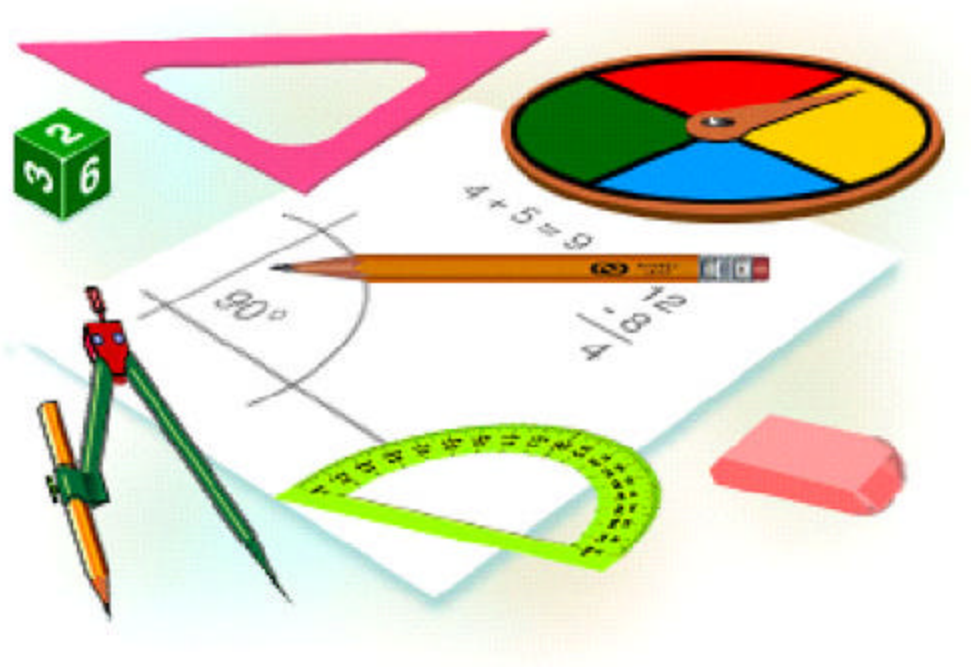
The Next Step

Mathematics Applications for Adults



Book 14013 – Measurement

OUTLINE

Mathematics - Book 14013

Measurement
Time
demonstrate an understanding of divisions of time
Money
make change in dollars and cents to $20.00.
count change back orally beginning with the cost of an item and amount tendered.
Metric Measurement
use metric measurement to estimate and measure linear, volume and mass measurements.
use correct units for linear, volume and mass measurements.
use a chart to convert from large to small (and vice versa) metric units.
Word Problems with Measurement
Solve one/two step problems with addition, subtraction, multiplication and division of whole numbers, time, money, temperature, and metric measurement.

THE NEXT STEP

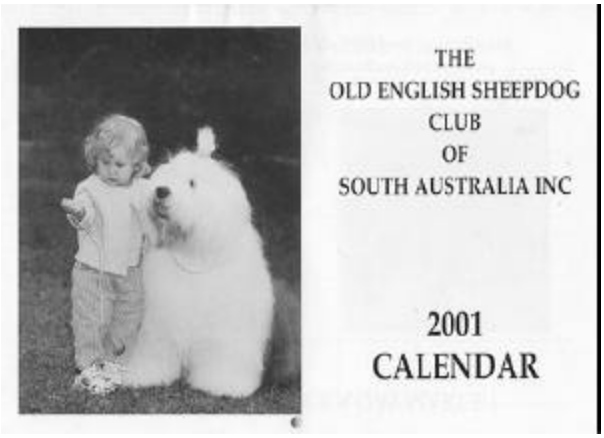
Book 14013

Measurement

Time

A ***day*** is the time it takes earth to spin around once on its *axis*, or twenty-four hours. (The axis is an imaginary pole that runs through the middle of the planet from the North Pole to the South Pole.) Seven days make up one *week*. Twenty-eight to thirty-one days make up one ***month***. A month is the approximate time needed for the moon to revolve once around earth. The lunar month actually takes twenty-nine days, twelve hours, forty-four minutes, and three seconds.

