Group 1 workshop pack

Cut out the four treatment-combination cards. Keep the challenge card face down until the instructor announces the stress test.

Treatment-combination cards

SS

STANDARD DIET

STANDARD HOUSING

NO BLUE MARKER

HS

HIGH-FIBRE DIET

STANDARD HOUSING

NO BLUE MARKER

SE

STANDARD DIET

ENRICHED HOUSING

ADD BLUE MARKER

HE

HIGH-FIBRE DIET

ENRICHED HOUSING

ADD BLUE MARKER

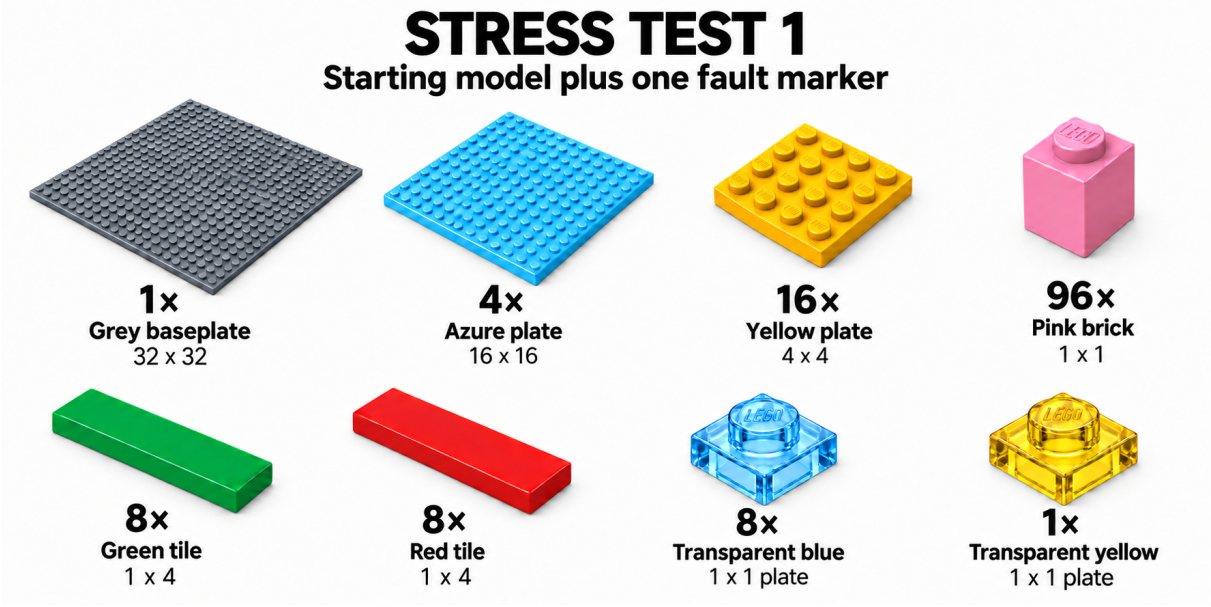
Reuse these same four cards

Shuffle the cards separately for Room 1, record the order, then reuse and reshuffle them for Rooms 2, 3 and 4. You need four cards, not sixteen.

The next page is your group's hidden stress test. Keep it in the envelope until the instructor checks your completed model.

Stress test: Group 1

Pen unavailable before allocation



The inventory shows your starting model and any extra marker. Reuse the built model. It does not show the number of usable experimental units after the event.

Change the model

Before animals enter the experiment, Pen 7 develops a water-system fault and cannot be used. Place one transparent yellow plate on Pen 7. No treatment has started.

Discuss and record

- Decide whether the original allocation should stand or be randomised again.
- Show what happens to the complete-block structure if only 15 pens remain.
- State whether pens in other rooms should be discarded.
- Record which treatment combination is absent from Room 2.

Uses one transparent yellow plate. No extra pen or treatment pieces are required.

Your group's explanation

Group 2 workshop pack

Cut out the four treatment-combination cards. Keep the challenge card face down until the instructor announces the stress test.

