

WRO RoboMission 2022

Secondary Game Rules



MY ROBOT MY FRIEND

THE RESCUE ROBOT

Version: 25 May 2022

Main Organiser:



Co-Organiser:

Sponsored by:



Ministry of Education
SINGAPORE

Supported by:



NRC 2022 WRO ROBOMISSION CATEGORY CHALLENGE BOOKLET CHANGE LOG

Version	Release Date	Description
1.0	25 May 2022	Official Challenge Booklet release

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PART ONE – GAME DESCRIPTION

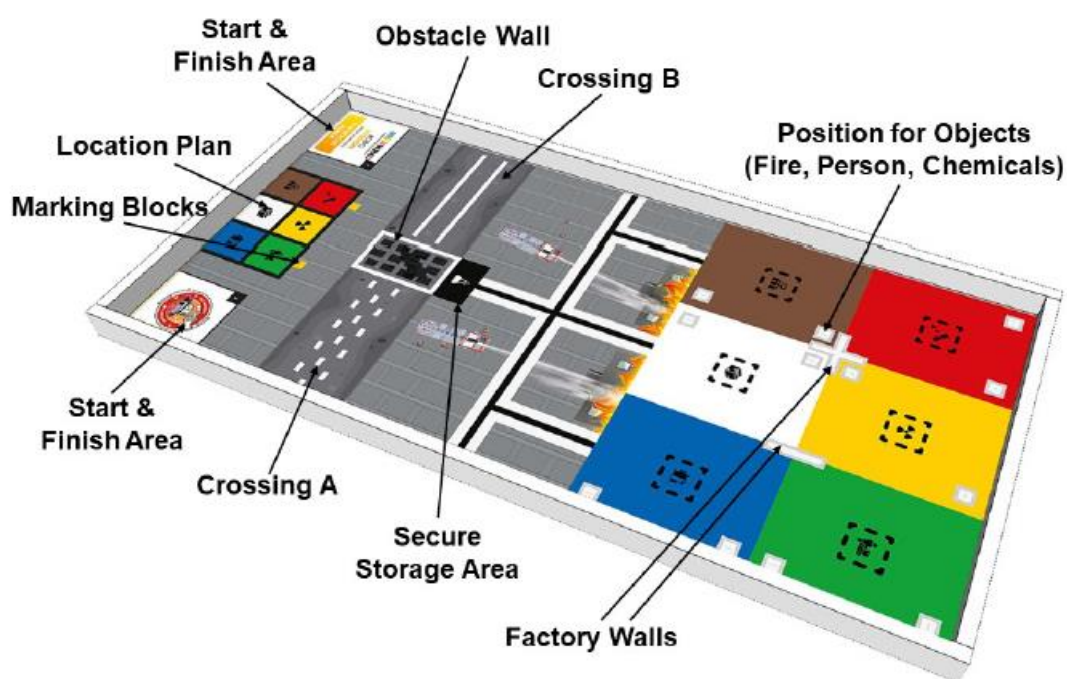
1. Introduction

A rescue robot supports rescuers in an emergency situation with dangerous or difficult tasks. Such robots must be able to withstand heat, overcome debris or stairs, detect injured persons, transport hazardous materials, and create situation pictures of unknown environments. The junior game field deals with some of these tasks.

On this playing field, the robot's tasks are to assist and extinguish a fire in a factory, to transport hazardous chemicals, and to provide the rescue services with information about the position of people in the factory. At the same time, the robot has to overcome unknown terrain on its way to the factory.

2. Game Field

The following graphic shows the game field with the different areas.



If the table is larger than the game mat, place the mat on the short side with the two start areas on the wall and align it centred between the long walls.








For more information about the table and game mat specifications, please refer to WRO RoboMission General Rules, Rule 4. The printable file of the mat and a PDF with the exact measurements are available on www.wro-association.org.

3. Game Objects, Positioning, Randomization

Objects in the factory

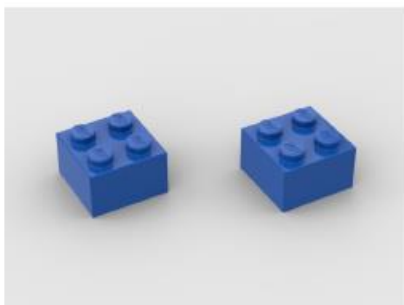
There are always 2 fire objects, 2 people (one small, one big) and 1 chemicals object on the field. These objects are **randomly placed in each round** on the white rectangles in the rooms. **Maximum one object is placed per room.**

The objects are placed with an orientation aligned to the little line inside the grey rectangle.

 <p>Chemicals Object (1)</p>	 <p>Fire object (2)</p>
 <p>Big Person (1)</p>	 <p>Small Person (1)</p>
 <p>Example for an object placed on the field</p>	 <p>Little grey line inside the grey area shows the placement / orientation of a game object</p>
 <p>Example for an object placed on the field</p>	

Water

Water objects are used to extinguish the fire in a room. Water objects can be placed on the robot before the start of the run. The water objects must fit into the maximum size of the robot.



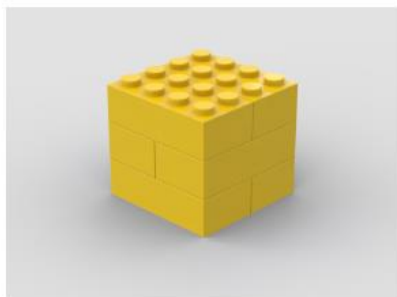
Water Objects (2)



Water objects in the start area of the competition day
(can be placed on the robot, it is not allowed to remove these objects from the game field)

Marking Blocks

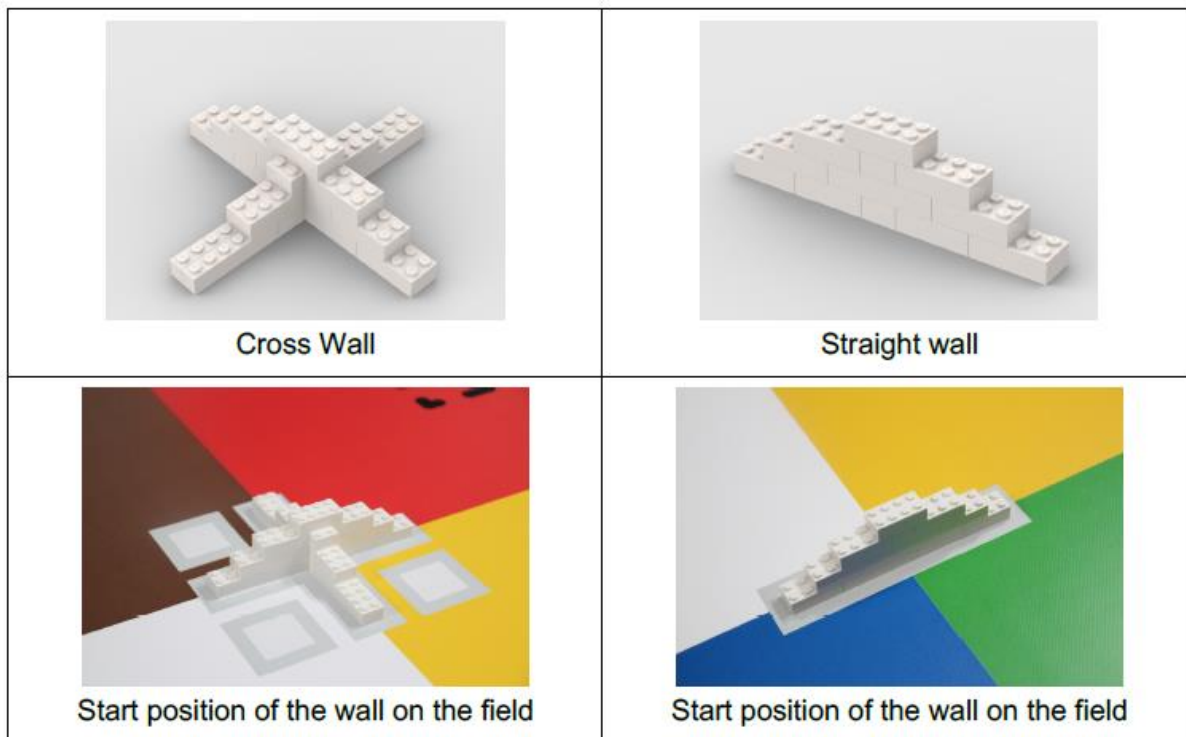
Marking blocks are used to mark the position of a person on the location plan. There are two marking blocks that are placed on the two yellow squares next to the location map.