Twelve months make up one ***year***. A year is the time it takes earth to revolve once around the sun, or 365 days, five hours, forty-eight minutes, and forty-six seconds.

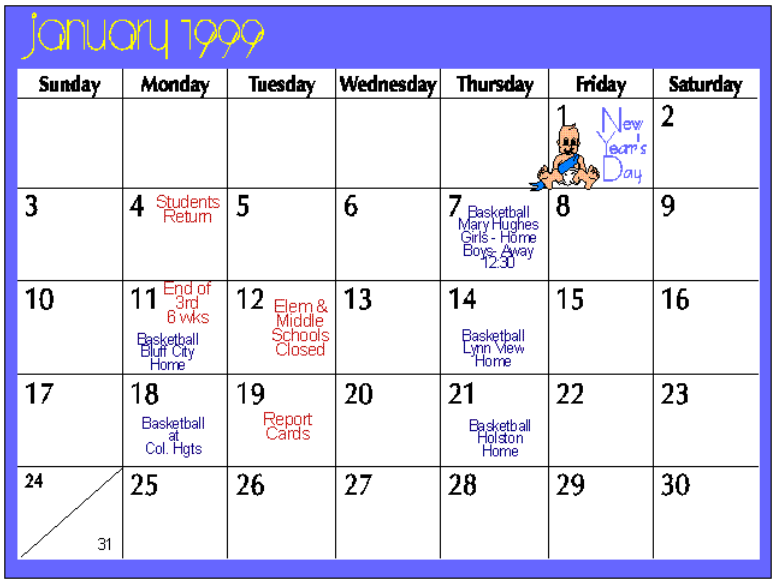


Calendars are tools that help us group days into weeks, months, and years. The calendar used throughout the world today is called the ***Gregorian*** calendar.

The astronomer Sosigenes was asked by Julius Caesar to created a calendar for the Roman Empire. The calendar was based on the solar year of 365 days. The year was divided into twelve months. Each month lasted thirty or thirty-one days, with the exception of February, which lasted either twenty-eight or twenty-nine days. The Julian calendar is the basis for the Gregorian calendar that was introduced by Pope Gregory VIII in 1582. The names used for the months in the Roman calendar were used in the Julian calendar. These names are also used today.

Roman	Gregorian	Roman	Gregorian
Januarius	**January**	**Quintilis**	**July**
Februarius	**February**	**Sextilis**	**August**

Martius	**March**	**September**	**September**
Aprilis	**April**	**October**	**October**
Maius	**May**	**November**	**November**
Junius	**June**	**December**	**December**



The names we use for weekdays come from the Saxons of England. The Saxons named the days for the planets and their gods.

SUN'S day .....Sunday
MOON'S day .....Monday
TIW'S day .....Tuesday
WODEN'S day .....Wednesday
THOR'S day.....Thursday
FRIGG'S day .....Friday
SATURN'S day .....Saturday

We divide ***days*** into 24 ***hours***, but hours are divided into ***60*** parts. Roman astronomers called each division a ***par minuta*** or "small part of an hour." From the Latin name comes our word

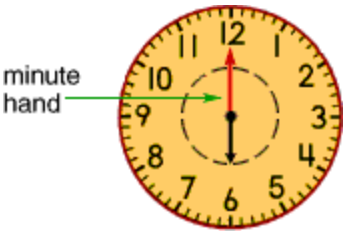
minute. These early astronomers also divided minutes into *60* equal parts. They called each division ***par seconda***, or ***second***.