Treatment-combination cards

SS

STANDARD DIET

STANDARD HOUSING

NO BLUE MARKER

HS

HIGH-FIBRE DIET

STANDARD HOUSING

NO BLUE MARKER

SE

STANDARD DIET

ENRICHED HOUSING

ADD BLUE MARKER

HE

HIGH-FIBRE DIET

ENRICHED HOUSING

ADD BLUE MARKER

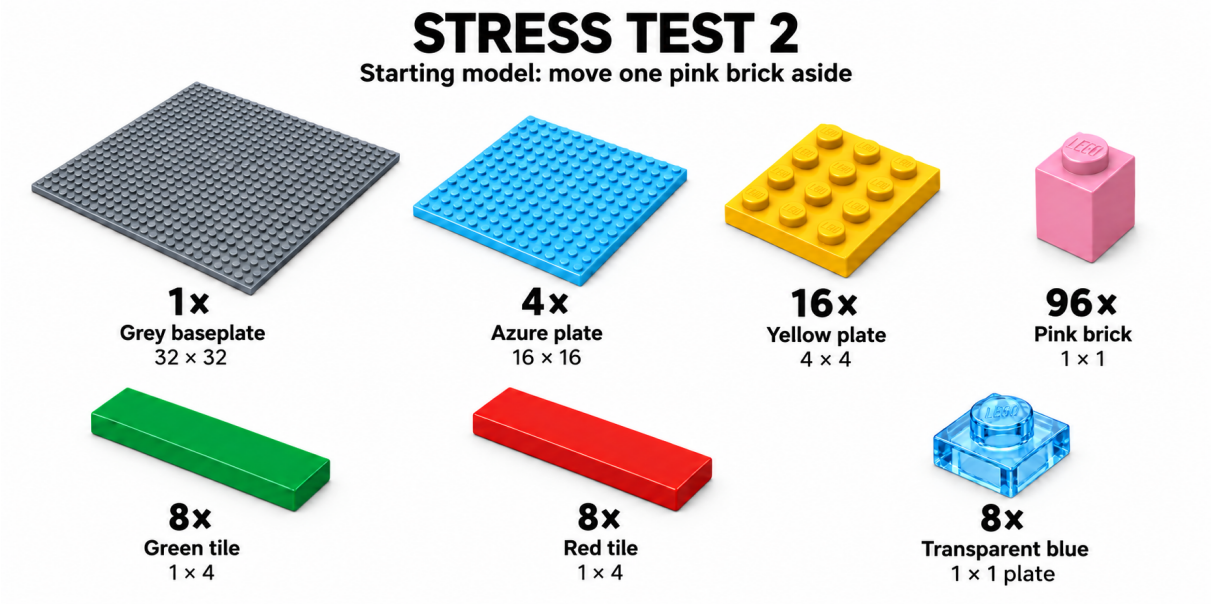
Reuse these same four cards

Shuffle the cards separately for Room 1, record the order, then reuse and reshuffle them for Rooms 2, 3 and 4. You need four cards, not sixteen.

The next page is your group's hidden stress test. Keep it in the envelope until the instructor checks your completed model.

Stress test: Group 2

One pig removed in Week 3



The inventory shows your starting model and any extra marker. Reuse the built model. It does not show the number of usable experimental units after the event.

Change the model

One pig in an enriched, high-fibre pen becomes ill and leaves the study during Week 3. Remove one pig piece from that pen and place it beside the model.

Discuss and record

- Count the remaining experimental units and animal observations.
- Decide whether treatment replication has changed.
- Identify the level at which information is missing.
- List the identifiers needed to record this event.

Uses one existing pig piece. No additional marker is required.

Your group's explanation

Group 3 workshop pack

Cut out the four treatment-combination cards. Keep the challenge card face down until the instructor announces the stress test.

