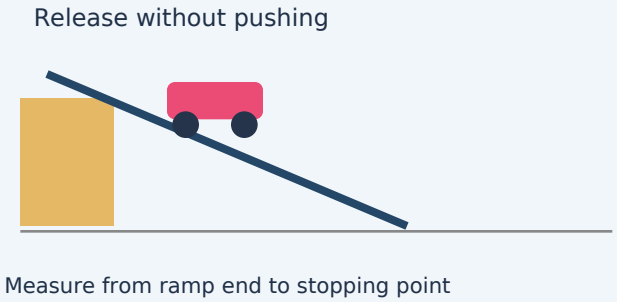
Find out how ramp height affects the distance a toy car rolls.

BUY ONE PACK OF EACH: $2.50

1 car + 1 ruler per team. Allocated reusable materials: ~$0.49/team.

*Planning estimate where the item price is not clearly shown. Before tax; shared supplies below are extra. Confirm package size and price locally.

SAMPLE DESIGN



1. Tape a cardboard ramp to a low stack of books; keep the ramp straight.

2. Release one car from the same marked starting line without pushing it.

3. Measure from the ramp end to the car's stopping point. Run three trials.

4. Raise the ramp support, keeping the ramp and floor surface the same. Repeat and compare average distances.

STEM: Gravity, energy, friction, averages

TRY + COMPARE: Test two support heights, such as 5 cm and 10 cm. Report all trials, not just the longest.

ALSO NEEDED / FACILITATOR NOTES: Scrap cardboard, books, tape, pencil. Ruler measures support height; use a tape measure for long runs. Keep a clear floor lane.

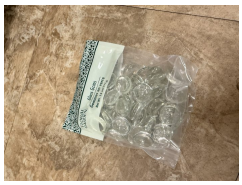
Illustrated samples show a possible setup, not tested results. Product photos: Kimberly Bell. Small parts require supervision.

Card Bridge Cargo Test

Grades 3-8 | 25-35 min | Pairs | Teams of 2-3



Playing cards | $1.25/deck*



Glass gems | $1.25/bag*

THE CHALLENGE

Build a bridge across a 10 cm gap and test its cargo capacity.

BUY ONE PACK OF EACH: $2.50

12 playing cards + 10 gems per team. Materials reusable; cost per team depends on gems per bag.

*Planning estimate where the item price is not clearly shown. Before tax; shared supplies below are extra. Confirm package size and price locally.

SAMPLE DESIGN



Folded card beams across a 10 cm gap

1. Set two book stacks 10 cm apart. Make a deck with 12 cards: overlap pairs across the gap.

2. Add gems one at a time near the center; stop when the deck collapses. Record the count.

3. Try folding cards lengthwise into beams. Rebuild with the same card count and gap.

4. Retest using the same gems. Compare designs and describe where each failed.

STEM: Bending, load, beams, fair tests

TRY + COMPARE: Use a new or reusable deck you can fold. Does a folded beam support more cargo?

ALSO NEEDED / FACILITATOR NOTES: Two book stacks, ruler, shallow tray to catch falling gems. No tape; keep the bridge low. Inspect glass for damage.

Static Paper Pickup

Grades 3-8 | 20-30 min | Pairs | Teams of 2-3



20 balloons | $1.25/pack (photo)



Playing cards | $1.25/deck*

THE CHALLENGE

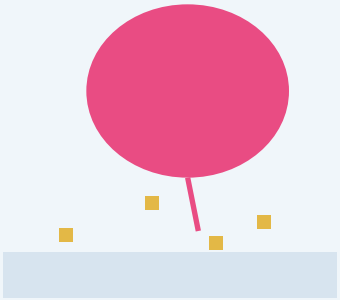
Use a charged balloon to lift tiny paper pieces without touching them.

BUY ONE PACK OF EACH: $2.50

1 balloon + 1 playing card as a sorting mat. Balloon share: ~$0.06; deck reusable.

*Planning estimate where the item price is not clearly shown. Before tax; shared supplies below are extra. Confirm package size and price locally.

SAMPLE DESIGN



Charged balloon attracts tissue scraps

1. Tear tissue paper into about 20 tiny pieces. Place them on a playing-card mat.

2. Hold an inflated, uncharged balloon above the pieces. Observe from the same height.

3. Rub the balloon on a dry wool cloth, then approach the paper slowly without touching it.

4. Count lifted pieces. Try three trials, rubbing for the same time and keeping paper size similar.

STEM: Static electricity, attraction, controlled variables

TRY + COMPARE: Compare 5 seconds and 15 seconds of rubbing. Results can vary with humidity.

ALSO NEEDED / FACILITATOR NOTES: Tissue scraps, dry wool cloth, balloon pump, timer. Adult inflates; check latex allergies. Keep uninflated balloons and fragments away from children under 8.

Balance Beam Designers

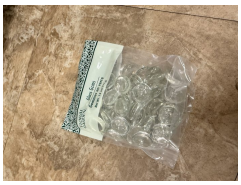
Grades 3-8 | 30 min | Pairs | Teams of 2-3



Rulers | $1.25/18 rulers*



Modeling clay | $1.25/200 g*



Glass gems | $1.25/bag*

THE CHALLENGE

Balance an uneven load by changing its distance from the pivot.