Measures of Time

1 minute (min.) = 60 seconds (sec.)
1 hour (hr.) = 60 minutes
1 day (da.) = 24 hours
1 week (wk.) = 7 days
1 year (yr.) = 365 days

Hour Hand

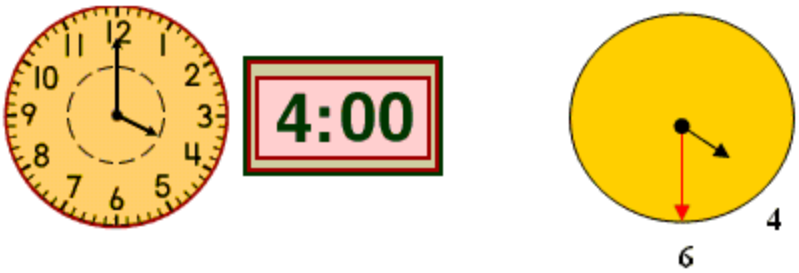
Minute Hand



O'clock

The clock shows 1 **o'clock**

Half Hour



A **half hour** is 30 minutes, so when the **minute hand** reaches the six and the hour hand remains on four, the new time will be **4:30.**

Standard time means the measurement of the day in two blocks of twelve hours each. The twelve hours from midnight to just before noon are ***a.m.*** hours. The twelve hours from noon until just before midnight are ***p.m.*** hours. The abbreviations "a.m." and "p.m." come from the Latin for ***ante meridiem*** and ***post meridiem***, meaning ***before*** (ante) and ***after*** (post) midday or noon (***meridiem***).

Today many clocks and watches use the battery-powered vibrations of a quartz crystal to keep time. The natural vibration of a quartz crystal is 100,000 times per second. Modern clocks and watches show the time in digital as well as analog displays.

Digital **Analog**

How to Tell Time

This clock demonstrates how minutes are to be read on an analog clock face. We know that there are 60 minutes in one hour, so the minute hand indicates the number of minutes that we are to read. In this picture, the minute hand (the longer red hand) is pointing at the 2 which stands for 10 minutes. The hour hand (the shorter blue hand) is pointing at the 9. We

can read the time as “10 minutes after 9”, “10 minutes past 9”, or “9:10”. You could even say that it is “50 minutes before 10”, because it will take another 50 minutes before the hour hand points at the 10.

To figure out the minutes on a clock face, you must skip count by fives. For example, the 1 represents 5 minutes, the 2 represents 10 minutes, the 3 represents 15 minutes…and so on.

Practice Exercise

1.  _____:_____	**2.**  _____:_____	**3.**  _____:_____	**4.**  _____:_____
5.  _____:_____	**6.**  _____:_____	**7.**  _____:_____	**8.**  _____:_____
9.  _____:_____	**10.**  _____:_____	**11.**  _____:_____	**12.**  _____:_____

Digital time is read from left to right. The first number stands for hours and the second number, after the colon, stands for minutes.
The clock above reads “10:20”. That means 10 hours and 20 minutes.
You will also notice that the numbers are proceeded by the letters “P.M.” which tells us that this clock is reading “10:20 in the evening”, “20 minutes after 10”, “20 minutes past 10”, “40 minutes before 11”, or “40 minutes to 1”.

Money

The word ***dollar*** comes from the German word for a large silver coin, the ***Thaler***. In 1781, ***cent*** was suggested as a name for the smallest division of the dollar. Thomas Jefferson, third President of the United States and an amateur scientist, thought that the dollar should be divided into 100 parts. The word ***cent*** comes from the Latin ***centum***, which means one hundred.

1 penny = 1 cent (¢)
1 nickel = 5 cents
1 dime = 10 cents
1 quarter = 25 cents
1 loonie ($) = 100 cents
1 toonie = 200 cents

Penny (Cent)

Nickel

Dime

Quarter

Dollar (Loonie)

Toonie

Canadian money is created in decimal-based currency. That means we can add, subtract, divide, and multiply money the same way we do any decimal numbers.