Treatment-combination cards

SS

STANDARD DIET

STANDARD HOUSING

NO BLUE MARKER

HS

HIGH-FIBRE DIET

STANDARD HOUSING

NO BLUE MARKER

SE

STANDARD DIET

ENRICHED HOUSING

ADD BLUE MARKER

HE

HIGH-FIBRE DIET

ENRICHED HOUSING

ADD BLUE MARKER

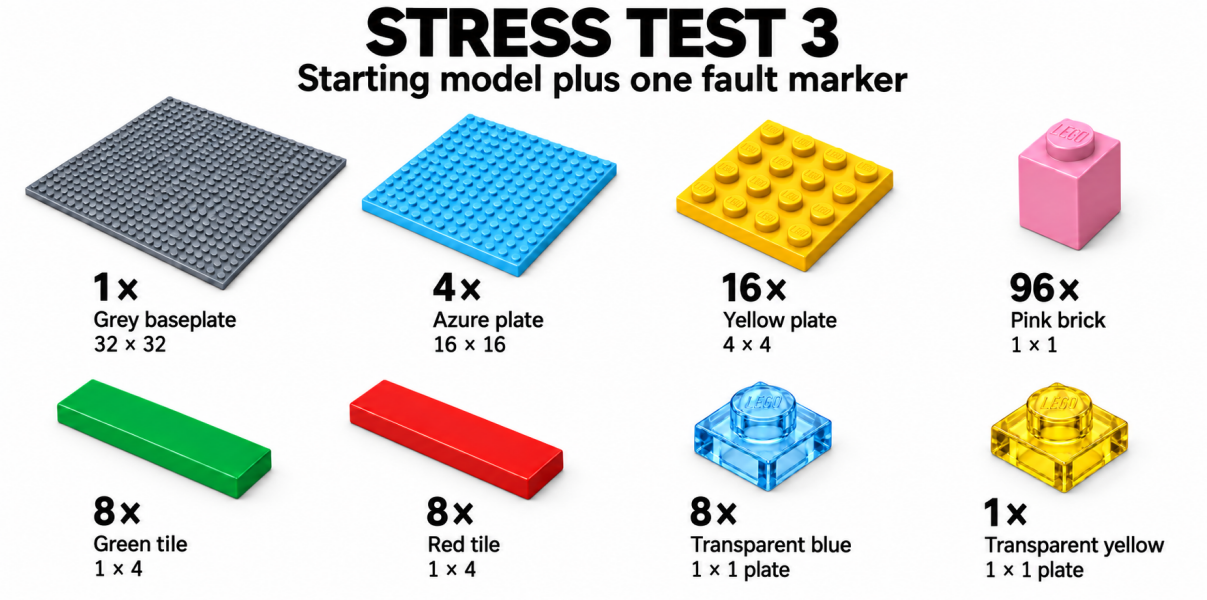
Reuse these same four cards

Shuffle the cards separately for Room 1, record the order, then reuse and reshuffle them for Rooms 2, 3 and 4. You need four cards, not sixteen.

The next page is your group's hidden stress test. Keep it in the envelope until the instructor checks your completed model.

Stress test: Group 3

A complete pen is lost



The inventory shows your starting model and any extra marker. Reuse the built model. It does not show the number of usable experimental units after the event.

Change the model

After treatment begins, feed is delivered incorrectly to one pen for several days. Mark that pen with one transparent yellow plate. Its treatment response is no longer valid.

Discuss and record

- Count the usable experimental units after the loss.
- Identify which treatment combination now has fewer independent replicates.
- Decide whether a matching pen should be deleted from every other room.
- Describe how the realised design differs from the planned design.

Uses one transparent yellow plate. Keep all other pieces in their realised positions.

Your group's explanation

Group 4 workshop pack

Cut out the four treatment-combination cards. Keep the challenge card face down until the instructor announces the stress test.

Treatment-combination cards

SS

STANDARD DIET

STANDARD HOUSING

NO BLUE MARKER

HS

HIGH-FIBRE DIET

STANDARD HOUSING

NO BLUE MARKER

SE

STANDARD DIET

ENRICHED HOUSING

ADD BLUE MARKER

HE

HIGH-FIBRE DIET

ENRICHED HOUSING

ADD BLUE MARKER

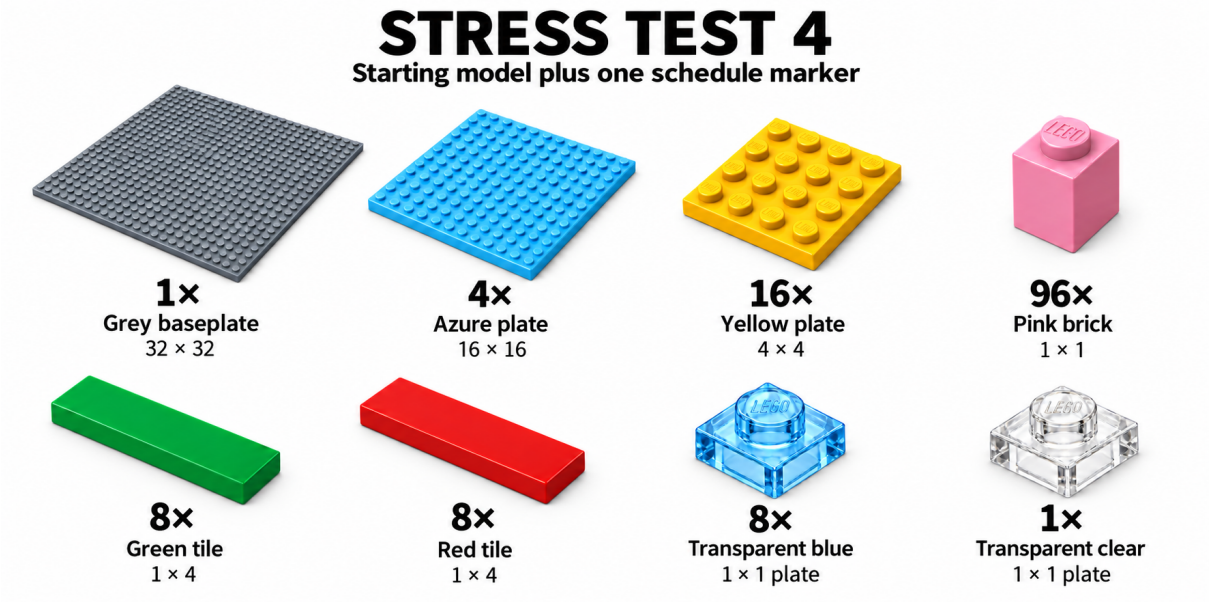
Reuse these same four cards

Shuffle the cards separately for Room 1, record the order, then reuse and reshuffle them for Rooms 2, 3 and 4. You need four cards, not sixteen.

The next page is your group's hidden stress test. Keep it in the envelope until the instructor checks your completed model.

Stress test: Group 4

Weekly weighing



The inventory shows your starting model and any extra marker. Reuse the built model. It does not show the number of usable experimental units after the event.

