

1C Conversion Chains

How can you use unit canceling to solve conversion problems?

$$115 \text{ km} \times \frac{1 \text{ mi}}{1.6 \text{ km}} = 72 \text{ mi}$$

Suppose you are traveling in Canada or Mexico, and you see a sign that says the next city is 115 km away. How

many miles is that? You could use the dimensional analysis process to figure it out. Dimensional analysis is a method of using conversion factors and unit canceling to solve unit conversion problems. In this activity, you will use conversion chains to start and solve conversions.

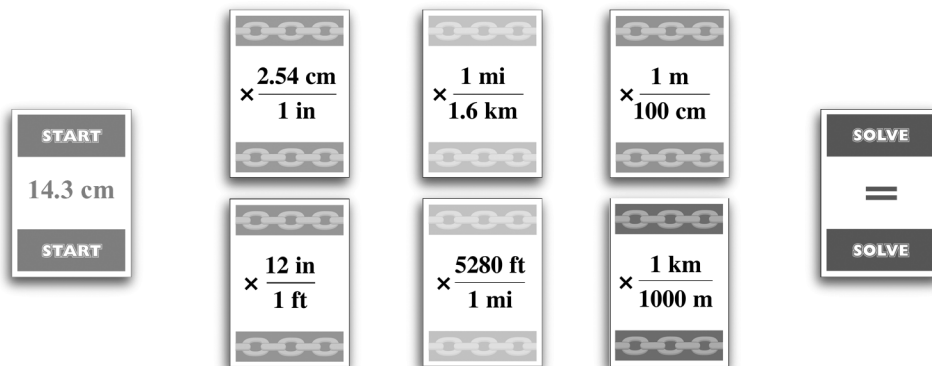
Materials

- Conversion Chain card deck
- Conversion chain table for recording chains and solutions
- Calculator

1 Conversion Chain cards

The deck of cards contains:

12 START cards, 12 SOLVE cards, 36 conversion factor cards



1. Look at the cards to identify what START, SOLVE, and conversion factor cards look like.
2. Shuffle the cards thoroughly!

2 Creating Conversion Chains

The object of the game is to have the most points after solving 6 conversion chains.

1. Deal 4 cards to each player (works best with 3–5 players).
2. Choose a player to go first. This player must play a START card draw one from the deck. If the player draws a START card, it may be played; otherwise play passes to the next player. Play passes until a START card has been played. Anytime a START card is played the player scores 5 points. (Each group must assign a scorekeeper).
3. The next player may play another START card or a conversion card that will continue the conversion chain. That means that the card must have a denominator unit that matches a START card unit, to cancel the starting unit and continue the chain. Only 6 START cards can be played in a game.

4. If the player has more than one card that could be played on multiple START cards, the player must choose only *one* card to play on each turn.
5. After playing a card, the player *must* draw a card.
6. If the player does not have a suitable card, the player must draw one card from the deck. If the card will play, he can play it. If the card won't play, he must pass his turn.
7. The next player plays a conversion factor card, plays a START card, or draws a card, and play continues.
8. A team can have as many as 3 conversion chains going at once.
9. After a minimum of 3 conversion factor cards have been played on any particular START card, any player is allowed to play a SOLVE card on her turn, and the player ***immediately scores 5 points for each conversion chain card in the chain.***

3 Solving a chain and scoring points

1. Anytime a SOLVE card is played on any conversion chain, all players must record the chain on the answer sheet and calculate the answer with the correct number of significant digits and unit.
2. Players compare answers and determine who has the correct answer. Consult your teacher if there are disagreements.
3. *Any* player with the correct answer scores 25 points.
4. Keep playing until your team has created and solved 6 conversion chains.
5. At the end of the game, after 6 conversion chains have been scored, players must subtract 5 points per card for unplayed cards remaining in the hand.
6. Total up the points, subtract the unused cards, and determine the winner.

4 Reminders and strategy

1. Whenever you play a START card, you score 5 points! If you draw a START card after 6 chains have already been started, you must keep that card in your hand, and it will cost you 5 points in the end.
2. Remember: you always draw a card at the end of *every* turn.
3. When a conversion chain has been solved, place the START, chain, and SOLVE cards to the side in a pile. You might want to look at a solved chain later in the game. Also, this will help your team keep track of how many conversion chains have been solved (the goal is to solve 6).
4. You can play a SOLVE card only after there are at least 3 conversion factor cards in any chain. For beginners, a SOLVE card should be played after 3 chain cards are in a chain. For advanced players, a SOLVE card can be held back and played after the chain is much longer. The SOLVE card player benefits, since 5 points are awarded for each chain card in the chain to that player!
5. Record each conversion chain your team creates in Table 1. There are blanks for recording 6 conversion factors per chain. If a chain has less than 6, just leave remaining boxes blank. If you need more than 6, continue on the back of the page.
6. The first row of Table 1 shows an example chain.

Table I: Conversion Chains

START card							Answer with correct sig figs and unit	Points scored
46.3 m	$\times \frac{1 \text{ km}}{1000 \text{ m}}$	$\times \frac{1 \text{ mi}}{1.6 \text{ km}}$	$\times \frac{5280 \text{ ft}}{1 \text{ mi}}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	153 ft	
	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$		
	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$		
	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$		
	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$		
	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$		
	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$		
	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$	$\times \text{ —}$		
							TOTAL	

5 Thinking about the game

a. The conversion chains you create for this game could be quite long, and the actual conversions could be solved with fewer conversion factors. What is the least number of conversion factors you would need to make these conversions, given the cards you have in the deck?

- converting ft to cm

- converting mi to m

b. Because of the limitations of the cards in the deck, to convert from km to cm, you would have to go through English units. What is a much easier way to convert from km to cm? Explain.

c. Explain the math reasoning behind why you are able to “cancel” like units that appear in the numerator and denominator of conversion factors in a conversion chain.
