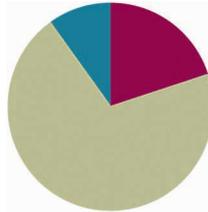


Lesson 5

Objective: Use addition and subtraction to solve multi-step word problems involving length, mass, and capacity.

Suggested Lesson Structure

■ Fluency Practice	(12 minutes)
■ Concept Development	(42 minutes)
■ Student Debrief	(6 minutes)
Total Time	(60 minutes)



Fluency Practice (12 minutes)

- Sprint: Convert to Kilograms and Grams **4.8A, 4.8B** (8 minutes)
- Convert Units **4.8A, 4.8B** (2 minutes)
- Unit Counting **4.8A, 4.8B** (2 minutes)

Sprint: Convert to Kilograms and Grams (8 minutes)

Materials: (S) Convert to Kilograms and Grams Sprint

Note: This Sprint helps students automatize their gram and kilogram conversions when applying them in word problems.

Convert Units (2 minutes)

Materials: (S) Personal white board

Note: Isolated review builds fluency with conversion so that students can use this skill as a tool for solving word problems.

T: (Write $1 \text{ L } 400 \text{ mL} = \underline{\quad} \text{ mL}$.) Fill in the equation.

S: (Write $1 \text{ L } 400 \text{ mL} = 1,400 \text{ mL}$.)

Repeat the process for $1 \text{ L } 40 \text{ mL}$, $1 \text{ L } 4 \text{ mL}$, and $1 \text{ L } 90 \text{ mL}$.



NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

Some of the objectives of the Sprint are to generate excitement about math, to cultivate self-determination and perseverance, and to offer joyful experiences of success in math. The first weeks of school are an appropriate time to involve students in the design of their Sprint experience. Guide students through a discussion to make optimal decisions about tools and supports that can be used, the sequence or timing for completion, and the type of reward and recognition for success and improvement.

Unit Counting (2 minutes)

Note: This fluency activity deepens student understanding of the composition and decomposition of unit conversions and works toward their mastery of adding and subtracting meters and centimeters. The numbers in bold type indicate the point at which the direction of the counting changes.

Direct students to count by centimeters using the following sequence:

- 800 cm, 1,600 cm, 2,400 cm, 3,200 cm, **4,000 cm**, 3,200 cm, 2,400 cm, 1,600 cm, 800 cm
- 800 cm, 1,600 cm, 2,400 cm, 3,200 cm, **4 m**, 3,200 cm, 2,400 cm, 1,600 cm, 800 cm
- 800 cm, 1 m 600 cm, 2 m 400 cm, 3 m 200 cm, **4 m**, 3 m 200 cm, 2 m 400 cm, 1 m 600 cm, 800 cm

Concept Development (42 minutes)

Materials: (S) Problem Set

Note: In this lesson, the Problem Set is comprised of the word problems from the lesson and used during the lesson itself for Problems 1–4. Problems 5 and 6 should be completed independently at the conclusion of the Concept Development. The lesson concludes with the Debrief.

1. Model the problem.

Have two pairs of students (choose as models those students who are likely to successfully solve the problem) work at the board while the others work independently or in pairs at their seats. Review the following questions before beginning the first problem.

- Can you draw something?
- What can you draw?
- What conclusions can you make from your drawing?

As students work, circulate. Reiterate the questions above.

After two minutes, have the two pairs of students share *only* their labeled diagrams.

For about one minute, have the demonstrating students receive and respond to feedback and questions from their peers.

2. Calculate to solve and write a statement.

Give everyone two minutes to finish work on the problem, sharing their work and thinking with a peer. All should then write their equations and statements for the answer.

3. Assess the solution for reasonableness.

Give students one to two minutes to assess and explain the reasonableness of their solutions.

Problem 1: Solve a two-step problem involving grams.

The potatoes Beth bought weighed 3 kilograms 420 grams. Her onions weighed 1,050 grams less than the potatoes. How much did the potatoes and onions weigh together?