Change the model

The researcher now weighs every pig once a week for eight weeks. Place one clear transparent plate beside the facility to represent the repeated schedule. Do not build 768 measurement pieces.

Discuss and record

- Decide whether treatment replication increases.
- Calculate the maximum number of weight records if no values are missing.
- Identify what is repeatedly measured.
- List the identifiers required in the observation table.

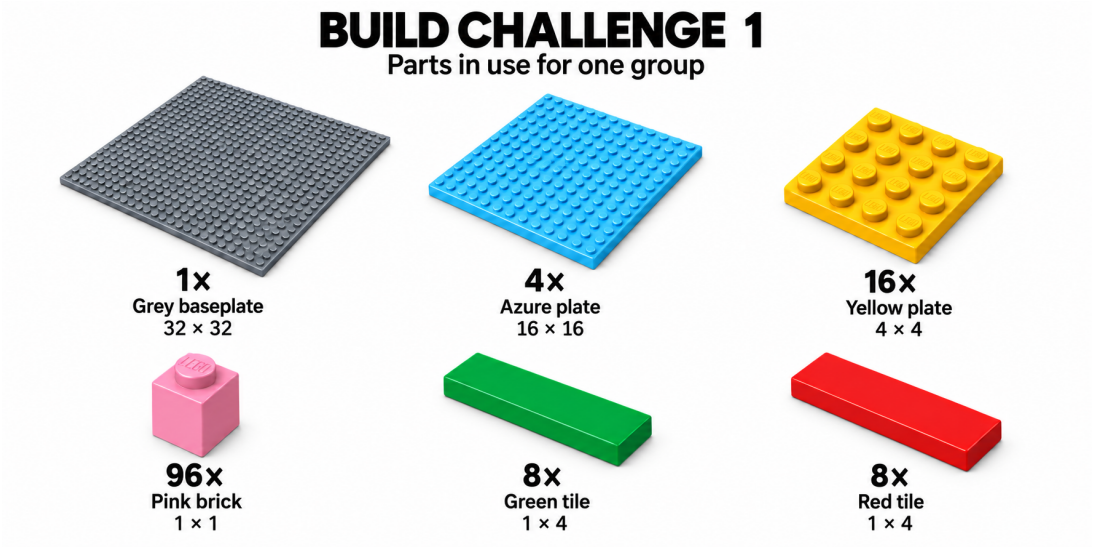
Uses one clear transparent plate as a symbol for the schedule.

Your group's explanation

Build challenge 1

Balanced totals, confounded rooms

Begin only after the core workshop record has been checked. Photograph or copy the original layout before rebuilding.



Quantities are for one group and include reused pieces. Restore pieces removed during the stress test, then select only this inventory. Put unlisted markers aside. Keep paper labels and your allocation record ready.

Build

Put green diet markers on every pen in Rooms 1 and 2. Put red diet markers on every pen in Rooms 3 and 4.

Discuss

Confirm the overall diet totals. Decide whether diet can be separated from room. Explain why more pigs within each pen would not solve the problem.

Finish

Repair the design so both diets occur in every room, then state what must still be randomised.

Pieces and assumptions

Uses 16 pens, 96 pigs, 8 green markers and 8 red markers.

Record your explanation or proposed repair

Build challenge 2

Fixed positions in every room

Begin only after the core workshop record has been checked. Photograph or copy the original layout before rebuilding.



Quantities are for one group and include reused pieces. Restore pieces removed during the stress test, then select only this inventory. Put unlisted markers aside. Keep paper labels and your allocation record ready.

Build

In every room, place diet markers in the same green, red, green, red position order.

Discuss

Check balance and blocking. Imagine that Positions 1 and 3 are nearest the ventilation inlet. Identify the remaining design problem.

Finish

Repair the design using a separate recorded chance procedure in every room.

Pieces and assumptions

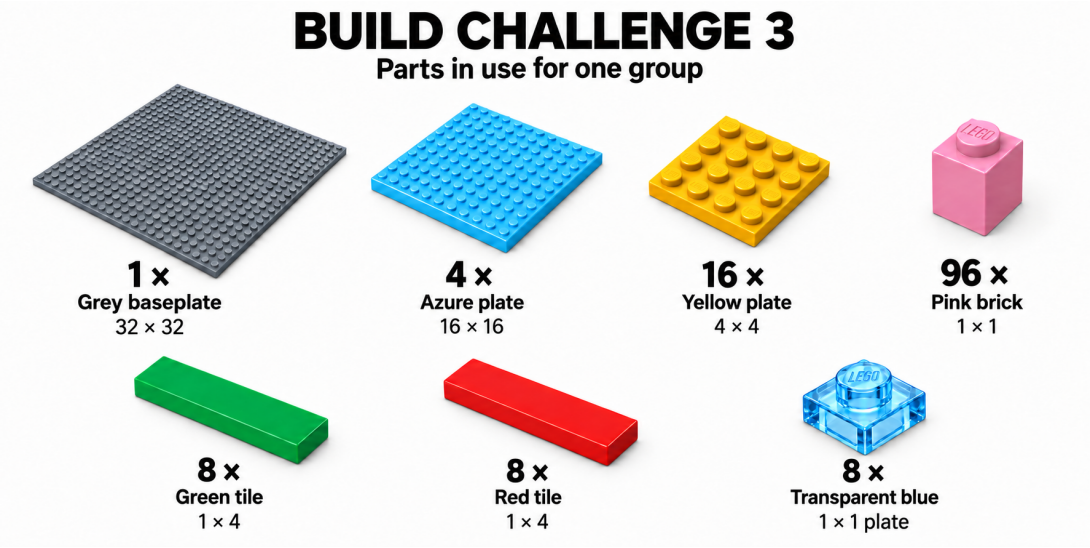
Uses 16 pens, 96 pigs, 8 green markers and 8 red markers.