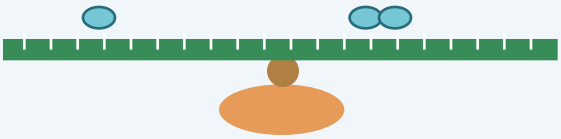
BUY ONE PACK OF EACH: $3.75

1 ruler + ~25 g clay + 6 gems per team. Clay + ruler share: ~$0.23; gems reusable.

*Planning estimate where the item price is not clearly shown. Before tax; shared supplies below are extra. Confirm package size and price locally.

SAMPLE DESIGN

1 gem farther out / 2 gems nearer pivot



Adjust positions until level

1. Make a firm clay mound and set a rounded pencil across it as a pivot.

2. Center a ruler across the pencil. Slide it slightly until the empty ruler balances. Mark that pivot location.

3. Place one gem on one side and two on the other. Move the gems until the beam balances.

4. Measure each load's distance from the pivot. Repeat with a new arrangement.

STEM: Levers, torque, balance, measurement

TRY + COMPARE: Use gems of similar size. Do two gems need to be closer to the pivot than one gem?

ALSO NEEDED / FACILITATOR NOTES: Rounded pencil, tape to secure pencil, tray. Plastic rulers can bend; keep loads small and the pivot low.

Swab-and-Clay Frameworks

Grades 3-8 | 30-40 min | Pairs | Teams of 2-3



300 cotton swabs | $1.25/pack*



Modeling clay | $1.25/200 g*

THE CHALLENGE

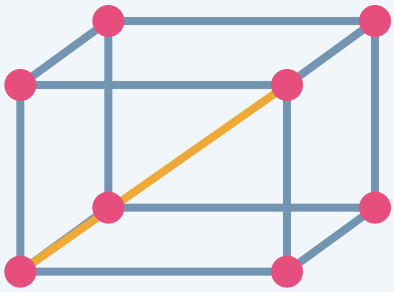
Build a cube frame, then investigate how diagonal braces affect its shape.

BUY ONE PACK OF EACH: $2.50

24 swabs + 50 g clay per team. Approximate allocated material cost: $0.41/team.

*Planning estimate where the item price is not clearly shown. Before tax; shared supplies below are extra. Confirm package size and price locally.

SAMPLE DESIGN



Clay corners + swab edges + diagonal brace

1. Roll clay into 8 equal corner joints. Connect 12 swabs to make a cube frame.

2. Gently press sideways at the top and observe how the square faces change shape.

3. Use extra swabs as diagonals on two faces. Overlap swabs and join with clay if a single swab is too short.

4. Press in the same way again. Sketch both frames and compare how much they lean.

STEM: Geometry, triangles, bracing, structural design

TRY + COMPARE: Keep corner joints small and firm. Is a triangular face harder to change than a square face?

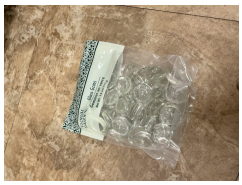
ALSO NEEDED / FACILITATOR NOTES: Tray, pencil. Keep swab shafts intact; this is a model, not a weight-bearing structure. Clay is not food.

Clay Cargo Boats

Grades 3-8 | 30-40 min | Pairs | Teams of 2-3



Modeling clay | $1.25/200 g*



Glass gems | $1.25/bag*

THE CHALLENGE

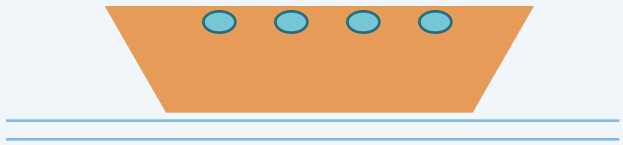
Make a clay hull that floats and carries glass-gem cargo.

BUY ONE PACK OF EACH: $2.50

50 g clay + 10 gems; gem count per bag varies.
Clay share: ~$0.31; gems reusable.

*Planning estimate where the item price is not clearly shown. Before tax; shared supplies below are extra. Confirm package size and price locally.

SAMPLE DESIGN



Wide clay hull + evenly spaced cargo

1. Shape 50 g of clay into a ball. Place it gently in a water tub and observe.

2. Use the same clay to make a wide, hollow bowl with a flat base and high sides.

3. Float the hull. Add gems one at a time, evenly spaced, until water enters or it sinks.

4. Record cargo count. Reshape the same clay and test again with the same gems.

STEM: Buoyancy, displacement, load distribution

TRY + COMPARE: Change hull width while keeping clay mass constant. Can you increase the cargo count?

ALSO NEEDED / FACILITATOR NOTES: Water tub, towel, scale if available. Use equal portions if no scale. Glass gems are small parts; inspect for chips.

Ramp Test Engineers

Grades 2-8 | 25-35 min | Pairs | Teams of 2-3



Toy cars | $1.25/3 cars*



Rulers | $1.25/18 rulers*

THE CHALLENGE

Find out how ramp height affects the distance a toy car rolls.

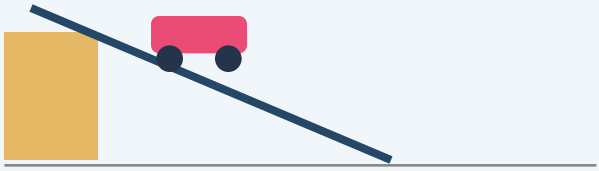
BUY ONE PACK OF EACH: $2.50

1 car + 1 ruler per team. Allocated reusable materials: ~$0.49/team.