Solution 1

Potatoes $3\text{ kg } 420\text{ g}$
 Onions $1,050\text{ g}$

$$\begin{array}{r} 3\text{ kg } 420\text{ g} \\ - 1,050\text{ g} \\ \hline 2\text{ kg } 370\text{ g} \end{array}$$

$$\begin{array}{r} 3\text{ kg } 420\text{ g} \\ + 2\text{ kg } 370\text{ g} \\ \hline 5\text{ kg } 790\text{ g} \end{array}$$

The potatoes and onions weigh $5\text{ kg } 790\text{ g}$.

Solution 2

P $3\text{ kg } 420\text{ g}$
 O $1,050\text{ g}$

$$3420 - 1050 = 2370$$

$$2370 + 3420 = 5790$$

The potatoes and onions weighed $5\text{ kg } 790\text{ g}$.

The structure of this problem and what it demands of the students is similar to that found within Module 1. Therefore, students are familiar with the process of a two-step problem. The main differences within this problem are that the focus is on mass and students are computing with mixed units. Lessons 1–4 have prepared the students for mixed unit calculations and conversions. Answering in mixed units or as a single unit of grams should be accepted. Watch for students using alternate strategies as well.

Problem 2: Solve a two-step problem involving meters.

Adele let out 18 meters 46 centimeters of string to fly her kite. She then let out 13 meters 78 centimeters more before reeling back in 590 centimeters. How long was her string after reeling it in?

Solution 1

Let Out $18\text{ m } 46\text{ cm}$ $13\text{ m } 78\text{ cm}$
 Reeled In h 590 cm

$$\begin{array}{r} 18\text{ m } 46\text{ cm} \\ + 13\text{ m } 78\text{ cm} \\ \hline 31\text{ m } 124\text{ cm} \\ \text{1 m} \quad 24\text{ cm} = 32\text{ m } 24\text{ cm} \\ 32\text{ m } 24\text{ cm} = 3,224\text{ cm} \\ \begin{array}{r} 3,224\text{ cm} \\ - 590\text{ cm} \\ \hline 2,634\text{ cm} \end{array} \\ 2,634\text{ cm} \\ \text{26 m } 34\text{ cm} \end{array}$$

The string was $26\text{ m } 34\text{ cm}$ after reeling it in.

Solution 2

$$\begin{aligned} &18\text{ m } 46\text{ cm} + 13\text{ m } 78\text{ cm} \\ &= 31\text{ m } 46\text{ cm} + 78\text{ cm} \\ &\quad \swarrow \quad \searrow \quad \swarrow \quad \searrow \\ &\quad 30 \quad 16 \quad 70 \quad 8 \\ &= 31\text{ m } 124\text{ cm} \\ &= 32\text{ m } 24\text{ cm} \end{aligned}$$

$$\begin{aligned} &32\text{ m } 24\text{ cm} - 590\text{ cm} \\ &3224\text{ cm} - 590\text{ cm} \\ &\quad \swarrow \quad \searrow \\ &2224 \quad +000 \\ &\quad \quad \quad 410 \\ &2224 + 410 = 2634 \end{aligned}$$

The string was $26\text{ m } 34\text{ cm}$.

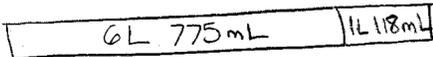
This two-step problem requires regrouping from meters to centimeters. As in the previous problem, students use what they have learned so far in Grade 4 to help solve this problem. Students might regroup across mixed units or change to similar units. In the second solution, the student adds the meters first, then the centimeters, and finally subtracts 590 centimeters from the total.

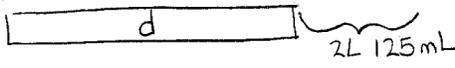
Problem 3

Solve a three-step problem involving liters.

Shyan's barrel contained 6 liters 775 milliliters of paint. She poured in 1 liter 118 milliliters more. The first day, Shyan used 2 liters 125 milliliters of the paint. After the second day, there were 1,769 milliliters of paint remaining in the barrel. How much paint did Shyan use on the second day?