Start position of the marking blocks

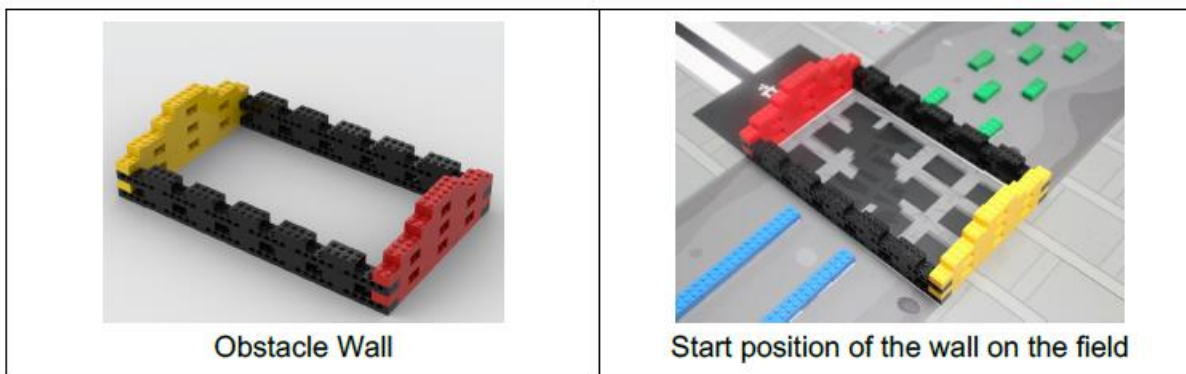
Factory Walls

There are two factory walls, one straight and one cross. The two factory walls are placed on the grey markings in the factory area.



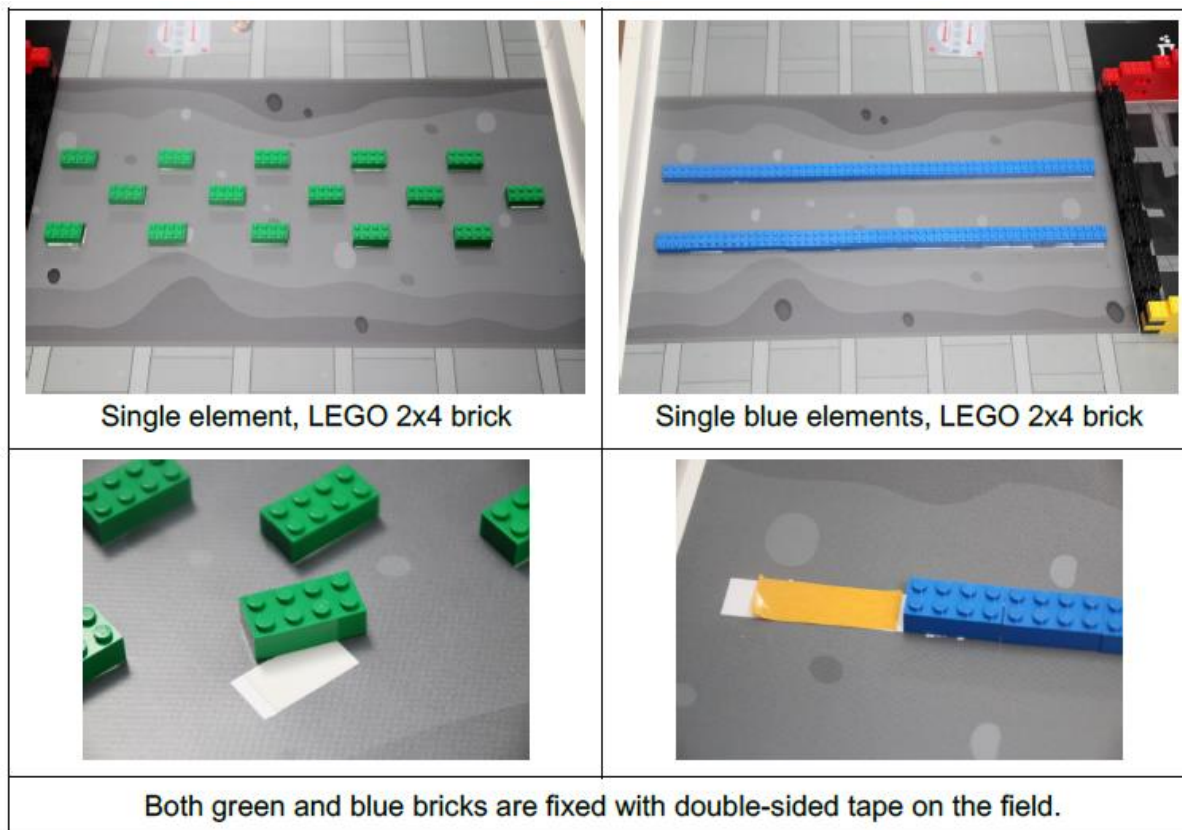
Obstacle Wall

There is an obstacle wall placed between the two areas that should be crossed by the robot. It is not allowed to move or damage this wall.



Obstacle elements

There are different obstacle elements on the field. There are 15 green single elements placed on the crossing A and two lines of 14 blue elements each (28 in total) placed on the crossing B.



Two start areas

There are two start & finish areas on the field. For the day of the competition, it is decided in which of the two areas the robot should start. Before the start of the run, the robot must start completely in one start area (defined as mentioned before), the surrounding line is not included in the start area. At the start, the cables count toward the maximum size of the robot, so they need to be included in the start area.

Summary randomization

On the competition day, the start area is randomly selected.

On this field, the following objects are **randomly placed in each round**:

- Objects in the factory on the grey squares (max. one object per room).

4. Robot Missions

For a better understanding, the missions will be explained in multiple sections.
The team can decide in which order they will do the missions.

4.1 Find and extinguish the fire

One task of a rescue robot is to identify the location of fire in an unknown building.

Therefore, the robot should identify the fire objects in the factory and place one water object in each corresponding room. Points are awarded if the water object is in the same room as the fire object. Maximum one water object per room counts.

Negative points are awarded if the water object is placed in a wrong room.

4.2 Move the chemicals out of the factory

Another task of a rescue robot is to identify and transport dangerous goods. Especially in a case of fire in a building, it is important to collect chemicals and bring them out. It is the task of the robot to identify the chemical object and to transport this object to the black secure storage area.

Points are awarded if the chemical object is outside the factory. Full points are awarded if the chemical object is completely inside the secure storage area.

4.3 Find people in the factory

In a case of fire in a building, it is important to know if and where people are placed inside the building. However, a rescue robot is not made to transport people on its own. The transport of people must still be done by humans at present.

Therefore, it is the task of the robot to identify the rooms with people and bring this information to the operations team. For that, the robot needs to drive through the factory, identify the people, remember the rooms and mark the rooms with the help of the marking blocks on the location map on the left side of the field.

Full points are awarded if a marking block is completely in the correct room of the location map.

4.4 Crossing uneven ground

Rescue robots work in unknown and uncertain environments. That's why the robot needs to cross uneven grounds on the game field as well. These uneven grounds are marked as "Crossing A" and "Crossing B".

Points are awarded if the robot completely crosses the area identified by the two lines before and after each crossing. Points are given only once for each crossing. The referee is responsible for overseeing the result of this challenge during the run.

4.5 Park the robot

At the end, the robot should return to the start & finish area that was not the start area.

Points are only awarded if the robot parks in this other area (not the start area) and the chassis of the robot is entirely (top-view) within the area (cables are allowed to be outside of the area).

4.6 Get bonus points and avoid penalties

Bonus points will be awarded for not moving or damaging the walls inside the factory. In addition, bonus points will be awarded for not moving the fire and person objects in the factory.

Penalty points are given for moving or damaging the obstacle wall.

5. Scoring

Definitions for the scoring

“Completely” means that the game object is only touching the corresponding area (not including the black lines).