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SAMPLE DESIGN

Release without pushing



Measure from ramp end to stopping point

1. Tape a cardboard ramp to a low stack of books; keep the ramp straight.

2. Release one car from the same marked starting line without pushing it.

3. Measure from the ramp end to the car's stopping point. Run three trials.

4. Raise the ramp support, keeping the ramp and floor surface the same. Repeat and compare average distances.

STEM: Gravity, energy, friction, averages

TRY + COMPARE: Test two support heights, such as 5 cm and 10 cm. Report all trials, not just the longest.

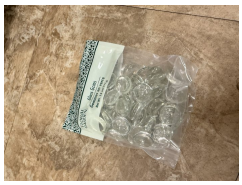
ALSO NEEDED / FACILITATOR NOTES: Scrap cardboard, books, tape, pencil. Ruler measures support height; use a tape measure for long runs. Keep a clear floor lane.

Card Bridge Cargo Test

Grades 3-8 | 25-35 min | Pairs | Teams of 2-3



Playing cards | $1.25/deck*



Glass gems | $1.25/bag*

THE CHALLENGE

Build a bridge across a 10 cm gap and test its cargo capacity.

BUY ONE PACK OF EACH: $2.50

12 playing cards + 10 gems per team. Materials reusable; cost per team depends on gems per bag.

*Planning estimate where the item price is not clearly shown. Before tax; shared supplies below are extra. Confirm package size and price locally.

SAMPLE DESIGN



Folded card beams across a 10 cm gap

1. Set two book stacks 10 cm apart. Make a deck with 12 cards: overlap pairs across the gap.

2. Add gems one at a time near the center; stop when the deck collapses. Record the count.

3. Try folding cards lengthwise into beams. Rebuild with the same card count and gap.

4. Retest using the same gems. Compare designs and describe where each failed.

STEM: Bending, load, beams, fair tests

TRY + COMPARE: Use a new or reusable deck you can fold. Does a folded beam support more cargo?

ALSO NEEDED / FACILITATOR NOTES: Two book stacks, ruler, shallow tray to catch falling gems. No tape; keep the bridge low. Inspect glass for damage.

Static Paper Pickup

Grades 3-8 | 20-30 min | Pairs | Teams of 2-3



20 balloons | $1.25/pack (photo)



Playing cards | $1.25/deck*

THE CHALLENGE

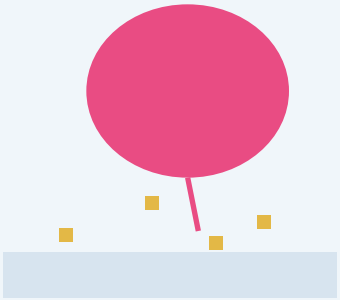
Use a charged balloon to lift tiny paper pieces without touching them.

BUY ONE PACK OF EACH: $2.50

1 balloon + 1 playing card as a sorting mat. Balloon share: ~$0.06; deck reusable.

*Planning estimate where the item price is not clearly shown. Before tax; shared supplies below are extra. Confirm package size and price locally.

SAMPLE DESIGN



Charged balloon attracts tissue scraps

1. Tear tissue paper into about 20 tiny pieces. Place them on a playing-card mat.

2. Hold an inflated, uncharged balloon above the pieces. Observe from the same height.

3. Rub the balloon on a dry wool cloth, then approach the paper slowly without touching it.

4. Count lifted pieces. Try three trials, rubbing for the same time and keeping paper size similar.

STEM: Static electricity, attraction, controlled variables

TRY + COMPARE: Compare 5 seconds and 15 seconds of rubbing. Results can vary with humidity.

ALSO NEEDED / FACILITATOR NOTES: Tissue scraps, dry wool cloth, balloon pump, timer. Adult inflates; check latex allergies. Keep uninflated balloons and fragments away from children under 8.

Balance Beam Designers

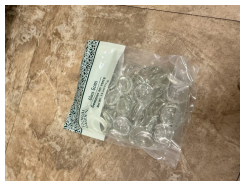
Grades 3-8 | 30 min | Pairs | Teams of 2-3



Rulers | $1.25/18 rulers*



Modeling clay | $1.25/200 g*



Glass gems | $1.25/bag*

THE CHALLENGE

Balance an uneven load by changing its distance from the pivot.

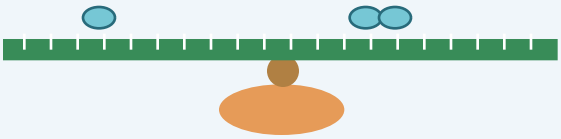
BUY ONE PACK OF EACH: $3.75

1 ruler + ~25 g clay + 6 gems per team. Clay + ruler share: ~$0.23; gems reusable.

*Planning estimate where the item price is not clearly shown. Before tax; shared supplies below are extra. Confirm package size and price locally.

SAMPLE DESIGN

1 gem farther out / 2 gems nearer pivot



Adjust positions until level

1. Make a firm clay mound and set a rounded pencil across it as a pivot.

2. Center a ruler across the pencil. Slide it slightly until the empty ruler balances. Mark that pivot location.

3. Place one gem on one side and two on the other. Move the gems until the beam balances.

4. Measure each load's distance from the pivot. Repeat with a new arrangement.

STEM: Levers, torque, balance, measurement

TRY + COMPARE: Use gems of similar size. Do two gems need to be closer to the pivot than one gem?

ALSO NEEDED / FACILITATOR NOTES: Rounded pencil, tape to secure pencil, tray. Plastic rulers can bend; keep loads small and the pivot low.