Solution 1

Barrel 

Day 1 

Day 2 

$$\begin{array}{r} 6\text{ L } 775\text{ mL} \\ + 1\text{ L } 118\text{ mL} \\ \hline 7\text{ L } 893\text{ mL} \end{array}$$

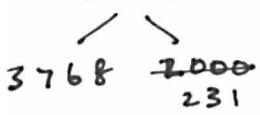
$$\begin{array}{r} 7\text{ L } 893\text{ mL} \\ - 2\text{ L } 125\text{ mL} \\ \hline 5\text{ L } 768\text{ mL} = 5,768\text{ mL} \end{array}$$

$$\begin{array}{r} 5,768\text{ mL} \\ - 1,769\text{ mL} \\ \hline 3,999\text{ mL} \end{array}$$

Shyan used 3,999 mL of paint on the second day.

Solution 2

$$\begin{aligned} 6775 - 2125 &= 4650 \\ 4650 + 1118 &= 5768 \\ 5768 - 1769 &= 3999 \end{aligned}$$



Shyan used 3 L 999 mL on the second day.

This is a three-step problem involving regrouping across units. Students are familiar with multi-step problems from Module 1 and extend their practice with them by solving with mixed units or converting to milliliters prior to solving. In the second solution, the student sees that it is easy to subtract 2,125 from 6,775 first, then adds the amount Adele poured in, and finally finishes the problem in the same way as shown in Solution 1, by subtracting the part left in the barrel.

Problem 4: Solve a three-step problem involving grams.

On Thursday, the pizzeria used 2 kilograms 180 grams less flour than they used on Friday. On Friday, they used 12 kilograms 240 grams. On Saturday, they used 1,888 grams more than on Friday. What was the total amount of flour used over the three days?

Solution 1

Thurs. \boxed{W} $\left. \begin{array}{l} \text{2 kg 180g} \\ \text{12 kg 240g} \\ \text{12 kg 240g} \end{array} \right\}$

Fri. $\boxed{12 \text{ kg } 240 \text{ g}}$

Sat. $\boxed{12 \text{ kg } 240 \text{ g } \quad 1,888 \text{ g}}$

$$\begin{array}{r} 12 \text{ kg } 240 \text{ g} \\ - 2 \text{ kg } 180 \text{ g} \\ \hline \text{Thurs. } 10 \text{ kg } 60 \text{ g} \end{array}$$

$12 \text{ kg } 240 \text{ g} = 12,240 \text{ g}$

$$\begin{array}{r} 12,240 \text{ g} \\ + 1,888 \text{ g} \\ \hline \text{Sat. } 14,128 \text{ g} \end{array}$$

$$\begin{array}{r} 10,060 \text{ g} \\ 12,240 \text{ g} \\ \hline 22,300 \text{ g} \\ + 14,128 \text{ g} \\ \hline 36,428 \text{ g} \end{array}$$

The total amount of flour was 36 kg 428g.

36 kg 428g

Solution 2

3 units of 12 kg 240g = 36 kg 720g

2 kg 180g - 1 kg 888g = 292g

$$\begin{array}{r} 1 \text{ kg } 1000 \text{ g} \\ - 1 \text{ kg } 888 \text{ g} \\ \hline 112 \text{ g} \end{array}$$

36 kg 720g - 292g = 36 kg 428g

$$\begin{array}{r} 36 \text{ kg } 720 \text{ g} \\ - 292 \text{ g} \\ \hline 35 \text{ kg } 428 \text{ g} \end{array}$$

The bakery used 36 kg 428g.

This three-step problem increases the complexity in that students might calculate, as in the first solution, for the three addends to complete the third step for determining how much flour was used over the three days. In the second solution strategy, the student, because of the strip diagram, notices 3 units of Friday minus the difference between the two small chunks. The answer will be a little less than three Fridays' worth of flour.

Problem Set (10 minutes)

Please note that Problems 1 through 4 of the Problem Set for this lesson are comprised of the lesson’s problems as stated at the introduction of the lesson. Problems 5 and 6 may be completed individually during this part of the lesson.

For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students should solve these problems using the RDW approach used for Application Problems.

Student Debrief (6 minutes)

Lesson Objective: Use addition and subtraction to solve multi-step word problems involving length, mass, and capacity.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

Any combination of the questions below may be used to lead the discussion.