Tasks	Each	Total
Find and extinguish the fire		
Water object completely in a room with a fire object (max. one water object per room counts)	15	30
Water object in a room without fire or more water objects than fires in the room	-3	-6
Move the chemicals out of the factory		
Chemical object completely outside of the factory (and not in secure storage area)		8
OR		
Chemical object completely inside the secure storage area		12
Find people in the factory		
Marking block is completely inside the correct square identifying a person object in the corresponding-coloured factory room	19	38
Crossing uneven ground in the factory		
Crossing the “Crossing A” or “Crossing B” completely, defined by driving through the full area (identified by the two lines before and after). Points are only awarded once per crossing area and if the obstacle wall was not moved or damaged.	15	30
Park the robot		
Robot stops in the start & finish area that was not the start area of the competition day <i>(only if other points, not bonus, are assigned)</i>		13
Get bonus points and avoid penalties		
Per fire and person object that is not moved or damaged	5	20
Per factory wall that is not moved or damaged	6	12
Obstacle wall that is moved or damaged		-12
Maximum Score		155

Scoring Interpretation

Water object completely in a room of a fire object (max. one water object per room counts)

→ 15 points

Water object in a room without fire or more water objects than fires in the room → -3 Points



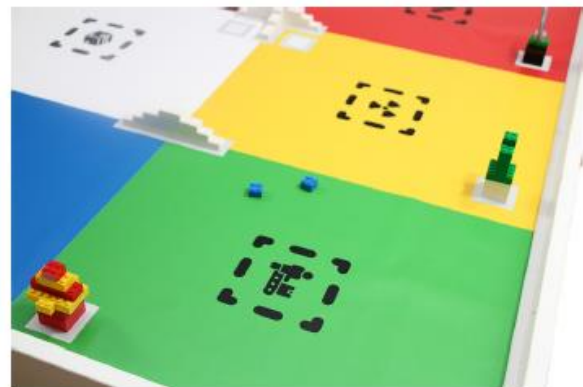
15 points



0 points (water object not completely in green room)



-3 points (water object in wrong room)



12 points (15 points for one water object, -3 for the other in the same room)

Chemical object outside of the factory (not in secure storage area) → 8 points

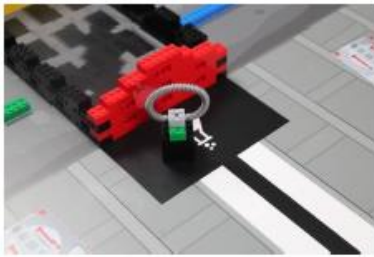


8 points

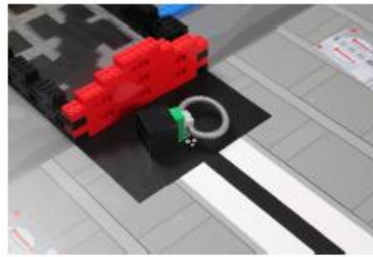


0 points (still partly in factory / white room in this case)

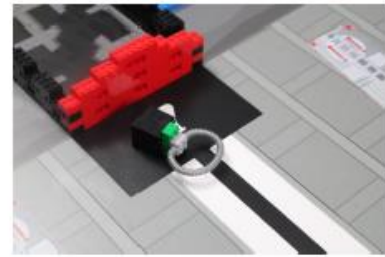
Chemical object outside of the factory and inside the secure storage area → 12 points



12 points



12 points (it is OK if the object is not standing)



12 points (the object is touching only the storage area)



0 points, partly outside.

Marking block is completely inside the correct square identifying a person object in the corresponding-coloured factory room → 19 points each

For this scoring example, the persons were placed in the yellow and white room!



38 points (2x 19 points)

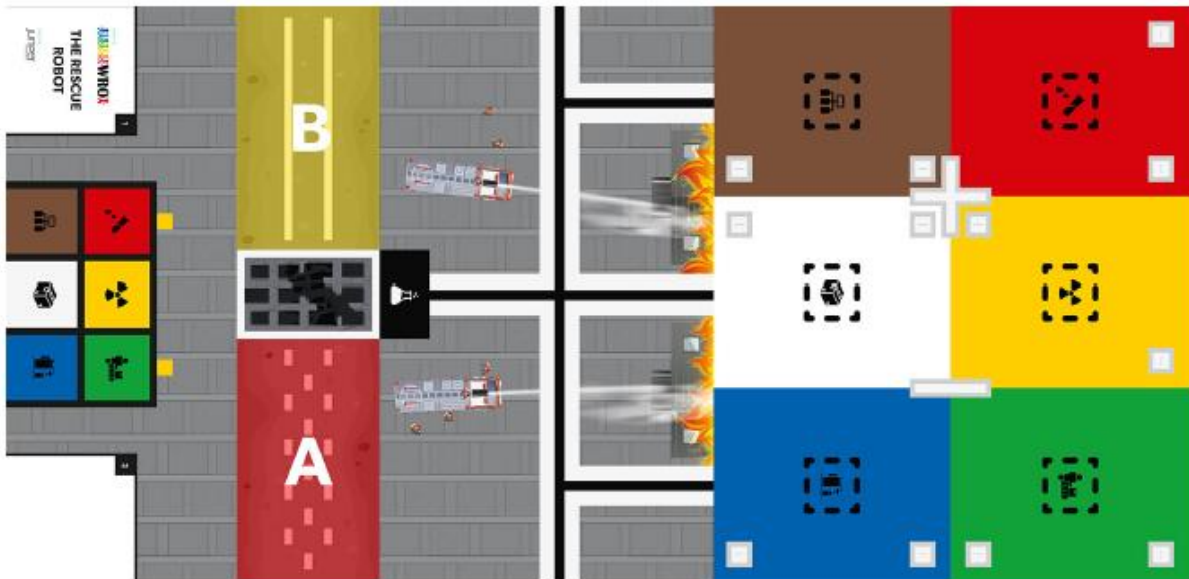


19 points (OK in white, yellow not ok because it is touching the black line)



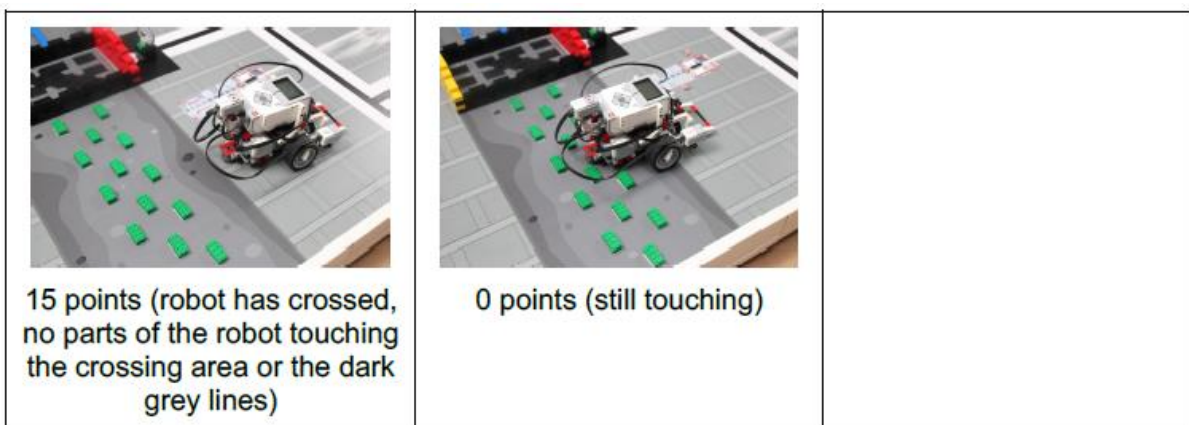
19 points, only one is correct (block in white)

Crossing the “Crossing A” or “Crossing B” completely is defined by driving through the full area (identified by the two lines before and after). Points are only awarded once per crossing area and if the obstacle wall was not moved or damaged. → 15 points each



Explanation: The two crossings (A + B, highlighted in light red and yellow) are bounded by dark grey lines on the left and right. The full areas A and B are considered as the crossings. The robot must pass the crossing completely to earn points.