Swab-and-Clay Frameworks

Grades 3-8 | 30-40 min | Pairs | Teams of 2-3



300 cotton swabs | $1.25/pack*



Modeling clay | $1.25/200 g*

THE CHALLENGE

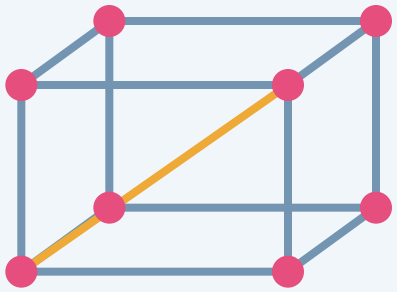
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BUY ONE PACK OF EACH: $2.50

24 swabs + 50 g clay per team. Approximate allocated material cost: $0.41/team.

*Planning estimate where the item price is not clearly shown. Before tax; shared supplies below are extra. Confirm package size and price locally.

SAMPLE DESIGN



Clay corners + swab edges + diagonal brace

1. Roll clay into 8 equal corner joints. Connect 12 swabs to make a cube frame.

2. Gently press sideways at the top and observe how the square faces change shape.

3. Use extra swabs as diagonals on two faces. Overlap swabs and join with clay if a single swab is too short.

4. Press in the same way again. Sketch both frames and compare how much they lean.

STEM: Geometry, triangles, bracing, structural design

TRY + COMPARE: Keep corner joints small and firm. Is a triangular face harder to change than a square face?

ALSO NEEDED / FACILITATOR NOTES: Tray, pencil. Keep swab shafts intact; this is a model, not a weight-bearing structure. Clay is not food.

Index-Card Cargo Bridge

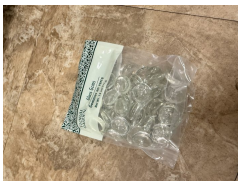
Grades 3-8 | 30-40 min | Pairs | Teams of 2-3



225 index cards | $1.25/pack (photo)



12 binder clips | $1.25/pack (photo)



Glass gems | $1.25/bag*

THE CHALLENGE

Engineer an index-card bridge that carries glass-gem cargo across a 10 cm gap.

BUY ONE PACK OF EACH: $3.75

12 index cards + 4 binder clips + 10 gems. Cards + clips: ~$0.48/team; gems reusable.

*Planning estimate where the item price is not clearly shown. Before tax; shared supplies below are extra. Confirm package size and price locally.

SAMPLE DESIGN



Folded card beams across a 10 cm gap

1. Set two book stacks 10 cm apart. Use 12 cards and up to four clips to connect overlapping cards.

2. Start with a flat deck. Add gems one at a time at the center and record the supported count.

3. Fold cards into beams or accordion sections. Keep the same card count, clips, and gap.

4. Retest with the same gems. Draw both designs and compare the cargo counts.

STEM: Beam shapes, load, compression, engineering design

TRY + COMPARE: Which card shape holds more cargo? Repeat each test three times.

ALSO NEEDED / FACILITATOR NOTES: Books, ruler, catch tray. Do not count clips as cargo. Glass gems are small parts; inspect for chips.

Toy-Car Cardboard Garage

Grades 3-8 | 30-40 min | Pairs | Teams of 2-3



225 index cards | $1.25/pack (photo)



40 clothespins | $1.25/pack*



Toy cars | $1.25/3 cars*

THE CHALLENGE

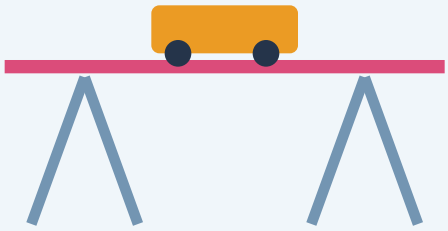
Make an elevated garage deck that holds one toy car for 10 seconds.

BUY ONE PACK OF EACH: $3.75

15 cards + 6 clothespins + 1 car. Approximate allocated materials: $0.69/team.

*Planning estimate where the item price is not clearly shown. Before tax; shared supplies below are extra. Confirm package size and price locally.

SAMPLE DESIGN



Folded card supports + deck + toy car

1. Fold cards into columns or triangular supports. Use clothespins as connectors.

2. Overlap remaining cards to form a deck wide enough for the car. Keep the deck at least 5 cm above the table.

3. Place the car gently on the deck. Time how long the structure holds it, up to 10 seconds.

4. Rebuild with a wider base or folded beams and retest using the same car.

STEM: Structures, stability, load paths, measurement

TRY + COMPARE: Use the same material limits. Which support shape prevents the deck from bending?

ALSO NEEDED / FACILITATOR NOTES: Ruler, timer, tabletop. Place the car by hand; do not roll it off the structure.

Clay-Joint Swab Bridge

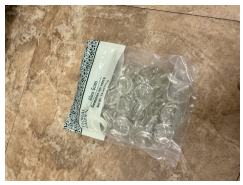
Grades 4-8 | 35-45 min | Pairs | Teams of 2-3



300 cotton swabs | $1.25/pack*



Modeling clay | $1.25/200 g*



Glass gems | $1.25/bag*

THE CHALLENGE

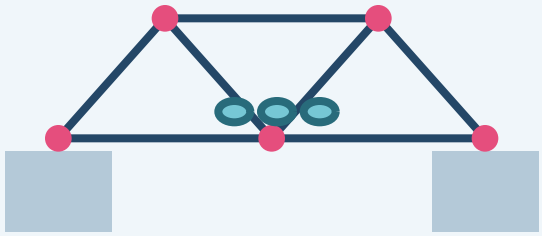
Build a short truss bridge using swabs and clay joints, then test its cargo load.