The basic unit of Canadian currency is the “loonie” or dollar. The dollar has the value of one on a place value chart. The decimal point separates dollars from cents, which are counted as tenths and hundredths in a place value chart.

$1.11	**ones = dollars**	**.**	**tenths = dimes**	**hundredths = pennies**
one cent				**1**
ten cents		**.**	**1**	**0**
one dollar	**1**	**.**	**0**	**0**

$4.63	**ones = dollars**	**.**	**tenths = dimes**	**hundredths = pennies**
three cents				**3**
sixty cents		**.**	**6**	**0**
four dollars	**4**	**.**	**0**	**0**

$1.11 = $1.00 + 10Ë + 1Ë is read as 1 dollar and 11 cents
$4.63 = $4.00 + 60Ë + 3Ë is read as 4 dollars and 63 cents

When you write down amounts of money using the dollar sign, ***$***, you write the amounts the same way as you write decimal numbers—in decimal notation. There is a separate cents sign, ***Ë***. The cents sign does not use decimal notation. So if you have to add cents to dollars, you have to change cents to dollar notation.

8Ë = $.08

36Ë = $.36

100Ë = $1.00

Practice Exercise

How much is the money worth?

1. 

$ _____

2.

$ _____

3.

$ _____

4.


$ _____

5.



$ _____

6.





$ _____

7.







$ _____

8. 

$ _____

Fill in the blank.

1. 5 dimes equals _____ cents.
2. **113** cents equals _____ dime, _____ dollar, _____ pennies.
3. 5 dollars, 4 quarters equals _____ cents.
4. **201** cents equals _____ dollar, _____ penny, _____ nickels, _____ quarters.
5. 4 dimes equals _____ cents.
6. 4 pennies, 1 dime equals _____ cents.
7. **300** cents equals _____ nickels, _____ dollars,
   _____ dimes, _____ quarters.
8. 5 dollars equals _____ cents.
9. 2 dollars, 2 quarters, 2 dimes equals _____ cents.

10. 4 dimes, 5 dollars equals _____ cents.
11. **560** cents equals _____ quarters, _____ nickels, _____ dollars.
12. 7 quarters equals _____ cents.
13. **190** cents equals _____ dollar, _____ quarters, _____ nickels.
14. 9 quarters equals _____ cents.
15. 5 dollars, 2 nickels equals _____ cents.
16. **223** cents equals _____ dollars, _____ nickels, _____ pennies.
17. 7 dimes equals _____ cents.
18. 4 dollars, 4 nickels, 3 quarters, 3 pennies equals _____ cents.
19. 4 dollars, 5 pennies equals _____ cents.
20. 2 nickels equals _____ cents.
21. **557** cents equals _____ dime, _____ pennies, _____ quarter, _____ nickels, _____ dollars.
22. **255** cents equals _____ pennies, _____ dollars, _____ quarters.

Making Change

Change is the difference between how much something costs and the amount of money given.

toothpaste 59Ë

You give the cashier $1.00
$1.00
- .59
Your change $ .49

soap = $1.59
towel = $4.50
shampoo = $3.60
total = $9.69

You give $10.00
$10.00
- 9.69
Your change $ .41

Change can be returned in different combinations.

41 cents =
4 dimes + 1 penny
2 dimes + 4 nickels + 1 penny
1 dime + 6 nickels + 1 penny
8 nickels + 1 penny

1 quarter + 1 dime + 1 nickel + 1 penny
41 pennies

Practice Exercise

Circle the coins needed to equal the amount of money shown.

1.

Circle **41** cents!

2.

Circle **17** cents!

3.

Circle **15** cents!

4.

Circle **30** cents!

5.

Circle **36** cents!

6.

Circle **32** cents!

You go shopping. What is the cost of your purchases in each store and how much change will you receive? These purchases do not have tax.