- How was the work completed to solve Problem 5 in the Problem Set different than that of the other problems?
- Did you find yourself using similar strategies to add and to subtract the mixed unit problems? Explain.
- How can drawing different models to represent a problem lead you to a correct answer?
- How was drawing a model helpful in organizing your thoughts to solve Problem 6?
- Describe a mixed unit. What other mixed units can you name?
- How can converting to a smaller unit be useful when solving problems? When is it not useful?



NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

Sustain engagement during this challenging lesson by guiding and rewarding responsible collaboration among students. Teach students to independently ask themselves, “Can I draw something? What can I draw? What conclusions can I make from my drawing?” Empower students to self-monitor their math work with a rubric for problem solving. Students working below or above grade level may want to omit drawing. Emphasize the value of modeling. Ask, “How did the picture help you solve? What happened when you did not draw the picture? Why?”

Name _____ Date _____

Model each problem with a tape diagram. Solve and answer with a statement.

1. The potatoes Beth bought weighed 3 kilograms 420 grams. Her onions weighed 1,050 grams less than the potatoes. How much did the potatoes and onions weigh together?



potatoes 3 kg 420g
 onions 1,050g

$$\begin{array}{r} 3 \text{ kg } 420 \text{ g} \\ - 1,050 \text{ g} \\ \hline 2 \text{ kg } 370 \text{ g (onions)} \end{array}$$

$$\begin{array}{r} 3 \text{ kg } 420 \text{ g} \\ + 2 \text{ kg } 370 \text{ g} \\ \hline 5 \text{ kg } 790 \text{ g} \end{array}$$

The potatoes and onions together weigh 5 kg 790g.

2. Adele let out 18 meters 46 centimeters of string to fly her kite. She then let out 13 meters 78 centimeters more before reeling back in 590 centimeters. How long was her string after reeling it in?



Let out 18 m 46 cm 13 m 78 cm
 after reeling in 590 cm

$$\begin{array}{r} 18 \text{ m } 46 \text{ cm} \\ + 13 \text{ m } 78 \text{ cm} \\ \hline 31 \text{ m } 124 \text{ cm} \end{array}$$

$$\begin{array}{r} 31 \text{ m } 124 \text{ cm} \\ - 590 \text{ cm} \\ \hline 25 \text{ m } 534 \text{ cm} \end{array}$$

The string was 25 m 534 cm after reeling it in.

3. Shyan's barrel contained 6 liters 775 milliliters of paint. She poured in 1 liter 118 milliliters more. The first day, Shyan used 2 liters 125 milliliters of the paint. At the end of the second day, there were 1,769 milliliters of paint remaining in the barrel. How much paint did Shyan use on the second day?

Barrel after day 1 6 L 775 mL 1 L 118 mL
 after day 2 1,769 mL

$$\begin{array}{r} 6 \text{ L } 775 \text{ mL} \\ + 1 \text{ L } 118 \text{ mL} \\ \hline 7 \text{ L } 893 \text{ mL} \end{array}$$

$$\begin{array}{r} 7 \text{ L } 893 \text{ mL} \\ - 2 \text{ L } 125 \text{ mL} \\ \hline 5 \text{ L } 768 \text{ mL} \end{array}$$

$$\begin{array}{r} 5 \text{ L } 768 \text{ mL} \\ - 4 \text{ L } 879 \text{ mL} \\ \hline 889 \text{ mL} \end{array}$$

Shyan used 889 mL of paint on the second day.

- How is regrouping a mixed unit of measurement similar to regrouping a whole number when adding or subtracting?
- How is converting mixed units of measurement useful in everyday situations?

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

4. On Thursday, the pizzeria used 2 kilograms 180 grams less flour than they used on Friday. On Friday, they used 12 kilograms 240 grams. On Saturday, they used 1,888 grams more than on Friday. What was the total amount of flour used over the three days?

Friday $12\text{ kg } 240\text{ g}$
 Thursday $2\text{ kg } 180\text{ g}$
 Saturday $12\text{ kg } 240\text{ g} + 1,888\text{ g}$

$12\text{ kg } 240\text{ g} + 10\text{ kg } 60\text{ g} = 22\text{ kg } 300\text{ g}$
 $22\text{ kg } 300\text{ g} + 1\text{ kg } 888\text{ g} = 24\text{ kg } 1188\text{ g}$

The total amount of flour used over the three days was $24\text{ kg } 1188\text{ g}$.