BUY ONE PACK OF EACH: $3.75

24 swabs + 50 g clay + 6 gems. Clay + swabs: ~$0.41/team; gems reusable.

*Planning estimate where the item price is not clearly shown. Before tax; shared supplies below are extra. Confirm package size and price locally.

SAMPLE DESIGN



Triangular side frame + clay joints

1. Set two low book supports 8 cm apart. Roll clay into small connector joints.

2. Build two side frames with triangular sections. Connect them with crosspieces. Use intact swabs.

3. Place a scrap-card deck across the crosspieces. Add one gem at a time near the center.

4. Record the load before the frame deforms. Strengthen one joint or add a brace and retest.

STEM: Trusses, joints, tension and compression, iteration

TRY + COMPARE: Clay joints can slip. Compare joint size while keeping the swab count and gap constant.

ALSO NEEDED / FACILITATOR NOTES: Two low supports, scrap-card deck, ruler, tray. This is a model; use only small loads.

Clothespin Balance Lab

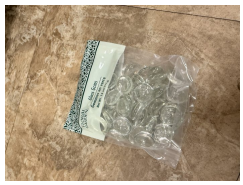
Grades 3-8 | 25-35 min | Pairs | Teams of 2-3



40 clothespins | $1.25/pack*



Rulers | $1.25/18 rulers*



Glass gems | $1.25/bag*

THE CHALLENGE

Balance one glass gem against two by adjusting their distances from the pivot.

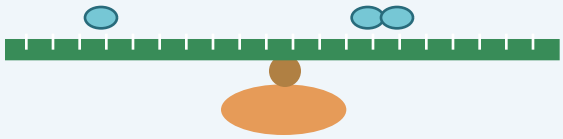
BUY ONE PACK OF EACH: $3.75

2 clothespins + 1 ruler + 6 gems. Pins + ruler: ~$0.13/team; gems reusable.

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SAMPLE DESIGN

1 gem farther out / 2 gems nearer pivot



Adjust positions until level

1. Secure a rounded pencil on a firm clay mound or a folded cardboard support. Balance the empty ruler across it.

2. Clip one clothespin at each end of the ruler; adjust the ruler until this empty setup balances. Mark the pivot.

3. Place one gem on one side and two on the other. Slide the gems inward or outward until level.

4. Measure each load distance from the pivot. Record three balanced arrangements.

STEM: Levers, torque, distance, balance

TRY + COMPARE: The clips stay fixed during each comparison. Use gems of similar size and keep the pivot low.

ALSO NEEDED / FACILITATOR NOTES: Rounded pencil, tape, small clay mound or scrap-card support, tray. Support material is from existing supplies and excluded from the purchase total.

Float the Freight

Grades 2-8 | 30-40 minutes | Teams of 2-3



AI-generated staged example; illustrates setup, not a tested result.



Cooking Concepts foil

Kitchen | $1.75 / 25 sq ft

Activity materials: $0.14
Buy full packages: $1.75

Two 12 x 12-inch foil sheets: 2 sq ft x $0.07 = $0.14. Pennies are reusable test weights.

CHALLENGE: Build a foil boat that carries the most pennies before taking on water.

1. Give each team two equal foil squares. Fold the first into a watertight hull with raised sides.

2. Float it in a shallow tub. Add pennies one at a time, spread across the floor. Stop when water enters or the hull sinks.

3. Record the penny count. Use the second square for a revised hull; change the base width or side height.

4. Test with the same pennies and water depth. Compare capacity and explain the design change.

WHY IT WORKS: Buoyancy and displacement: a hull must displace enough water to support its total weight.

RECORD + REFLECT: Sketch each hull; record length, width, and supported penny count. Which tradeoff helped?

SHARED TOOLS / FACILITATOR NOTES: Water tub, ruler, towel, reusable pennies. Keep small parts supervised and wipe spills. Staged example does not predict capacity.

Costs exclude tax, delivery, shared tools, and reusable test weights. Prices/availability vary; online listings checked Nov. 2, 2026. Product photo credits and clickable shopping links: page 7.

Hidden-Color Art Lab

Grades 3-8 | 30-40 minutes | Teams of 2-3



AI-generated staged example; illustrates setup, not a tested result.



Fresh Cup coffee filters

Kitchen | $1.25 / 100 filters



Playskool washable markers

School | $1.25 / 8 markers

Activity materials: $0.09 est.
Buy full packages: $2.50

Three filters: $0.0375, plus $0.05 estimated shared marker-ink allowance = ~$0.09. Marker ink use is not measured.

CHALLENGE: Investigate whether a marker color contains more than one dye, then turn the dried paper into art.

1. Cut three filter strips. Draw a pencil baseline 2 cm from the bottom and make a small washable-marker dot on it. Use a different dark color on each strip.

2. Hang each strip from a pencil across a glass. Put only the bottom edge in water; keep the ink dot above water.

3. Watch the water rise for 10-15 minutes. Remove before it reaches the top. Record any separated colors.

4. Dry strips and arrange them into a color collage. Explain how the scientific result shaped the artwork.

WHY IT WORKS: Capillary action moves water through paper; dyes may separate because they interact differently with water and paper.

