Association for **Science and Discovery Centres**

Kessler Syndrome

Start

Kessler Syndrome

NATIONAL SPACE ACADEMY

Kessler Syndrome
Created by Peter Wesson at the National Space Academy

Move
Move your satellite to any adjacent sector.

Move
Move your satellite to any adjacent sector.

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Move
Move your satellite to any adjacent sector.

Move
Move your satellite to any adjacent sector.

Move
Move your satellite to any adjacent sector.

Move
Move your satellite to any adjacent sector.

Laser ablation
Target junk in any **adjacent sector**.
Move target to any adjacent sector except the sector your satellite is in.

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Target junk in any **adjacent sector**.
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Move target to any adjacent sector except the sector your satellite is in.

Laser ablation
Target junk in any **adjacent sector**.
Move target to any adjacent sector except the sector your satellite is in.

Laser ablation
Target junk in any **adjacent sector**.
Move target to any adjacent sector except the sector your satellite is in.

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Laser ablation
Target junk in any **adjacent sector**.
Move target to any adjacent sector except the sector your satellite is in.

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Move target to any adjacent sector except the sector your satellite is in.

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Target junk in any **adjacent sector**.
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Laser ablation
Target junk in any **adjacent sector**.
Move target to any adjacent sector except the sector your satellite is in.

Laser ablation
Target junk in any **adjacent sector**.
Move target to any adjacent sector except the sector your satellite is in.

Claw
Target a piece of junk in the **same sector**.
Move target into any adjacent sector.

Claw
Target a piece of junk in the **same sector**.
Move target into any adjacent sector.

Claw
Target a piece of junk in the **same sector**.
Move target into any adjacent sector.

Claw
Target a piece of junk in the **same sector**.
Move target into any adjacent sector.

Claw
Target a piece of junk in the **same sector**.
Move target into any adjacent sector.

Claw
Target a piece of junk in the **same sector**.
Move target into any adjacent sector.

Claw
Target a piece of junk in the **same sector**.
Move target into any adjacent sector.

Claw
Target a piece of junk in the **same sector**.
Move target into any adjacent sector.

Claw
Target a piece of junk in the **same sector**.
Move target into any adjacent sector.

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Missile
Target junk in any sector. Roll a dice.
1 = Draw 2 disaster cards
2-5 = Draw 1 disaster card
6 = The junk flies into space. Remove it.

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Target junk in any sector. Roll a dice.
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Move
Move your satellite to any adjacent sector.

Move
Move your satellite to any adjacent sector.

Move
Move your satellite to any adjacent sector.

Move
Move your satellite to any adjacent sector.

Move
Move your satellite to any adjacent sector.

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Action

Major disaster
The 2 objects break into 4 and move separately into adjacent sectors.

Major disaster
The 2 objects break into 4 and move separately into adjacent sectors.

Major disaster
The 2 objects break into 4 and move separately into adjacent sectors.

Major disaster
The 2 objects break into 4 and move separately into adjacent sectors.

Major disaster
The 2 objects break into 4 and move separately into adjacent sectors.

Disaster
The 2 objects break into 3 and move separately into adjacent sectors.

Disaster
The 2 objects break into 3 and move separately into adjacent sectors.

Disaster
The 2 objects break into 3 and move separately into adjacent sectors.

Disaster
The 2 objects break into 3 and move separately into adjacent sectors.

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Disaster

Disaster

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Disaster

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Disaster

Disaster

Disaster

Disaster

Disaster
The 2 objects break into 3 and move separately into adjacent sectors.

Disaster
The 2 objects break into 3 and move separately into adjacent sectors.

Disaster
The 2 objects break into 3 and move separately into adjacent sectors.

Disaster
The 2 objects break into 3 and move separately into adjacent sectors.

Disaster
The 2 objects break into 3 and move separately into adjacent sectors.

Could be worse
The 2 objects collide and move separately into adjacent sectors.

Could be worse
The 2 objects collide and move separately into adjacent sectors.

Could be worse
The 2 objects collide and move separately into adjacent sectors.

Could be worse
The 2 objects collide and move separately into adjacent sectors.

Could be worse
The 2 objects collide and move separately into adjacent sectors.

Lucky escape
The 2 objects stick together forming one and remain in the same sector.

Lucky escape
The 2 objects stick together forming one and remain in the same sector.

Lucky escape
The 2 objects stick together forming one and remain in the same sector.

Lucky escape
The 2 objects stick together forming one and remain in the same sector.

Lucky escape
The 2 objects stick together forming one and remain in the same sector.