5. The gas tank in Zachary's car has a capacity of 60 liters. He added 23 liters 825 milliliters of gas to the tank, which already has 2,050 milliliters of gas. How much more gas can Zachary add to the gas tank?

$60\text{ L} - 23\text{ L } 825\text{ mL} = 36\text{ L } 175\text{ mL}$
 $36\text{ L } 175\text{ mL} - 2,050\text{ mL} = 34\text{ L } 125\text{ mL}$

Zachary can add $34\text{ L } 125\text{ mL}$ more gas to his car.

6. A giraffe is 5 meters 20 centimeters tall. An elephant is 1 meter 77 centimeters shorter than the giraffe. A rhinoceros is 1 meter 58 centimeters shorter than the elephant. How tall is the rhinoceros?

giraffe $5\text{ m } 20\text{ cm}$
 elephant $1\text{ m } 77\text{ cm}$
 rhinoceros $1\text{ m } 58\text{ cm}$

$5\text{ m } 20\text{ cm} - 1\text{ m } 77\text{ cm} = 3\text{ m } 43\text{ cm}$
 $3\text{ m } 43\text{ cm} - 1\text{ m } 58\text{ cm} = 1\text{ m } 85\text{ cm}$

The rhinoceros was $1\text{ meter } 85\text{ centimeters}$ tall.

A

Number Correct: _____

Convert to Kilograms and Grams

1.	2,000 g =	kg	g
2.	3,000 g =	kg	g
3.	4,000 g =	kg	g
4.	9,000 g =	kg	g
5.	6,000 g =	kg	g
6.	1,000 g =	kg	g
7.	8,000 g =	kg	g
8.	5,000 g =	kg	g
9.	7,000 g =	kg	g
10.	6,100 g =	kg	g
11.	6,110 g =	kg	g
12.	6,101 g =	kg	g
13.	6,010 g =	kg	g
14.	6,011 g =	kg	g
15.	6,001 g =	kg	g
16.	8,002 g =	kg	g
17.	8,020 g =	kg	g
18.	8,200 g =	kg	g
19.	8,022 g =	kg	g
20.	8,220 g =	kg	g
21.	8,222 g =	kg	g
22.	7,256 g =	kg	g

23.	3,800 g =	kg	g
24.	4,770 g =	kg	g
25.	4,807 g =	kg	g
26.	5,065 g =	kg	g
27.	5,040 g =	kg	g
28.	6,007 g =	kg	g
29.	2,003 g =	kg	g
30.	1,090 g =	kg	g
31.	1,055 g =	kg	g
32.	9,404 g =	kg	g
33.	9,330 g =	kg	g
34.	3,400 g =	kg	g
35.	4,000 g + 2,000 g =	kg	g
36.	5,000 g + 3,000 g =	kg	g
37.	4,000 g + 4,000 g =	kg	g
38.	$8 \times 7,000$ g =	kg	g
39.	$49,000$ g $\div 7$ =	kg	g
40.	$16,000$ g $\times 5$ =	kg	g
41.	$63,000$ g $\div 7$ =	kg	g
42.	$17 \times 4,000$ g =	kg	g
43.	$13,000$ g $\times 5$ =	kg	g
44.	$84,000$ g $\div 7$ =	kg	g

B

Number Correct: _____

Improvement: _____

Convert to Kilograms and Grams

1.	1,000 g =	kg	g
2.	2,000 g =	kg	g
3.	3,000 g =	kg	g
4.	8,000 g =	kg	g
5.	6,000 g =	kg	g
6.	9,000 g =	kg	g
7.	4,000 g =	kg	g
8.	7,000 g =	kg	g
9.	5,000 g =	kg	g
10.	5,100 g =	kg	g
11.	5,110 g =	kg	g
12.	5,101 g =	kg	g
13.	5,010 g =	kg	g
14.	5,011 g =	kg	g
15.	5,001 g =	kg	g
16.	7,002 g =	kg	g
17.	7,020 g =	kg	g
18.	7,200 g =	kg	g
19.	7,022 g =	kg	g
20.	7,220 g =	kg	g
21.	7,222 g =	kg	g
22.	4,378 g =	kg	g