Record your explanation or proposed repair

Build challenge 3

Diet and housing move together

Begin only after the core workshop record has been checked. Photograph or copy the original layout before rebuilding.



Quantities are for one group and include reused pieces. Restore pieces removed during the stress test, then select only this inventory. Put unlisted markers aside. Keep paper labels and your allocation record ready.

Build

Make eight SS pens and eight HE pens. Do not use the HS or SE combinations.

Discuss

Identify the missing combinations. Decide whether a diet effect can be separated from a housing effect and whether an interaction can be studied.

Finish

Repair the design by placing one SS, HS, SE and HE pen in every room.

Pieces and assumptions

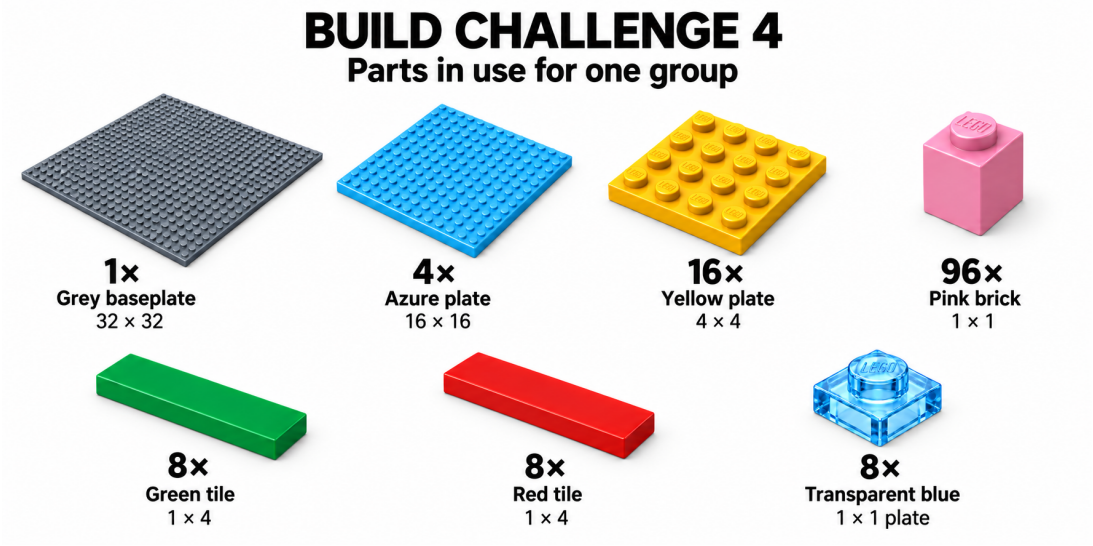
Uses 8 green and 8 red diet tiles and 8 blue markers. No extra pieces are needed.

Record your explanation or proposed repair

Build challenge 4

All combinations, wrong rooms

Begin only after the core workshop record has been checked. Photograph or copy the original layout before rebuilding.



Quantities are for one group and include reused pieces. Restore pieces removed during the stress test, then select only this inventory. Put unlisted markers aside. Keep paper labels and your allocation record ready.

Build

In Rooms 1 and 2, make two SS and two SE pens. In Rooms 3 and 4, make two HS and two HE pens.

Discuss

Confirm that all four combinations occur four times overall. Identify which factor is confounded with room.

Finish

Repair the design so every room contains all four combinations, then randomise their positions.