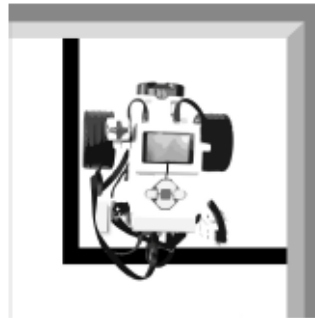
For this task, the judge will score the robot on a behaviour during the run. In case the robot ends the run in / after a crossing the following photos apply.



Robot stops in the start & finish area **that was not the start area** of the competition day (only if other points, not bonus, are assigned) → 13 points



The projection of the robot is completely inside the start/finish area.



The projection of the robot is completely inside, and cables are out. That is still OK.



No points if the projection of the robot is not in the start/finish area.

Fire / Person object not moved or damaged → 5 points each

Note: The same logic applies for all objects in the factory.



10 points (fire + person)



10 points (fire + person, OK that person is moved inside the grey area)



5 points (fire), blue person is outside the grey area.



5 points (fire), blue person is damaged.

Factory Wall is not moved or damaged → 6 points each

Note: The same logic applies for both the factory walls.



6 points



6 points, moved
inside grey area



0 points, wall outside



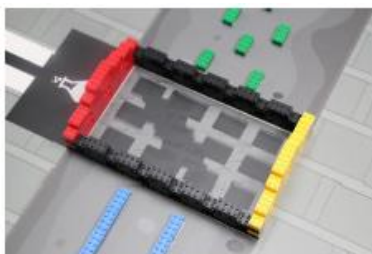
0 points, wall outside



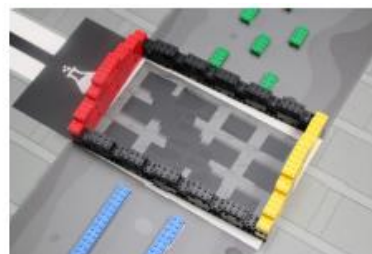
0 points, damaged

Obstacle wall that is moved or damaged → - 12 points

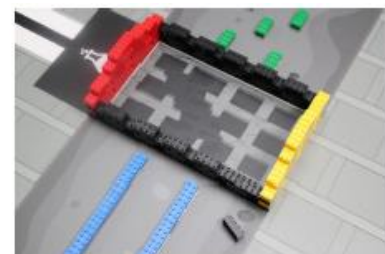
Note: It is not allowed to move or damage the obstacle wall, not even a little bit.



OK, no penalty.



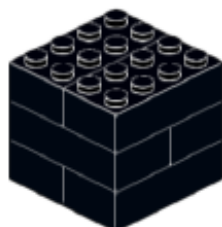
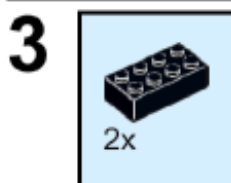
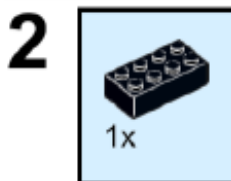
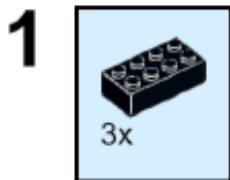
-12 points, moved.



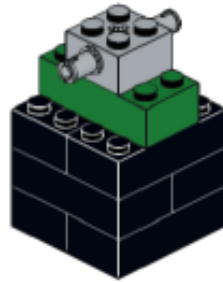
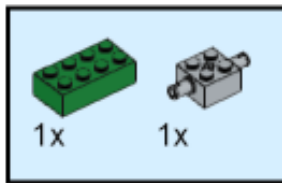
-12 point, damaged.

PART TWO – ASSEMBLY OF GAME OBJECTS

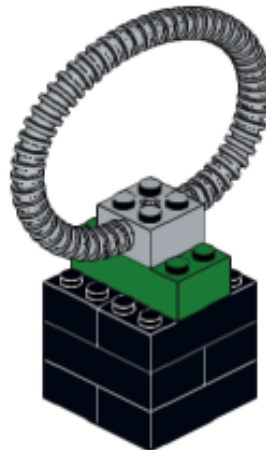
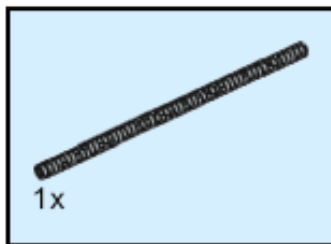
6. Chemicals Object (1x)



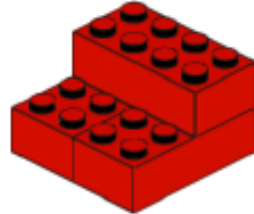
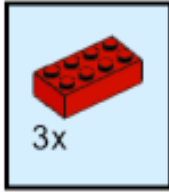
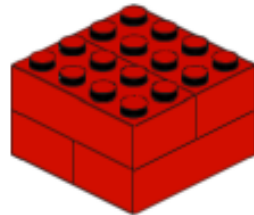
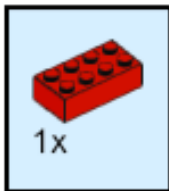
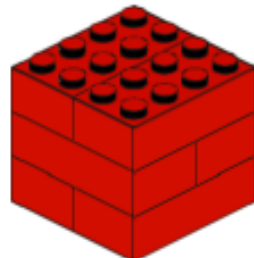
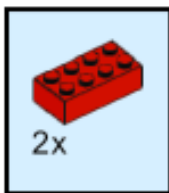
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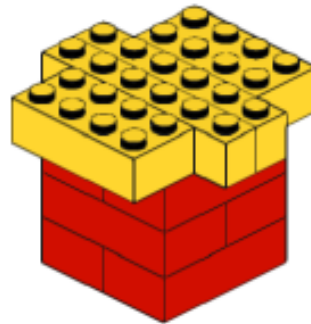
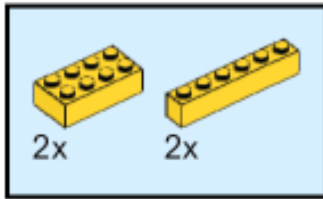
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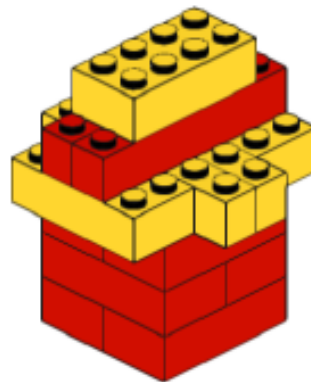
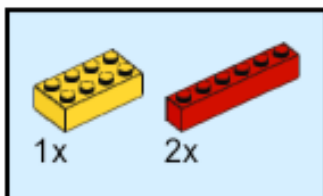
7. Fire Object (2x)

1**2****3**

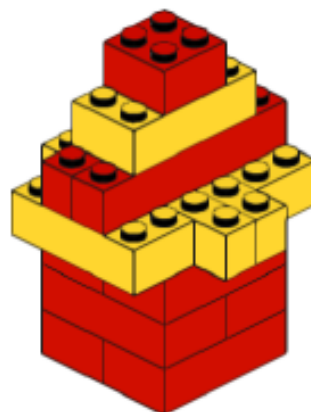
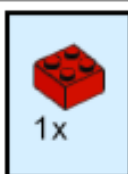
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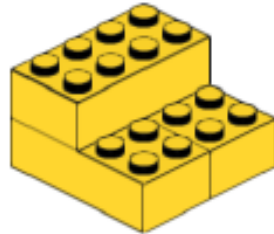
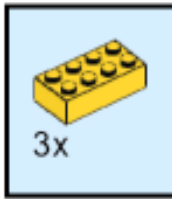
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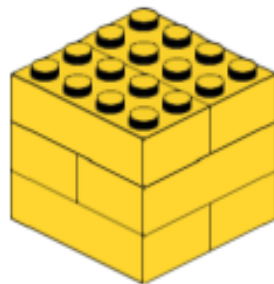
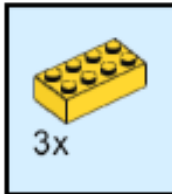