1. Grocery Store: You buy 1 loaf of bread 99¢, 1 can of tuna $1.35, margarine $2.01 and sliced cheese $3.56. You give the cashier $8.00.
   cost of purchase? _____
   change? _____

2. Shoe Store: You buy 1 pair of winter boots $95.00 and 1 pair of running shoes $35.99. You give the cashier $140.00.
   cost of purchase? _____
   change? _____

   Now it is bill time:
3. Your telephone bill for June is $276.35. You give the teller $300.00.
   change? _____

4. You go to a coffee shop for a coffee $1.25, hamburger $2.50, french fries 75¢ and pie $1.25. You give the cashier $10.00.
   cost of purchase? _____
   change? _____

Metric Measurement

In the 1790s, French scientists worked out a system of measurement based on the ***meter***. The meter is one ten-millionth of the distance between the North Pole and the Equator. The French scientists made a metal rod equal to the length of the standard meter.

By the 1980s, the French metal bar was no longer a precise measure for he meter. Scientists figured out a new standard for the meter. They made it equal to 1/299,792,548 of the distance light travels in a vacuum in one second.

Since the speed of light in a vacuum never changes, the distance of the meter will not change.

The French scientists developed the ***metric*** system to cover measurement of length, area, volume, and weight.

Metric Length Equivalents

Metric Unit	Abbreviation	Metric Equivalent
millimeter	mm	.1 centimeter
centimeter	cm	10 millimeters
decimeter	dm	10 centimeters
meter	m	100 centimeters
decameter	dam	10 meters
hectometer	hm	100 meters
kilometer	km	1000 meters

Metric Weight Equivalents

Metric Unit	Abbreviation	Metric Equivalent
milligram	mg	.001 gram
centigram	cg	10 milligrams
decigram	dg	10 centigrams
gram	g	1,000 milligrams
decagram	dag	10 grams
hectogram	hg	100 grams
kilogram	kg	1,000 grams

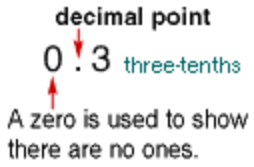
Metric Volume Measures

Metric Unit	Abbreviation	Metric Equivalent
milliliter	ml	.001 liter
centiliter	cl	10 milliliters
deciliter	dl	10 centiliters
liter	l	1,000 milliliters
decaliter	dal	10 liters
hectoliter	hl	100 liters
kiloliter	kl	1,000 liters

Decimal Point

A period that separates the whole numbers from the fractional part of a number; or that separates dollars from cents

Example:



Kilometers Hectometers Decameters Meters Decimeters Centimeters Millimeters

Kilograms Hectograms Decagrams Grams Decigrams Centigrams Milligrams

Kiloliters Hectoliters Decaliters Liters Deciliters Centiliters Milliliters

To use this chart, if a question asks you how many grams that you can get from 200 centigrams, for example, try this:

Start by putting down the number:

200

If we don’t see a decimal point, the number is a whole number; and therefore, a decimal point may be inserted to the right of the last digit:

200.

Now, using your chart, start at centigrams and count back to grams (two spaces to the left).

Move the decimal point in your number the same amount of spaces in the same direction:

2.00

The answer to the question is that 200 centigrams is equal to 2 grams.

If a question asks you to tell how many millimeters are is 8.3 decimeters, try this:

Write down the number:

8.3

We already see a decimal point, so there is no need to guess where to place it:

8.3

Now, using your chart, start at decimeters and count forward to millimeters (two spaces to the right).

Move the decimal point in your number the same amount of spaces in the same direction:

830.

The answer to the question is that 830 millimeters is equal to 8.3 decimeters.

Fill in the answer.