RECORD + REFLECT: Compare colors using equal strip sizes, dot sizes, and water depth. Some inks may separate poorly; record that too.

SHARED TOOLS / FACILITATOR NOTES: Three clear cups/glasses, water, pencils, scissors, scrap paper, tape. Adult support for cutting; keep marker caps out of mouths.

Costs exclude tax, delivery, shared tools, and reusable test weights. Prices/availability vary; online listings checked Nov. 2, 2026. Product photo credits and clickable shopping links: page 7.

Sponge Rescue Engineers

Grades 2-8 | 25-35 minutes | Teams of 2-3



AI-generated staged example; illustrates setup, not a tested result.



Scotch-Brite sponges

Cleaning | $1.50 / 2 sponges

Activity materials: $0.75
Buy full packages: $1.50

One sponge: $1.50 / 2 = $0.75. Reusable if cleaned and dried; replace if damaged.

CHALLENGE: Design a repeatable method for transferring the most water in one sponge trip.

1. Weigh a dry sponge. Set a tray of water and an empty measuring cup side by side.

2. Soak the sponge for 10 seconds, lift for 5 seconds, then weigh it on a tared dry dish. Subtract dry mass to estimate absorbed water mass.

3. Squeeze the water into the cup. Record recovered volume. Repeat three times using the same soak and drip times.

4. Compare one-hand and two-hand squeezing. Discuss how technique affects recovery and reliability.

WHY IT WORKS: Absorption, pore spaces, mass, volume, repeatability. One gram of room-temperature water is approximately one milliliter.

RECORD + REFLECT: Record dry mass, wet mass, and recovered milliliters. Why might absorbed and recovered amounts differ?

SHARED TOOLS / FACILITATOR NOTES: Kitchen scale, dry weighing dish, tray, measuring cup, timer, water, towel. Use a new cleaning sponge; do not use it for food afterward.

Costs exclude tax, delivery, shared tools, and reusable test weights. Prices/availability vary; online listings checked Nov. 2, 2026. Product photo credits and clickable shopping links: page 7.

Pocket Truss Bridge

Grades 4-8 | 40 min + drying | Teams of 2-3



AI-generated staged example; illustrates setup, not a tested result.



Jumbo natural craft sticks

Crafts | $1.25 / 60 sticks



Elmer's school glue

School | $1.25 / 4 fl oz

Activity materials: $0.30 est.
Buy full packages: $2.50

12 sticks: $0.25; 5 mL glue: ~$0.05 from a 118 mL bottle. Total ~$0.30. Glue amount is an allowance.

CHALLENGE: Create a small bridge with triangular sides that holds a penny load across an 8 cm gap.

1. Lay out two triangular side frames using three sticks each. Glue overlapping ends flat on a protected surface.

2. Use two crosspieces to connect the frames. Add four overlapping deck sticks across the crosspieces. Use up to 12 sticks total.

3. Allow glue to dry fully according to its label before testing. Rest the bridge on two low book stacks with an 8 cm clear gap.

4. Add pennies at the center one at a time. Record the supported count, note failed joints, and propose a revision.

WHY IT WORKS: Triangles resist shape change; truss members and joints share the load. Joint quality can control failure.

RECORD + REFLECT: Draw the load path. Was failure caused by a bending stick, a slipping support, or a glue joint?

SHARED TOOLS / FACILITATOR NOTES: Low book stacks, ruler, pennies, tray, surface protector. Teacher checks dried joints before testing. Small loads only; never use body weight.

Costs exclude tax, delivery, shared tools, and reusable test weights. Prices/availability vary; online listings checked Nov. 2, 2026. Product photo credits and clickable shopping links: page 7.

Foil Sculpture Stability Studio

Grades 2-8 | 30-40 minutes | Teams of 2-3



AI-generated staged example; illustrates setup, not a tested result.



Cooking Concepts foil

Kitchen | $1.75 / 25 sq ft

Activity materials: $0.21
Buy full packages: $1.75

Three 12 x 12-inch foil sheets: 3 sq ft x $0.07 = $0.21. Equal material budget for all three designs.

CHALLENGE: Create an expressive freestanding sculpture, then improve its resistance to tipping.

1. Use one foil square to shape a roughly 15 cm-tall sculpture with a narrow base. Give it a branching or abstract form.

2. Make two more sculptures with equal foil areas and similar heights; try medium and wide bases.

3. Stand each on a stiff tray. Slowly raise one tray edge and measure the edge height when the sculpture tips. Repeat three times.

4. Use the evidence to redesign your favorite sculpture while preserving its artistic theme.

WHY IT WORKS: Center of mass, support area, stability, sculpture, constrained design. Base width is one factor; mass distribution also matters.

RECORD + REFLECT: Record height, base width, and tray-edge lift at tipping. Discuss any differences beyond base size.

SHARED TOOLS / FACILITATOR NOTES: Ruler, stiff tray or board, books, pencil. Keep sculptures away from outlets. Do not use foil edges as cutting tools.

Costs exclude tax, delivery, shared tools, and reusable test weights. Prices/availability vary; online listings checked Nov. 2, 2026. Product photo credits and clickable shopping links: page 7.

Sponge-Pontoon Rafts

Grades 3-8 | 40 min + drying | Teams of 2-3



AI-generated staged example; illustrates setup, not a tested result.