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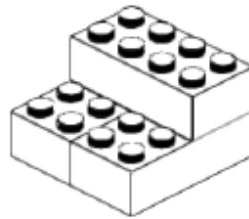
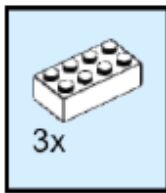
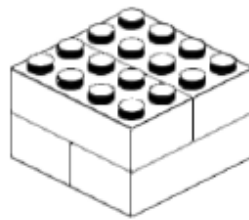
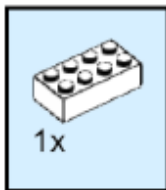
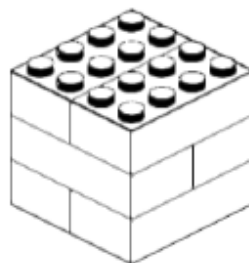
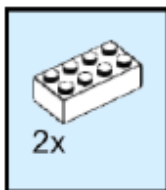


8. Marking Blocks (2x)

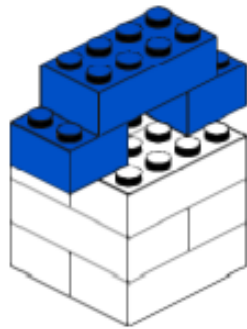
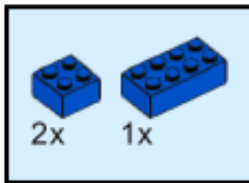
1

2

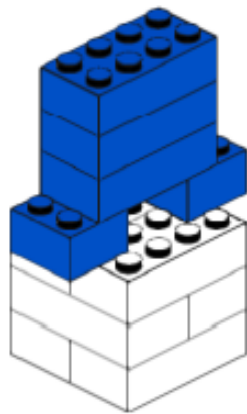
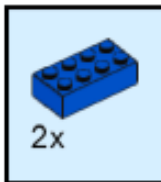
9. Big Person (1x)

1**2****3**

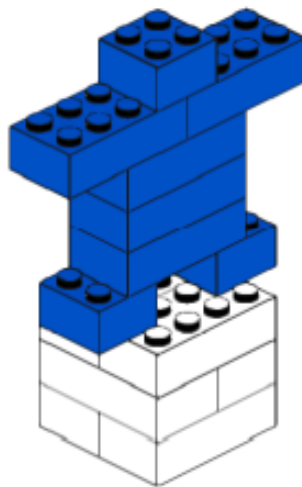
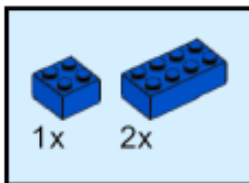
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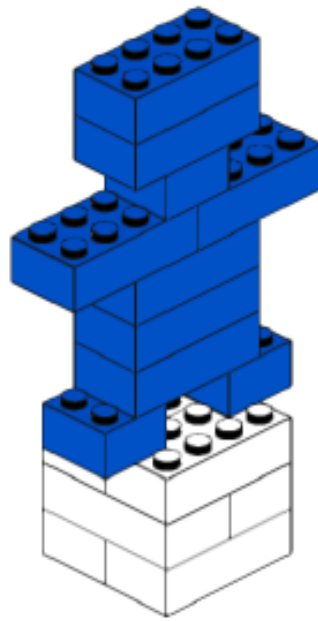
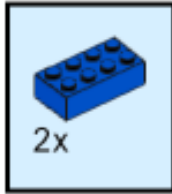
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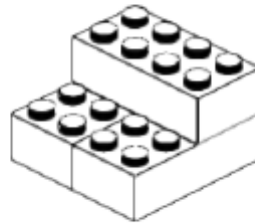
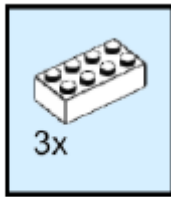
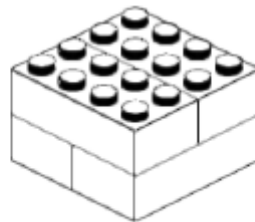
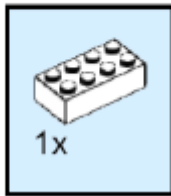
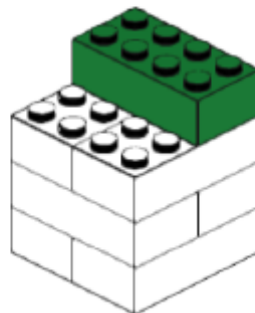
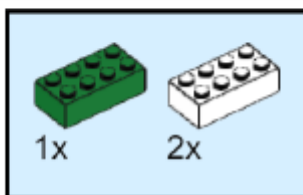


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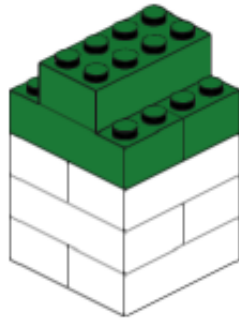
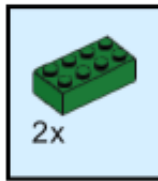


7

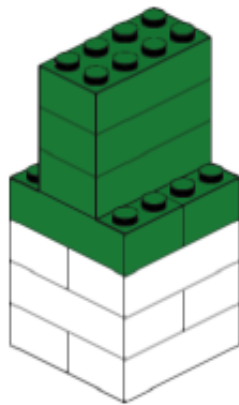
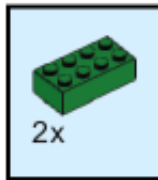


10. Small Person (1x)**1****2****3**

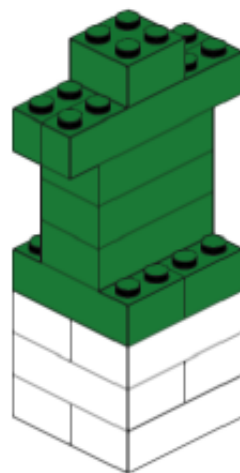
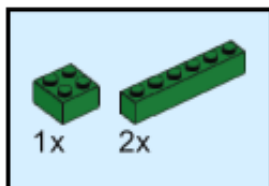
4



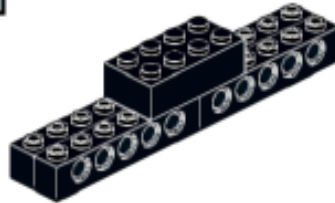
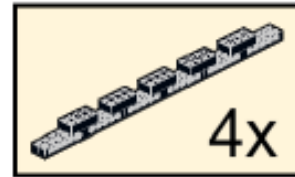
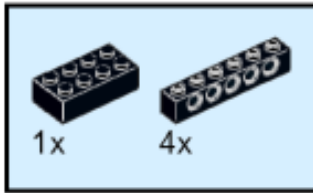
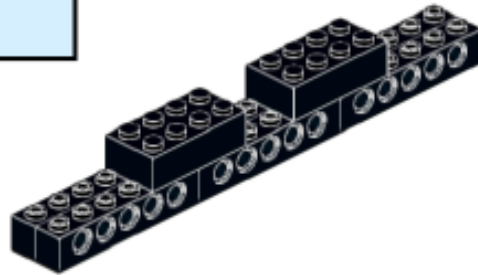
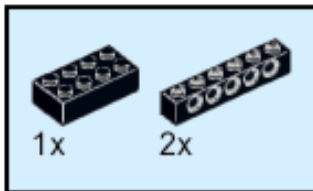
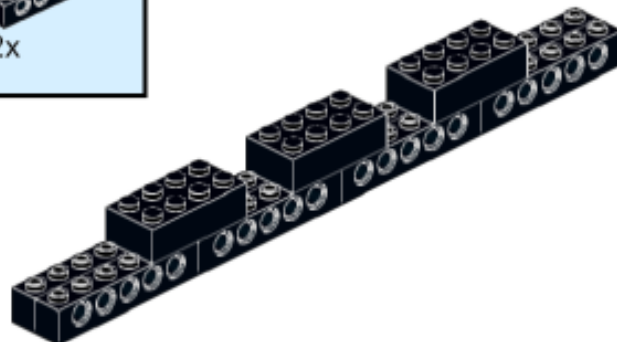
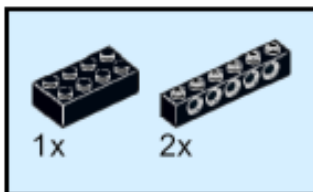
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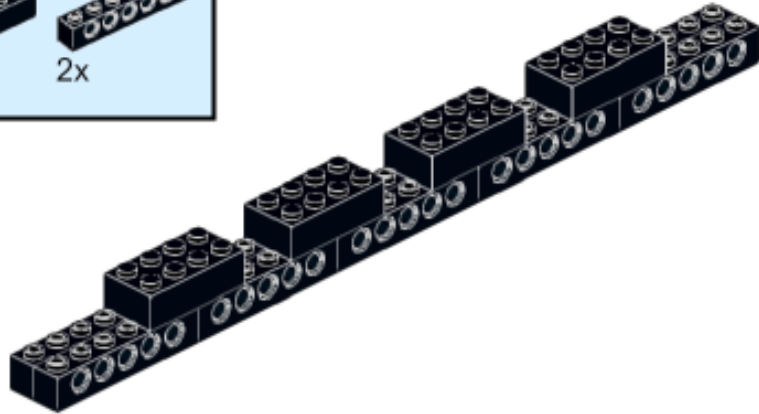
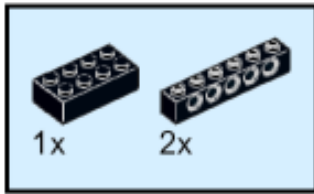
6