Pieces and assumptions

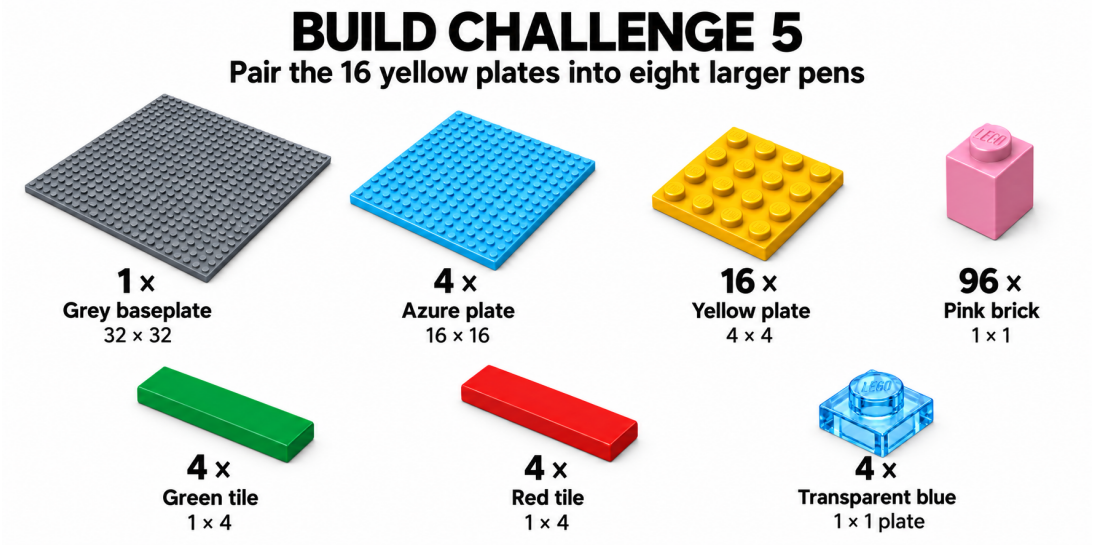
Uses 16 pens, 96 pigs, 8 green and 8 red diet tiles and 8 blue markers.

Record your explanation or proposed repair

Build challenge 5

Same pigs, fewer experimental units

Begin only after the core workshop record has been checked. Photograph or copy the original layout before rebuilding.



Quantities are for one group and include reused pieces. Restore pieces removed during the stress test, then select only this inventory. Put unlisted markers aside. Keep paper labels and your allocation record ready.

Build

Pair adjacent pen areas to represent eight larger pens. Put 12 pigs in each larger pen. Allocate two larger pens to each treatment combination.

Discuss

Compare the numbers of pigs, experimental units and replicates with the 16-pen design. Decide which design has greater treatment replication.

Finish

No repair is required. Explain why the same 96 pigs can provide different treatment replication.

Pieces and assumptions

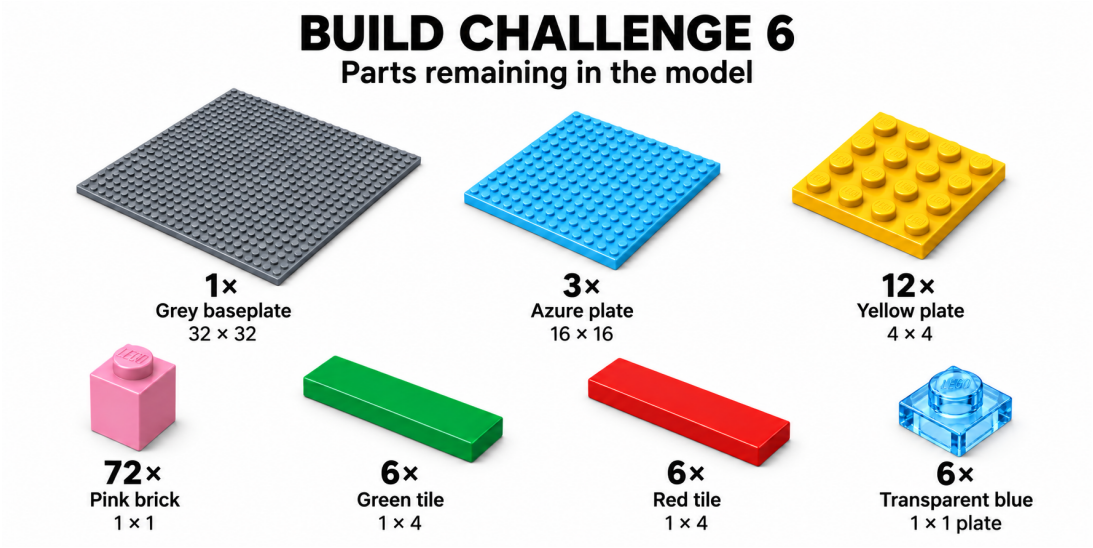
Uses all 16 pen plates as 8 paired areas, all 96 pigs, 4 green tiles, 4 red tiles and 4 transparent blue plates. Put unused markers aside.

Record your explanation or proposed repair

Build challenge 6

One complete room is unavailable

Begin only after the core workshop record has been checked. Photograph or copy the original layout before rebuilding.



Quantities are for one group and include reused pieces. Restore pieces removed during the stress test, then select only this inventory. Put unlisted markers aside. Keep paper labels and your allocation record ready.

Build

Set aside one complete room with its four pens and 24 pigs. Keep one SS, HS, SE and HE pen in each remaining room.