1. 8 kg = _____ g
2. 7 cm = _____ mm
3. 8 L = _____ cl
4. 60 ml = _____ cl
5. 2 m = _____ cm
6. 40 mg = _____ cg
7. 10 m = _____ cm
8. 9000 g = _____ kg
9. 900 cm = _____ m
10. 12000 m = _____ km
11. 1 cg = _____ mg
12. 11000 L = _____ kl

13. 30 mg = _____ cg

14. 11 m = _____ mm

15. 12 m = _____ cm

16. 1 L = _____ ml

17. 7 km = _____ m

18. 7 L = _____ cl

19. 90 mm = _____ cm

20. 3 g = _____ mg

21. 10 kl = _____ L

22. 110 mg = _____ cg

23. 500 cl = _____ L

24. 5 cg = _____ mg

25. 4 km = _____ m

26. 4000 mg = _____ g

27. 10 cm = _____ mm

28. 1 kl = _____ L

29. 80 ml = _____ cl

30. 6000 mg = _____ g

31. 6000 L = _____ kl

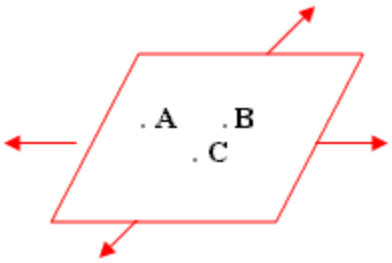
32. 12 cl = _____ ml

33. 3 km = _____ m

Geometric Shapes

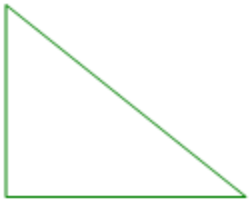
Polygons are two-dimensional, or flat, shapes, formed from three or more line segments that lie within one ***plane***.

Planes are an infinite set of points that make up a flat surface. Planes extend in all directions to infinity but have no thickness.



Plane ABC

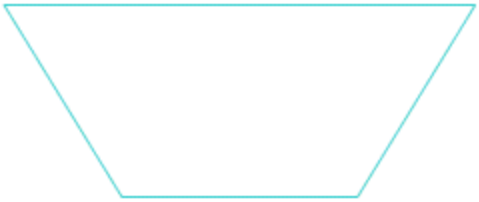
The line segments in polygons form angles that meet at points called ***vertexes*** (corners). Polygons come in many shapes and sizes, including:



Triangles are polygons that have three sides and three vertexes.

Quadrilaterals are polygons that have four sides and four vertices.

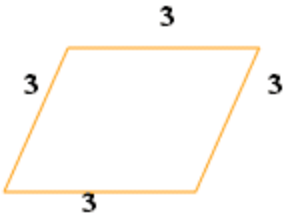
Parallelograms are quadrilaterals that have parallel line segments in both pairs of opposite sides.



Trapezoids are quadrilaterals that have one pair of parallel sides.

Squares are rectangles that have sides of equal length.

Rectangles are parallelograms formed by line segments that meet at right angles. A rectangle always has four right angles.

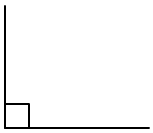


Rhombuses are parallelograms that have sides of equal length.

Against the Grain by 6/26/99

Polygons

Name	Number of sides
triangle	3
quadrilateral	4
square	4 equal and perpendicular (meet at right angles)
rectangle	4 perpendicular
rhombus	4 equal opposite parallel
parallelogram	4 opposite parallel
pentagon	5
hexagon	6
heptagon	7
octagon	8
nonagon	9

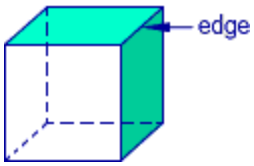


decagon	**10**
undecagon or hendecgon	**11**
dodecagon	**12**
icosagon	**20**

Edge

The line segment where two faces of a solid figure meet

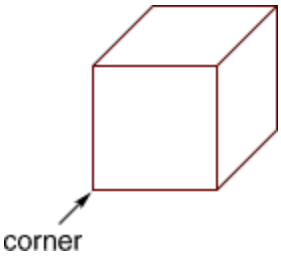
Example:



Corner (Vertex)

The place where two or more edges meet

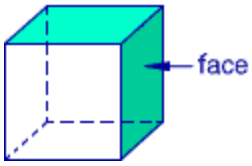
Example:



Face

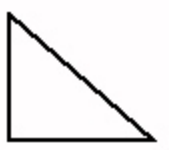
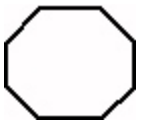
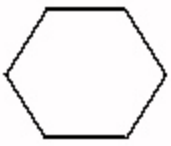
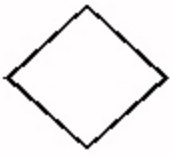
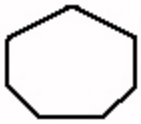
A flat surface of a solid figure

Example:



Practice Exercise

Write down the name for each polygon.

1.  **Triangle**	2.  _____
3.  _____	4.  _____
5.  _____	6.  _____
7.  _____	8.  _____

Word Problems with Measurement

Solve the problems below.

1. The restaurant opens at 10:00 a.m. and closes at 8:00 p.m. everyday. How long is the restaurant open each day?

2. Sue Langdon left her house at 11:15 a.m. Her bus journey to the cinema took 35 minutes. She arrived at the cinema 25 minutes early for the show. What time did the show start?

3. **Mr Hoffman drove from Woodstock to Fredericton. His drive took 1 h 20 min. If he arrived at Fredericton at 3:15 p.m., what time did he leave Woodstock?**

4. **One complete lap on a running track is 400m. Barry ran 4 and a half laps. What distance did he run?**

5. **Nick is 1 m 23 cm tall. Kimberly is 12 cm shorter than Nick. What is their total height?**

6. **The distance between Nackawic and Millville is 12 km 400 m and between Nackawic and Crabbe Mountain is 26 km. Tom travelled from Nackawic to Millville and then returned to Nackawic before going to Crabbe Mountain. What was the total distance Tom travelled?**

7. **Jerry has 16 pieces of string each 59 cm long. To tie one parcel, he needs 92 cm. How many parcels can Jerry tie?**

8. A train travels from Montreal to Bathurst, passing Campbellton. The train travels 85 km in each hour. From Montreal to Campbellton it takes 3 hours and from Campbellton to Bathurst it takes 2 hours. What is the distance between Montreal and Bathurst?

9. **The total weight of a bag with 8 books inside is 2 kg 340 g. If the bag weighs 950 g, what is the weight of the books?**

10. One tennis ball weighs 25 g. A box of tennis balls weighs 390 g. If the box weighs 15 g, how many tennis balls are packed into each box?

11. My mother baked 4 cakes using 8 packets of flour, 2 packets of sugar and 20 eggs. 1 packet of flour weighs 600g, 1 packet of sugar weighs 450 g and each egg weighs 35 g. What is the weight of each cake?

12. **Johnny wants to buy a tennis racket which costs $65.30. He has only $56.50. How much more money does he need?**

13. **Mary's mother asked her to buy 3 packets of milk. Each packet of milk costs $1.55. If her mother gave her $5, how much change would she receive?**

14. **Susan had $24.35. She bought a doll for $12.95 and a bookmark for $0.80. How much money had she left?**

15. **George paid $3.50 for 10 slices of bacon. How much was 1 slice of bacon? How much would 15 slices of bacon cost?**

16. **6 boys bought a present for their teacher for Valentine's Day. If each boy paid $6.40, how much was the present?**

17. **A container can hold 27 litres. How many pails of water are needed to fill the container if a pail can hold 3 litres?**

18. **Container A can hold 2050 ml. Container B can hold 1 litre 500 ml more than Container A. How much can Container B hold?**

19. **Mrs. McBride has 3 litres of orange juice. She gave each of her children 220 ml of orange juice. She has 6 children. How much orange juice has she left?**