Jumbo natural craft sticks

Crafts | $1.25 / 60 sticks



Scotch-Brite sponges

Cleaning | $1.50 / 2 sponges



Elmer's school glue

School | $1.25 / 4 fl oz

Activity materials: $0.97 est.
Buy full packages: $4.00

8 sticks: $0.17; 1 sponge: $0.75; 5 mL glue: ~$0.05. Total ~$0.97. Teacher cuts sponge into two pontoons.

CHALLENGE: Build a floating platform that supports cargo without tilting to one side.

1. Teacher cuts one new sponge into two equal rectangular pontoons. Arrange six sticks side by side with two cross sticks underneath.

2. Glue cross sticks to the deck, then attach one sponge pontoon under each side. Let glue dry fully according to label.

3. Float briefly in a shallow tub. Add pennies in a balanced pattern and record the load before the deck becomes awash or tips.

4. Move cargo off-center and observe the change. Redesign pontoon spacing for a second test.

WHY IT WORKS: Buoyancy, stability, load distribution, water absorption. Wet sponges can change performance over time.

RECORD + REFLECT: Compare centered and off-center cargo. Use the same soak duration for fair tests; school glue may soften in water.

SHARED TOOLS / FACILITATOR NOTES: Water tub, pennies, scissors, towel, timer. Adult cuts sponge. Test briefly; inspect joints between trials and dry raft afterward. Pilot the build before class.

Costs exclude tax, delivery, shared tools, and reusable test weights. Prices/availability vary; online listings checked Nov. 2, 2026. Product photo credits and clickable shopping links: page 7.

SHOPPING + COST NOTES

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Cooking Concepts foil
Kitchen | $1.75 / 25 sq ft
Open Dollar Tree product listing



Fresh Cup coffee filters
Kitchen | $1.25 / 100 filters
Open Dollar Tree product listing



Playskool washable markers
School | $1.25 / 8 markers
Open Dollar Tree product listing



Scotch-Brite sponges
Cleaning | $1.50 / 2 sponges
Open Dollar Tree product listing



Jumbo natural craft sticks
Crafts | $1.25 / 60 sticks
Open Dollar Tree product listing



Elmer's school glue
School | $1.25 / 4 fl oz
Open Dollar Tree product listing

HOW TO READ THE BUDGET

Activity cost allocates only the materials issued to one team or one build. Full-package cost is the checkout cost for one package of every featured product on that sheet. Shared tools and pennies are assumed already available. Marker ink and glue quantities are explicitly estimated allowances. A full basket of all six featured products is $8.25 before tax and fees; the number of lessons it supports depends on team counts and material use.

All activity photos are AI-generated staged illustrations created for this guide, not photographs of tested builds. Prompts requested realistic classroom setups: foil cargo boat, paper chromatography, sponge absorption, glued craft-stick truss, foil stability sculptures, and sponge-pontoon raft. Pilot builds before instruction. Product photography belongs to the respective retailer/brands.

Shape-Shifting Sculptures

Grades 2-8 | 30-40 minutes | Teams of 2-3



AI-generated staged example; illustrates setup, not a tested result.



Crafter's Square chenille stems

Crafts | $1.25 / 45 stems

Activity materials: $0.33
Buy full packages: $1.25

12 stems x ($1.25 / 45) = ~$0.33 per team. Stems may be reshaped for reuse.

CHALLENGE: Create a freestanding 3D geometric sculpture and make it resist a gentle sideways push.

1. Start with a cube frame using 12 stems as edges. Twist ends together at eight corners; fold exposed wire tips inward.

2. Count the vertices, edges, and faces. Gently push one top corner and describe how the square faces deform.

3. Untwist and rebuild into a square pyramid using eight stems; use the remaining four as braces or decorations.

4. Compare stability on the same tray. Add a color pattern that emphasizes the geometric structure.

WHY IT WORKS: Geometry, bracing, flexible joints, sculpture. Triangles can resist shape change better than unbraced squares, but wire flexibility also matters.

RECORD + REFLECT: Sketch both models and record edge counts and height. What change helped the sculpture stay upright?

SHARED TOOLS / FACILITATOR NOTES: Tray, ruler, paper, pencil. Adult checks wire tips. Use gentle pushes; these flexible models are not load-bearing.

Costs exclude tax, delivery, shared tools, and reusable test weights. Prices/availability vary; online listings checked Nov. 2, 2026. Product photo credits and clickable shopping links: page 6.

Design a Straw Maze

Grades 2-8 | 30-40 minutes | Teams of 2-3



AI-generated staged example; illustrates setup, not a tested result.



Home Store flexible straws

Kitchen | $1.50 / 150 straws

Activity materials: $0.15 est.
Buy full packages: $1.50

10 straws x $0.01 = $0.10, plus $0.05 shared tape allowance. Recycled box lid and reusable marble assumed available.

CHALLENGE: Build a tilting maze with a continuous route and at least two dead ends.

1. Sketch a maze inside a recycled box lid. Make every corridor wider than the marble, including turns.

2. Cut up to 10 straws into wall segments and tape them flat to the lid. Use straight portions; trim away flexible elbows if needed.

3. Tilt the box gently to guide the marble from start to finish. Have a partner test the route without help.

4. Record completion time and where the marble gets stuck. Revise one section and repeat three trials.

WHY IT WORKS: Engineering design, gravity, motion, spatial reasoning, sequencing. Maze layout creates constraints and choices.

RECORD + REFLECT: Draw the successful route as arrows. How did wall placement affect the time and control needed?