Discuss

Count the remaining experimental units and replicates. Check whether the remaining blocks and treatment totals are balanced.

Finish

Compare this loss with losing one pen. Decide whether researchers should discard a whole room merely to restore balance after a single-pen loss.

Pieces and assumptions

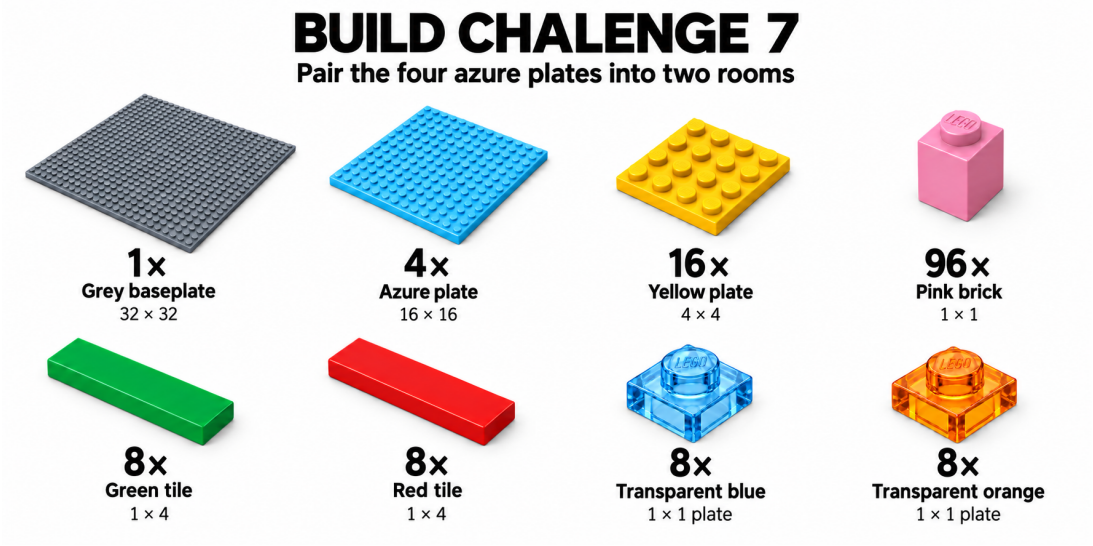
Uses a subset of the existing kit. No new pieces are required.

Record your explanation or proposed repair

Build challenge 7

Three factors in two rooms

Begin only after the core workshop record has been checked. Photograph or copy the original layout before rebuilding.



Quantities are for one group and include reused pieces. Restore pieces removed during the stress test, then select only this inventory. Put unlisted markers aside. Keep paper labels and your allocation record ready.

Build

New hypothetical facility: two rooms of eight pens. Pair two azure plates for each room. Keep diet and housing, and add feeding frequency: transparent orange absent = once daily, present = twice daily. Assume feeding can be assigned separately to pens. Put every combination in each room and randomise positions using handwritten combination slips.

Discuss

How many combinations are there? How many independent pens receive each? Is each new room a complete block? Could a four-pen room contain every combination?

Finish

Record the allocation. Explain why adding a factor changed replication even though you still have 96 pigs.

Pieces and assumptions

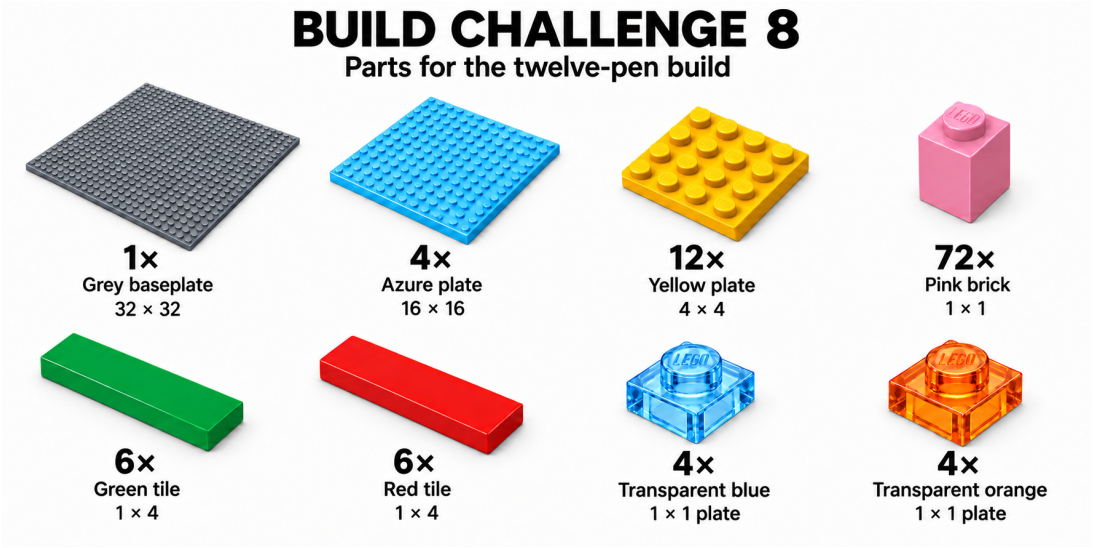
16 yellow pen plates, 96 pink bricks, 8 green and 8 red diet tiles, 8 transparent blue and 8 transparent orange plates. Reuse all four azure plates.