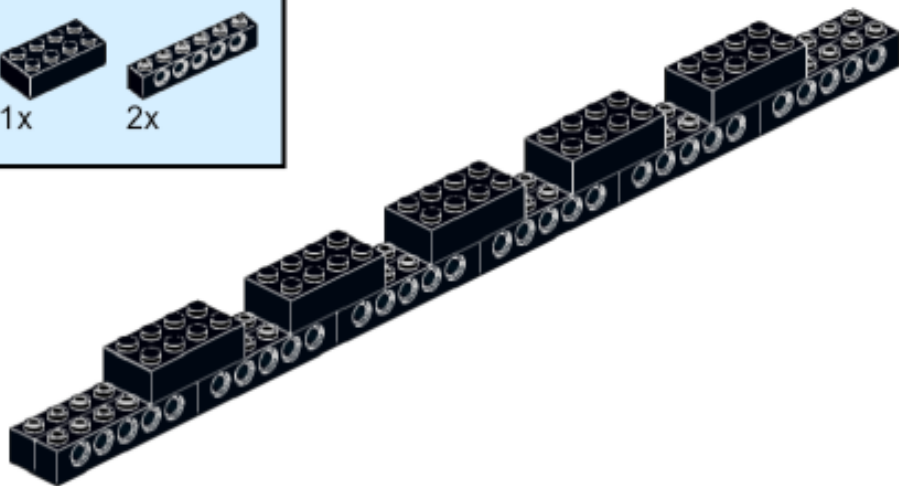
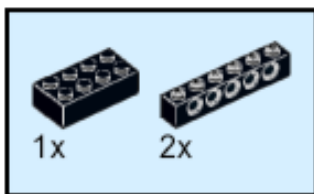
11. Obstacle Wall (1x)

1**2****3**

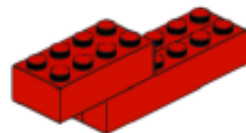
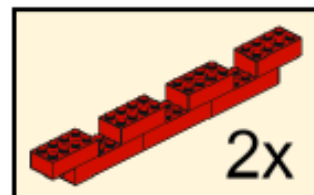
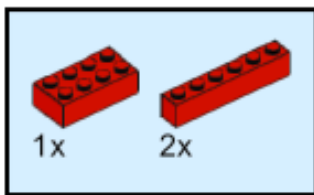
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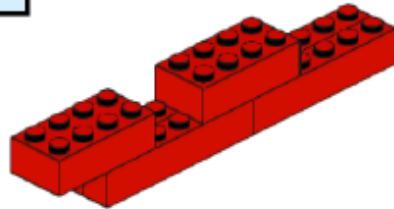
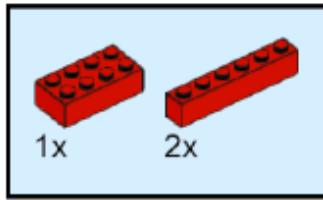
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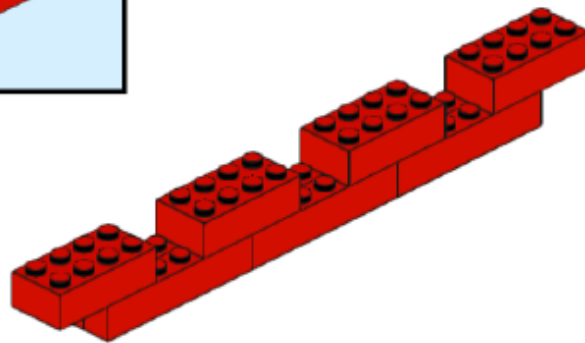
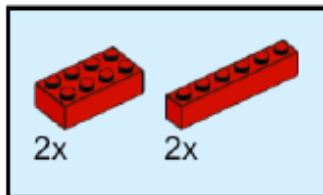
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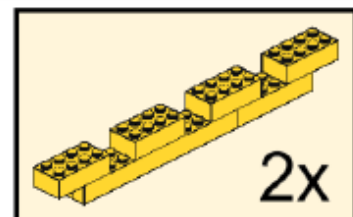
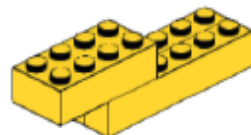
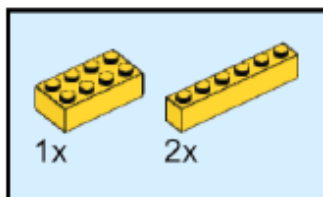
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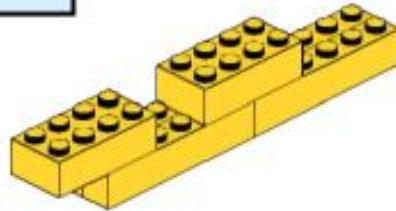
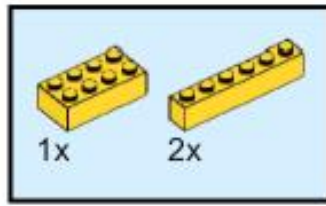
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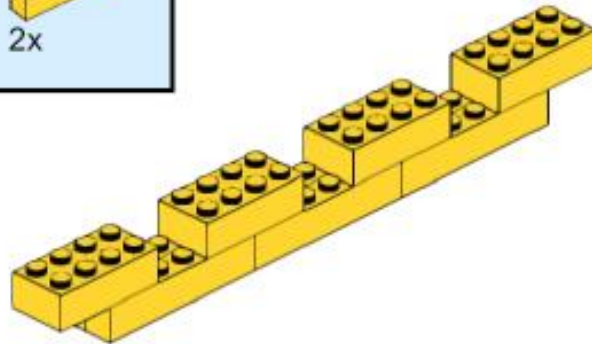
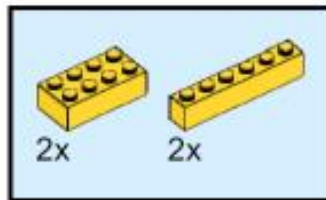
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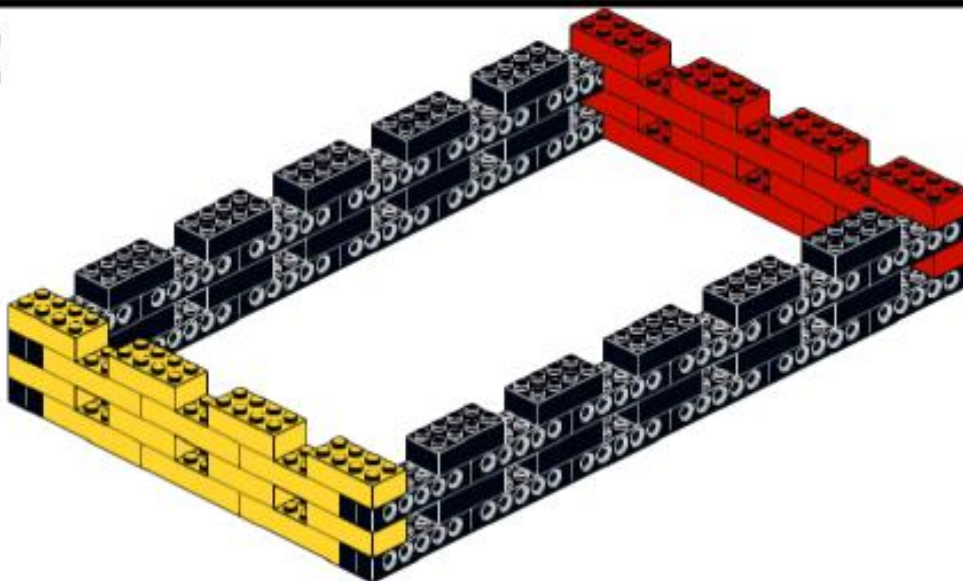
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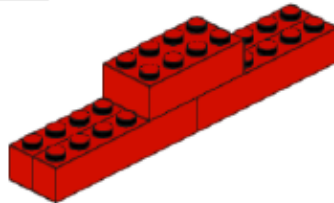
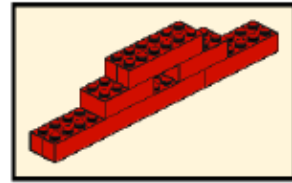
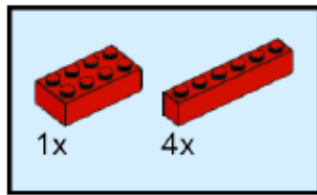
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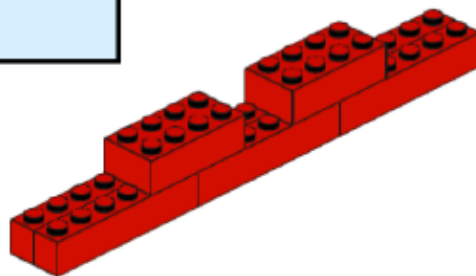
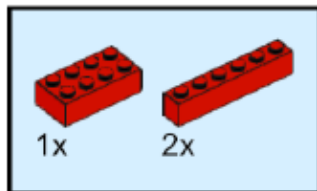
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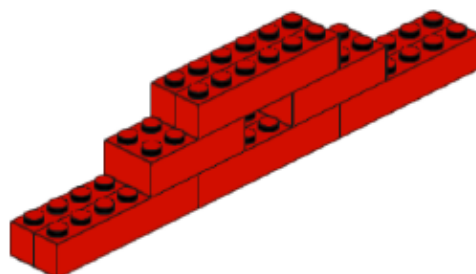
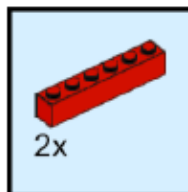
13