SHARED TOOLS / FACILITATOR NOTES: Recycled cardboard lid, tape, scissors, marble, timer, ruler. Small marble requires supervision; use a larger ball and wider corridors for younger groups.

Costs exclude tax, delivery, shared tools, and reusable test weights. Prices/availability vary; online listings checked Nov. 2, 2026. Product photo credits and clickable shopping links: page 6.

Balloon Rocket Run

Grades 3-8 | 25-35 minutes | Teams of 2-3



AI-generated staged example; illustrates setup, not a tested result.



Assorted latex balloons

Party | $1.25 / 20 balloons



Home Store flexible straws

Kitchen | $1.50 / 150 straws

Activity materials: $0.15 est.
Buy full packages: $2.75

1 balloon $0.0625 + 1 straw $0.01 + tape $0.03 + string $0.05 allowances = ~$0.15. String can be reused.

CHALLENGE: Investigate how the amount of air changes a balloon rocket's travel distance.

1. Thread a 5 cm straight straw segment onto a 2-3 m smooth string. Secure string taut between two stable supports at equal height.

2. Adult inflates the balloon with a pump. Pinch the neck closed; tape the balloon below the straw with its nozzle pointing backward.

3. Release from the same starting position without pushing. Measure travel distance. Repeat three times.

4. Compare two measured balloon circumferences. Keep string slope, balloon, and straw the same and record all trials.

WHY IT WORKS: Action and reaction: air expelled backward exerts a forward force on the balloon. Friction and string slope affect travel.

RECORD + REFLECT: Use a flexible tape to measure balloon circumference before release. Does more air always produce longer travel?

SHARED TOOLS / FACILITATOR NOTES: Pump, smooth string, tape, two stable supports, measuring tape, clothespin. Check latex allergies. Adult handles inflation; keep uninflated balloons and fragments away from children under 8. Keep string out of walkways.

Costs exclude tax, delivery, shared tools, and reusable test weights. Prices/availability vary; online listings checked Nov. 2, 2026. Product photo credits and clickable shopping links: page 6.

Window Water-Cycle Lab

Grades 2-8 | 20 min + 1-3 days | Teams of 2-3



AI-generated staged example; illustrates setup, not a tested result.



Surefresh sandwich slider bags

Kitchen | $1.50 / 20 bags

Activity materials: $0.22 est.
Buy full packages: $1.50

2 bags x $0.075 = $0.15 + tape $0.05 + marker-ink $0.02 allowances = ~$0.22. Water is a shared supply.

CHALLENGE: Observe evaporation and condensation in a sealed bag, then compare two locations.

1. Draw a sun, cloud, and water line on the outside of two bags with a permanent marker. Label locations on removable tape.

2. Add 30 mL room-temperature water to each. Close fully and check for leaks.

3. Tape one upright to a bright warm window and one to a cooler shaded window or clear vertical surface. Keep water pools at the bottom.

4. Observe at the same times for 1-3 days. Record droplets above the water line and any drops running back down.

WHY IT WORKS: Liquid water can evaporate into invisible vapor and condense on a cooler surface. This is a simplified water-cycle model, not cloud formation at full atmospheric scale.

RECORD + REFLECT: Compare droplet coverage using sketches or photos. Locations differ in more than light, so report temperature differences if measurable.

SHARED TOOLS / FACILITATOR NOTES: Water, measuring spoon/cup, tape, permanent marker, optional thermometer. Adult handles marker. Secure bags against leaks; avoid hot windows or direct contact with heaters. Condensation depends on conditions.

Costs exclude tax, delivery, shared tools, and reusable test weights. Prices/availability vary; online listings checked Nov. 2, 2026. Product photo credits and clickable shopping links: page 6.

Marshmallow Skyline

Grades 3-8 | 30-40 minutes | Teams of 2-3



AI-generated staged example; illustrates setup, not a tested result.



Home Store flexible straws

Kitchen | $1.50 / 150 straws



Jet-Puffed mini marshmallows

Grocery | $1.50 / 7 oz (198 g)

Activity materials: $0.35 est.
Buy full packages: $3.00

20 straws x $0.01 = $0.20 + 20 g marshmallows x ($1.50 / 198 g) = ~$0.15. Total ~$0.35 per team.

CHALLENGE: Build a freestanding tower at least 20 cm tall using flexible straws and marshmallow joints.

1. Issue each team 20 straws and 20 g mini marshmallows. Cut straws into short straight segments; keep the same total material limit.

2. Push straw ends gently into marshmallows to make joints. Build a broad base, then add upright members and crosspieces.

3. Add diagonal braces where square faces lean. Measure height after the tower stands on its own for 10 seconds.

4. Compare a narrow and wide base using the same supplies. Record height, base width, and where joints bend or slip.

WHY IT WORKS: Structures, bracing, center of mass, material properties. Soft marshmallow joints can creep and straws may buckle.

RECORD + REFLECT: How did the base and bracing affect stability? Sketch a city skyline and explain one engineering choice.

SHARED TOOLS / FACILITATOR NOTES: Scissors, ruler, tray, scale or teacher-preportioned marshmallows. Check food sensitivities; materials are for building, not eating. Mini marshmallows may need replacing after repeated assembly.

Costs exclude tax, delivery, shared tools, and reusable test weights. Prices/availability vary; online listings checked Nov. 2, 2026. Product photo credits and clickable shopping links: page 6.

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