Record your explanation or proposed repair

Build challenge 8

Three housing levels

Begin only after the core workshop record has been checked. Photograph or copy the original layout before rebuilding.



Quantities are for one group and include reused pieces. Restore pieces removed during the stress test, then select only this inventory. Put unlisted markers aside. Keep paper labels and your allocation record ready.

Build

New hypothetical facility: two rooms of six pens. Pair two azure plates per room and set four yellow pen plates and 24 pigs aside. Cross two diets with three housing levels: no marker = standard, transparent blue = shelter, transparent orange = manipulable material. These are alternatives: never add blue and orange to the same pen. Put every combination in each room, then randomise positions.

Discuss

How many factors, levels and combinations are there? How many pen replicates per combination? Could all 16 pens give equal replication?

Finish

Explain the trade-off between using all pens and equal replication. Suggest how all 16 could be used if unequal replication were acceptable.

Pieces and assumptions

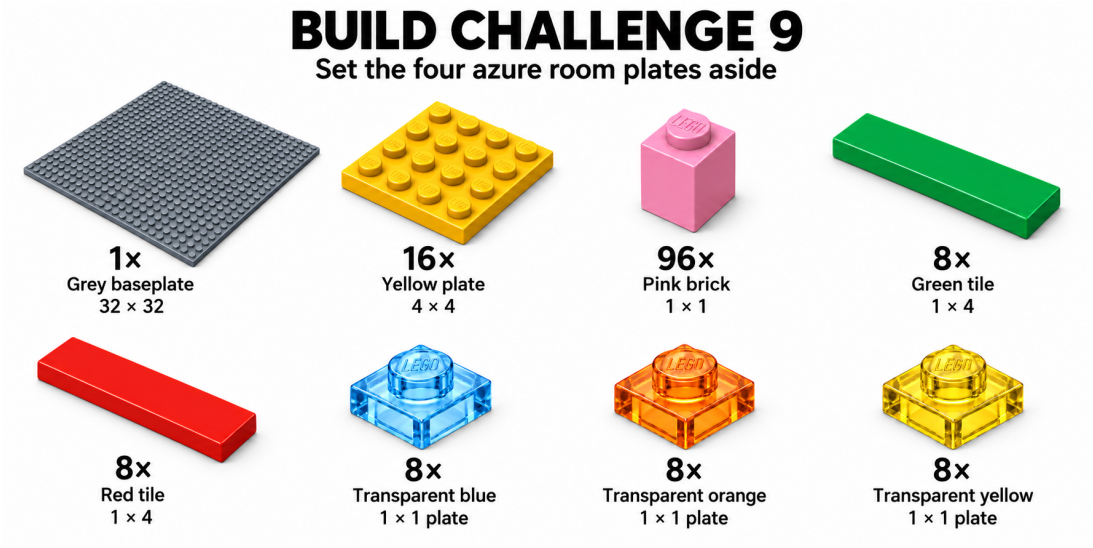
12 yellow pen plates, 72 pink bricks, 6 green and 6 red diet tiles, 4 transparent blue and 4 transparent orange plates. Orange has a different meaning on this card.

Record your explanation or proposed repair

Build challenge 9

Four factors, sixteen pens

Begin only after the core workshop record has been checked. Photograph or copy the original layout before rebuilding.



Quantities are for one group and include reused pieces. Restore pieces removed during the stress test, then select only this inventory. Put unlisted markers aside. Keep paper labels and your allocation record ready.

Build

New hypothetical setting: all pens share one common environment. Set the four azure room plates aside and place 16 yellow pen plates on the grey base, six pigs per pen. Cross all four binary factors in the legend below. Make one paper slip for each distinct combination and randomly allocate the slips to numbered pens. Every combination must occur.

Factor	First level	Second level
Diet	Standard: green 1x4 tile	High-fibre: red 1x4 tile
Housing	Standard: no blue plate	Enriched: transparent blue
Feeding	Once daily: no orange plate	Twice daily: transparent orange
Lighting	Standard: no yellow plate	Extended: transparent yellow

Discuss

How many combinations fit? How many independent pens receive each complete combination? How many pens receive each individual factor level? Do six pigs in a pen replicate its treatment combination?

Finish

Explain what happens if one pen is lost. Propose a change that gives at least two independent pens per combination using the same 16 pens. How many pens would be needed to retain all four factors with two pens per combination?

Pieces and assumptions

Use existing pieces only. Treat each factor as separately assignable to each pen, including feeding and independently controlled lighting. Record your allocation on the handout's four-factor page.

Record your explanation or proposed repair