23.	2,700 g =	kg	g
24.	3,660 g =	kg	g
25.	3,706 g =	kg	g
26.	4,095 g =	kg	g
27.	4,030 g =	kg	g
28.	5,006 g =	kg	g
29.	3,004 g =	kg	g
30.	2,010 g =	kg	g
31.	2,075 g =	kg	g
32.	1,504 g =	kg	g
33.	1,440 g =	kg	g
34.	4,500 g =	kg	g
35.	3,000 g + 2,000 g =	kg	g
36.	4,000 g + 3,000 g =	kg	g
37.	5,000 g + 4,000 g =	kg	g
38.	$9 \times 8,000$ g =	kg	g
39.	$64,000$ g \div 8 =	kg	g
40.	$17,000$ g \times 5 =	kg	g
41.	$54,000$ g \div 6 =	kg	g
42.	$18,000$ g \times 4 =	kg	g
43.	$14 \times 5,000$ g =	kg	g
44.	$96,000$ g \div 8 =	kg	g

Name _____

Date _____

Model each problem with a strip diagram. Solve and answer with a statement.

1. The potatoes Beth bought weighed 3 kilograms 420 grams. Her onions weighed 1,050 grams less than the potatoes. How much did the potatoes and onions weigh together?



2. Adele let out 18 meters 46 centimeters of string to fly her kite. She then let out 13 meters 78 centimeters more before reeling back in 590 centimeters. How long was her string after reeling it in?



3. Shyan's barrel contained 6 liters 775 milliliters of paint. She poured in 1 liter 118 milliliters more. The first day, Shyan used 2 liters 125 milliliters of the paint. At the end of the second day, there were 1,769 milliliters of paint remaining in the barrel. How much paint did Shyan use on the second day?

4. On Thursday, the pizzeria used 2 kilograms 180 grams less flour than they used on Friday. On Friday, they used 12 kilograms 240 grams. On Saturday, they used 1,888 grams more than on Friday. What was the total amount of flour used over the three days?



5. The gas tank in Zachary's car has a capacity of 60 liters. He adds 23 liters 825 milliliters of gas to the tank, which already has 2,050 milliliters of gas. How much more gas can Zachary add to the gas tank?

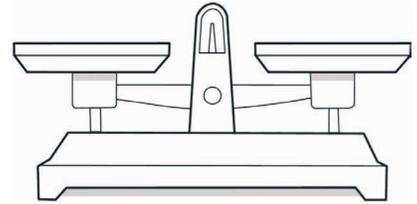
6. A giraffe is 5 meters 20 centimeters tall. An elephant is 1 meter 77 centimeters shorter than the giraffe. A rhinoceros is 1 meter 58 centimeters shorter than the elephant. How tall is the rhinoceros?

Name _____

Date _____

Model each problem with a strip diagram. Solve and answer with a statement.

1. Jeff places a pineapple with a mass of 890 grams on a balance scale. He balances the scale by placing two oranges, an apple, and a lemon on the other side. Each orange weighs 280 grams. The lemon weighs 195 grams less than each orange. What is the mass of the apple?



2. Brian is 1 meter 87 centimeters tall. Bonnie is 58 centimeters shorter than Brian. Betina is 26 centimeters taller than Bonnie. How tall is Betina?

4. A Springer Spaniel weighs 20 kilograms 490 grams. A Cocker Spaniel weighs 7,590 grams less than a Springer Spaniel. A Newfoundland weighs 52 kilograms 656 grams more than a Cocker Spaniel. What is the difference, in grams, between the weights of the Newfoundland and the Springer Spaniel?
5. Marsha has three rugs. The first rug is 2 meters 87 centimeters long. The second rug has a length 98 centimeters less than the first. The third rug is 111 centimeters longer than the second rug. What is the difference in centimeters between the length of the first rug and the third rug?
6. One barrel held 60 liters 868 milliliters of sap. A second barrel held 20,089 milliliters more sap than the first. A third barrel held 40 liters 82 milliliters less sap than the second. If the sap from the three barrels was poured into a larger container, how much sap would there be in all?