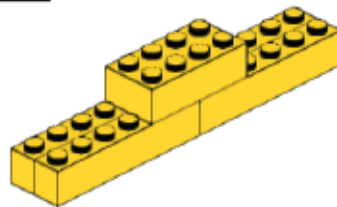
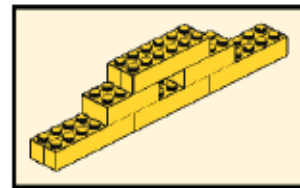
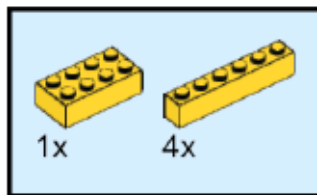
14



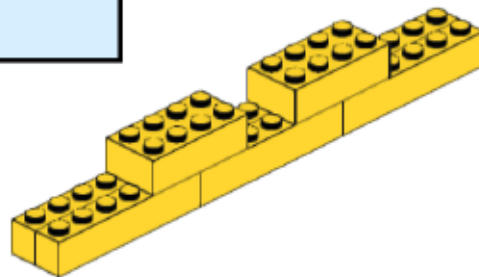
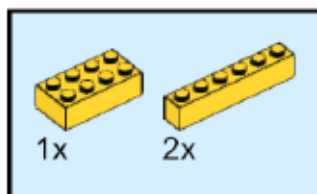
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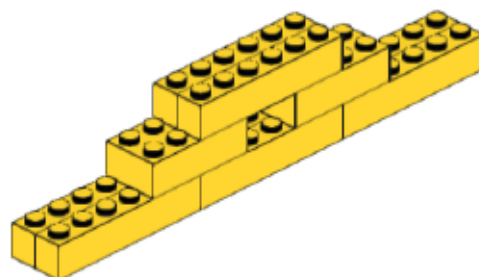
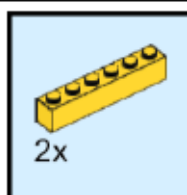
16



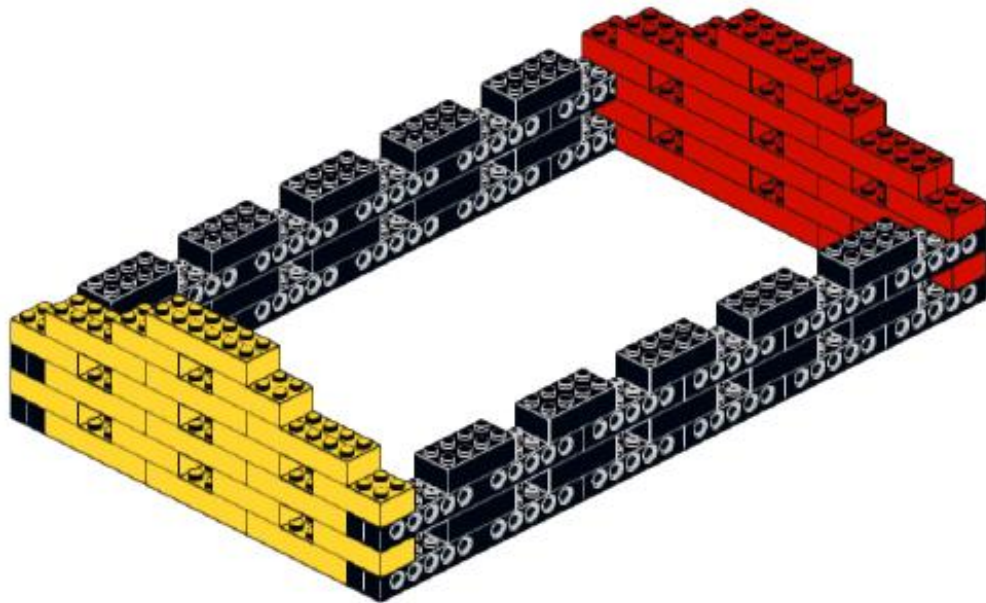
17

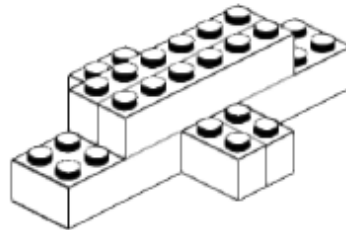
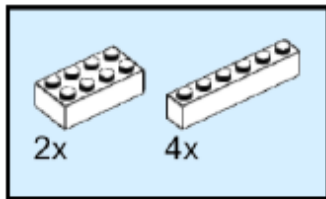
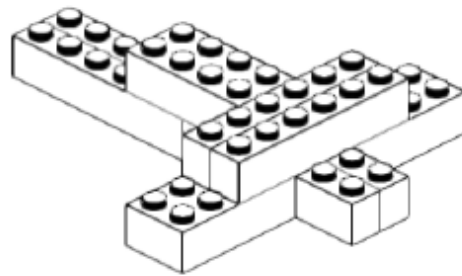
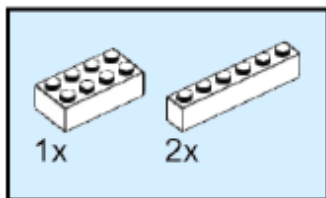
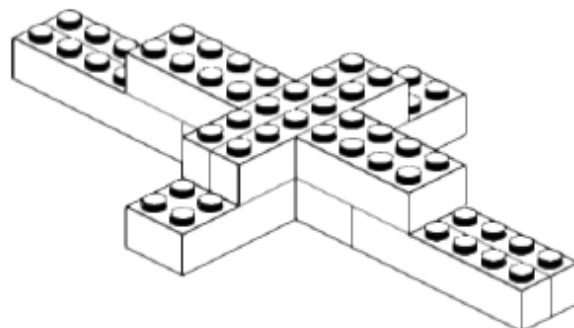
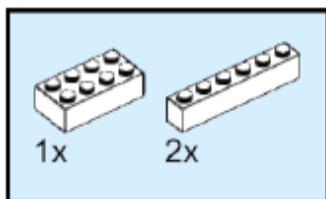