20. **A man has 2 rooms to paint. Each room requires 4.5 litres of paint. If each can of paint is 2 litres, how many cans of paint must he buy?**

Answer Key

Book 14013 - Measurement

Page 9

1. 12:55 **2.** 7:25 **3.** 5:15 **4.** 7:40
5. 9:15 **6.** 8:30 **7.** 1:45 **8.** 4:25
9. 7:05 **10.** 3:40 **11.** 11:15 **12.** 3:05

Page 13

1. $3.00 **2.** $1.60 **3.** $2.56 **4.** $4.07
5. $0.30 or 30 cents **6.** $1.41 **7.** $2.66
8. $2.82

Page 16

1. 50 cents **2.** 1 dime, 1 dollar, 3 pennies
3. 600 cents
4. 1 dollar, 1 penny, 5 nickels, 3 quarters
5. 40 cents **6.** 14 cents
7. 6 nickels, 2 dollars, 2 dimes, 2 quarters
8. 500 cents **9.** 270 cents **10.** 540 cents
11. 13 quarters, 7 nickels, 2 dollars
12. 175 cents
13. 1 dollar, 3 quarters, 3 nickels
14. 225 cents **15.** 510 cents
16. 2 dollars, 4 nickels, 3 pennies **17.** 70 cents
18. 498 cents **19.** 405 cents **20.** 10 cents
21. 1 dime, 2 pennies, 1 quarter, 4 nickels, 5 dollars **22.** 5 pennies, 2 dollars, 2 quarters.

*****Note***There could be more than one solution for questions 4, 7, 11, 13, 16, 21, and 22. Accept any reasonable response.**

Page 19 **1.** Circle 1 quarter, 1 nickel, 1 dime, and 1 penny **2.** Circle 1 dime, 1 nickel, and 2 pennies **3.** Circle 1 dime and l nickel **4.** Circle 1 quarter and 1 nickel **5.** Circle 1 quarter, 1 dime, and 1 penny **6.** Circle 3 dimes and 2 pennies **or** 1 quarter, 1 nickel, and 2 pennies **or** 2 dimes, 2 nickels, and 2 pennies

Page 21 **1.** $7.91, 9 cents **2.** $130.99, $9.01 **3.** $23.65 **4.** $5.75, $4.25

Page 26 **1.** 8000 g **2.** 70 mm **3.** 800 cl **4.** 6 cl **5.** 200 cm **6.** 4 cg **7.** 1000 cm **8.** 9 kg **9.** 9 m **10.** 12 km **11.** 10 mg **12.** 11 kl **13.** 3 cg **14.** 11000 mm **15.** 1200 cm **16.** 1000 ml **17.** 7000 m **18.** 700 cl **19.** 9 cm **20.** 3000 mg **21.** 10000 L **22.** 11 cg **23.** 5 L **24.** 50 mg **25.** 4000 m **26.** 4 g **27.** 100 mm **28.** 1000 L **29.** 8 cl **30.** 6 g **31.** 6 kl **32.** 120 ml **33.** 3000 m

Page 32 **2.** Triangle **3.** Pentagon **4.** Octagon **5.** Hexagon **6.** Rhombus **7.** Square **8.** Heptagon

Page 33 (word problems with measurement)

1. 10 hours **2.** 12:15 p.m. **3.** 1:55 p.m. **4.** 1800 m **5.** 2 m 34 cm **or** 2.34 m **6.** 50 km 800 m **or** 50.8 km **7.** 10 parcels **8.** 425 km **9.** 1 kg 390 g **or** 1.39 kg **10.** 15 tennis balls **11.** 1600 g **12.** $8.80

13. 35 cents **14.** $10.60
15. 35 cents for one slice, $5.25 for 15 slices
16. $38.40 **17.** 9 pails
18. 3550 ml **or** 3.55 L **19.** 1680 ml **or** 1.68 L
20. 5 cans of paint