Disaster

Disaster

Disaster

Disaster

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Disaster

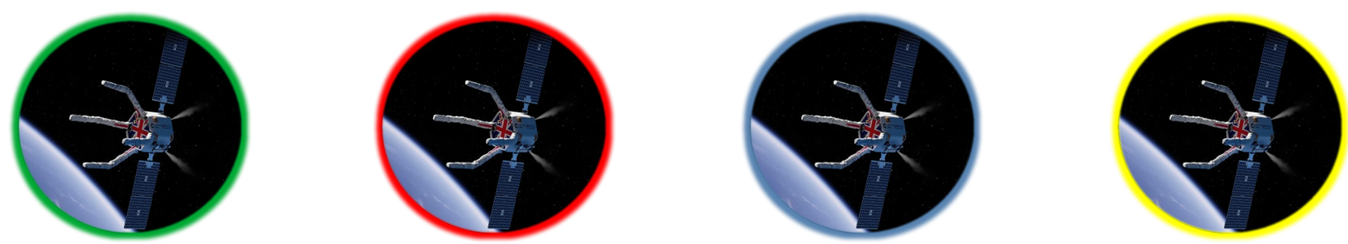
Disaster

Disaster

Disaster

Disaster





Kessler syndrome - The Rules

The aim of the game

Players work together to clear space junk and prevent **Kessler syndrome**.
They can do this by using their actions to move space junk out of orbit.
Junk is considered out of orbit when it ends a players turn in the central earth sector where it will burn up in the atmosphere or in the outer space sectors beyond the outer ring where it drifts into a graveyard orbit.

Players take actions by playing **action cards** during their turn.
Although they have to be careful to stop junk colliding. Every time two or more pieces of junk finish their move or a players turn in the same sector a collision occurs. And the players have to draw a **disaster card**.

The board is made up of 30 sectors. 28 of these sectors are divided into three orbit rings. The additional 2 sectors, are the central earth sector and the outer space sector beyond the outer orbit ring.

Winning

Work together to **survive 5 turns without Kessler syndrome** occurring.

Kessler syndrome occurs when, at the end of the space junk move or a players turn:

all of the sectors in the outer orbit ring are filled with junk (16 total).

Or

When all of the sectors in the middle orbit ring **and** inner orbit ring are filled with junk (12 total).

Setting up the board

Set up the board as instructed below, with junk equally spaced out:

1 piece of junk on the inner orbit ring.
4 in the middle orbit ring.
4 in the outer orbit ring.

Players choose a coloured counter to play as, then take turns to decide where their spacecraft starts. A player's spacecraft can start in any sector and can be in the same sector as junk or another player's spacecraft without causing a collision.

Dealing cards

Shuffle the **blue** **action card** deck and deal 5 cards to each player.
Place the rest of the deck face down next to the board.
Action cards are discarded when used. Once the action card deck is empty shuffle the discard pile and place it face down as the new action card deck.
Shuffle the **orange** **disaster card** deck and place face down next to the board. Disaster cards are discarded when used. Once the disaster card deck is empty shuffle the discard pile and place it face down as the new disaster card deck.

Turn order

1. Junk Moves.

Starting from the **start** point on the outer ring going clockwise. Roll a dice for each piece of junk and move it clockwise around the ring the appropriate spaces:

1-2 = 1 space
3-4 = 2 spaces
5-6 = 3 spaces

Continue to do this for each orbit ring moving inwards.

2. Draw disaster cards.

Draw a disaster card for each collision that occurred. Collisions occur when two or more pieces of junk end their move or a players turn in the same sector.

3. Player turn.

Starting from the **start** point on the outer ring going clockwise. Player take it in turns make three **actions,** Using the **action cards** from their hand. Players must make three actions every turn. They then collect three new **action cards** from the deck.

4. More junk! Roll a dice and add the pieces of junk to the board.

1-2 = 1 piece
3-4 = 2 pieces
5-6 = 3 pieces

Players decide as a group where to place these new pieces of junk.

Players actions

Move—Move your satellite to any adjacent sector. You may move into sectors occupied by junk or another satellite without causing a disaster.

Laser ablation—Fire a laser at the junk causing a stream of hot gas to push it into a new orbit. You may only target junk in **adjacent sectors** to your satellite. Move the target piece of junk to any adjacent sector. You cannot move the junk into the same sector as your satellite.

Claw—Use your claw to capture the target and pull it into a new orbit. You must target a piece of junk in the **same sector** as your satellite. Move target piece of junk into any adjacent sector.
Note: This is the only method that the ClearSpace UK spacecraft will actually use in the **UK Space Agency's Active Debris Removal mission.** Specifically, the craft will drag junk satellites towards Earth, where they will burn up in the atmosphere. The other action cards are examples of other potential ways to clear space debris.

Missile—You throw caution to the wind and launch a missile at a target piece of junk in any sector. What's the worst that could happen?
Roll a dice:

1 = Draw 2 disaster cards for the targets sector.
2-5 = Draw 1 disaster card for the targets sector.
6 = The junk flies harmlessly off into space. Remove it.

Discard a card—If a player has no playable actions they can discard an action card instead of playing one.
NOTE—The **missile** and **move** actions are always playable.

Collisions and disaster cards

Draw **disaster cards** for collisions, when two or more pieces of junk finish their move or a players turn in the same sector.

Draw 1 disaster card if 2 pieces of junk are in the same sector.
Draw 2 disaster cards if 3 pieces of junk are in the same sector.
Draw 3 disaster cards if 4+ pieces of junk are in the same sector.

When resolving disaster cards. The new junk can be put in any adjacent sector that is empty, except the central earth sector or the outer space sectors. If there are no empty sectors place them in an occupied sector and draw another disaster card. Continue until all collisions and disasters are resolved.