18

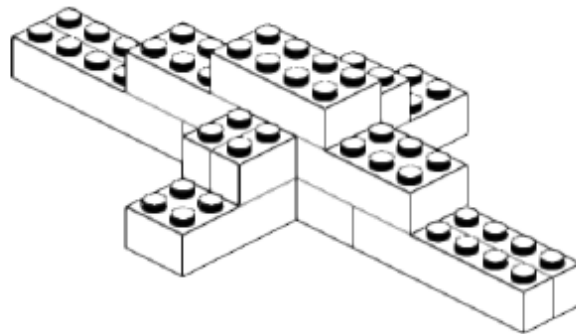
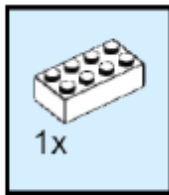


19

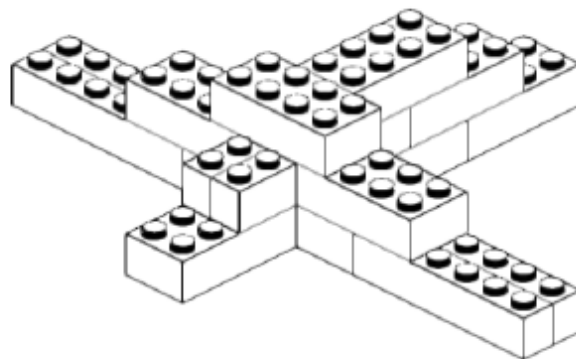
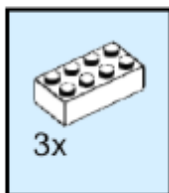


12. Cross Wall (1x)**1****2****3**

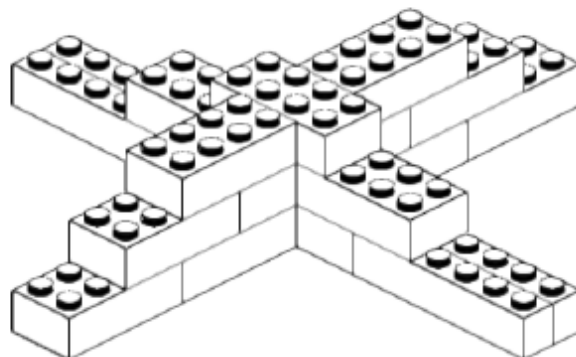
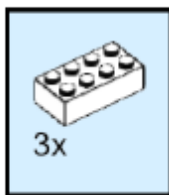
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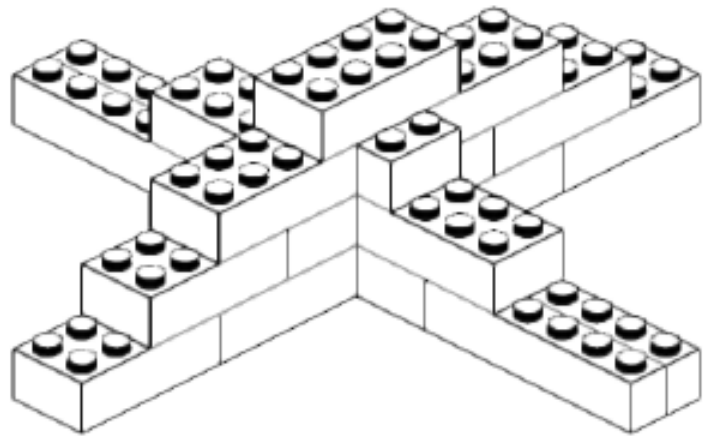
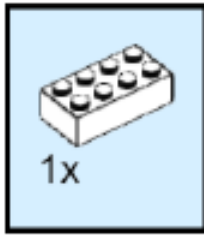
5



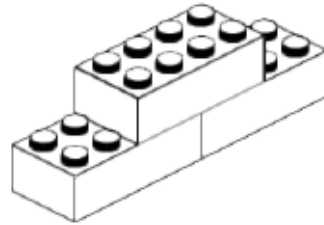
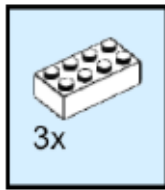
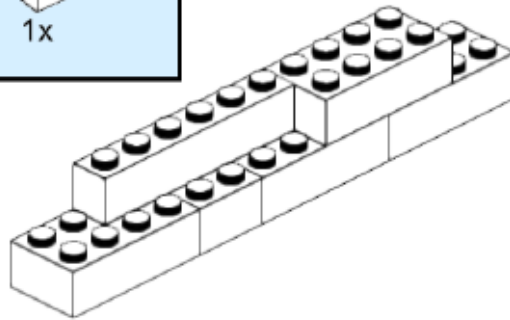
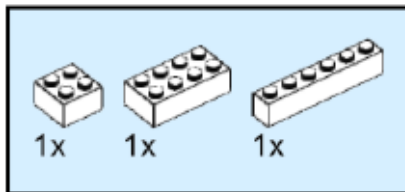
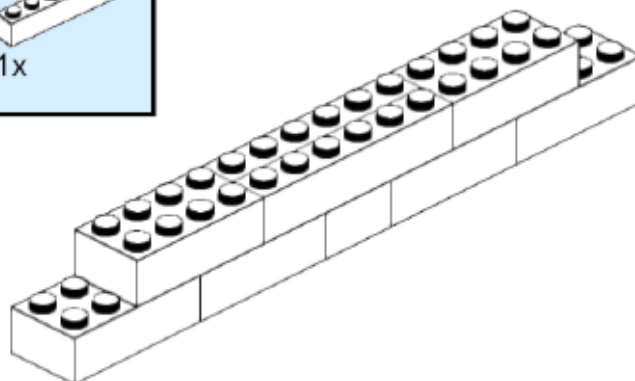
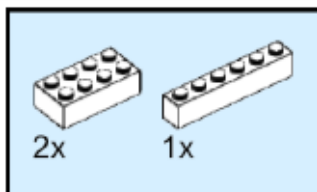
6



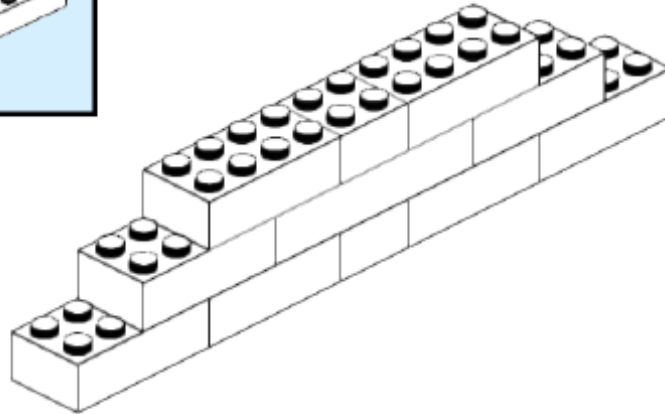
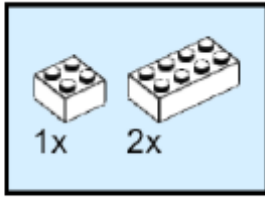
7



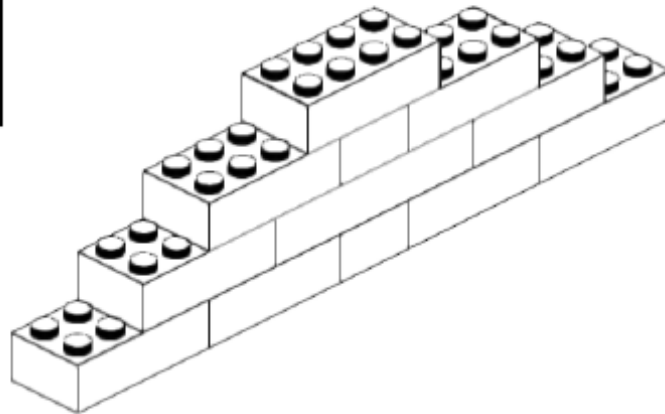
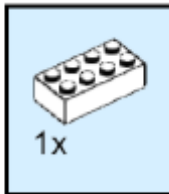
13. Straight Wall (1x)

1**2****3**

4



5

**END**