FLUIDS UNIT

PDF & DIGITAL FORMATS

2 Peas and a Dog

Middle School Teaching Resources

RESOURCE INCLUDES

- ✓ Ontario Curriculum Aligned
- ✓ Detailed Lesson Plans
- ✓ Readings, Videos, Graphic Organizers, Group Work, Projects, Rubrics
- ✓ Hands-On Science Labs
- ✓ MP3 Audio Files
- ✓ Answer Keys
- ✓ Quizzes & Unit Test
- ✓ Print & Digital Formats

INCLUDED LESSONS

- Introduction – Science Safety, Fluids Introduction, and Unit Vocabulary
- Particle Theory of Matter
- Experiment – What is Viscosity? What is Flow Rate?
- Mass, Volume, and Density
- Calculating Density
- Mass to Volume Ratio Experiment
- Compressibility
- Canada's Wonderland Case Study
- What is Buoyancy & Float or Sink Experiment
- Fluid Systems Mid-Unit Quiz
- Pressure, Volume, and Temperature (& Optional Experiment)
- Pascal's Law
- Fluids in Controlled and Manufactured Devices
- Building a Pneumatic or Hydraulic Device (2 Options)
- Inquiry & Stations – Investigating Applications of Fluid Mechanics
- Fluid Technologies Research Inquiry
- The Impact of Fluid Spills
- Fluid Systems Unit Test
- Sub Plans/Unit Review – Bill Nye Videos

UNIT ORGANIZATION

GRADE 8 FLUIDS
ONTARIO CURRICULUM ALIGNMENT

Lesson	2007 Curriculum	2022 Curriculum
Introduction: Safety & Vocabulary	2.1, 2.6	A1.4, A1.5
1. Particle Theory of Matter	3.3	C2.3
2. What is Viscosity?	2.5, 3.1	A1.2, C2.1, C2.8
3A & B– Mass, Volume, and Density	3.2	C2.2
4. Mass to Volume Ratio Experiment	2.2, 2.3, 3.3	A1.2
5. Compressibility	3.4	C2.4, C2.9
6. Canada's Wonderland Case Study	3.4	A1.1, C2.4, C2.9
7. What is Buoyancy & Float or Sink Experiment	3.5	A1.2, C2.5
8. Mid-unit Quiz	Review	Review
9. Pressure, Volume, and Temperature & Optional Experiment	3.6	A1.2, C2.6
10. Pascal's Law	3.7	C2.7
11. Fluids in Controlled and Manufactured Devices	3.8	C2.10
12. Building a Pneumatic or Hydraulic Device	2.6, 2.7, 2.8	A1.3, A1.5
13. Investigating Applications of Fluid Mechanics	2.4, 2.7	A1.1, A1.5

CURRICULUM ALIGNMENT

LESSON OVERVIEW

Lesson	Activity Type	Name	Suggested Time
Intro	Class Discussion QR Code Scavenger Hunt	Safety Rules, Fluids Introduction & Unit Vocabulary	2 Classes
#1	Whole Class Readings, Drawing & True and False	Particle Theory of Matter	1 – 2 Classes
#2	Whole Class Readings, Cut and Match & Experiment	What is Viscosity? What is Flow Rate? & Experiment	2 Classes
#3A	Whole Class Readings & Graphic Organizer	Mass, Volume, and Density	2 Classes
#3B	Calculations Activity	Mass, Volume, and Density	
#4	Experiment	Mass–to–Volume Ratio Experiment	1 – 2 Classes
#5	Whole Class Readings & & Fill in the Blanks	Compressibility	1 Classes

UNIT PLAN

INTRODUCTION

Fluids Introduction

Lesson Overview:
Students will learn about what makes up a fluid, where they can be found, and how they use fluids.

Materials Needed:
Photocopy a class set or use the provided Google Slides version of the:
- Fluids Introduction sheet

Teacher Instructions:
1. Read the "Fluids Introduction" paragraph as a class.
2. When finished, have students brainstorm all of their uses of fluids. In the graphic organizer, have them fill out their fluid usage, how often they use the fluid, and whether they think it's a solid, liquid, or gas.
3. This can help serve to get students talking about fluids in a real life content.

LESSON PLANS

WHAT'S INSIDE?

WHAT IS VISCOSITY?

What is viscosity?
Viscosity refers to how much a liquid can flow. Viscosity also indicates how thick or thin a liquid is. A fluid with a high viscosity is thick, like honey, oil, and shampoo, and resists flowing. A fluid with a low viscosity is thin, like water, juice, and tea, and flows easily.

Can any
There a When a liquid is the temperature changes, the particles in honey move quicker and farther from each other. This results in less viscous honey, and as a result, a honey that flows easier. Similarly, if you want your water to flow slower, you can freeze it. When it's cold, the particles will move slower and closer together. As such, the water will turn to ice, be thicker, and will not flow as easily.

What are flow rates?
Now that you have an understanding of viscosity being a liquid's resistance to flow, you can better understand flow rates and what impacts them. Flow rate refers to how long it takes for a fluid to reach from one point to another. To measure flow rates, you will have to record the time it takes for the fluid to move.

ARTICLES

SCIENCE VOCABULARY WORD #1

Using a phone or a tablet, scan the QR code below to find the hidden word.

ENGAGING ACTIVITIES

VISCOSITY SORT AND MATCH

Cut out the titles and images below. Match the correct title with all the images that relate to it. Once checked by your teacher, glue the pieces onto the back of the "What is Viscosity?" article.

High Viscous Fluids

Low Viscous Fluids

WHAT'S INSIDE?

SAMPLE ANSWERS

Note: These are sample answers for teacher use only. These items have not been tested.

Liquid	Hypothe Observe
Water	I think wate really quickl it is t
Toothpaste	Toothpaste i I think that a lot of time the bot
Vegeta	quickly c I assume relatively eas
Ketchup	Ketchup is assume it v long time to botto

ANSWER KEY

Compressibility

When you squeeze something, you're making it **smaller** Compressibility is the ability to put **external** force on a substance, which **decreases** its size. With the force or **pressure,** the particles move closer together.

The most compressible state of matter is **gas.** This is because there is a lot of **space** between the particles. **Liquids,** however, are difficult to compress. **Solids** are also re incompressible.

suggests, use **water** or **oil** as a fluid. With applied or external force, hydraulic fluids are very **powerful**. There are a lot of daily uses of hydraulic systems, like **elevators or cranes.**

Pneumatic systems, on the other hand, use compressed air or gas as their main fluid. Pneumatic devices work over a large **temperature** range, which make them **safer** than hydraulic systems. A daily example of this system is **bus** doors or breaks.

WILL IT FLOAT OR SINK EXPERIMENT

Task: You are going to create an object that will float in the water and that can withstand external weight.

1. Complete a rough copy of your plan for the lab using the "Science Lab" graphic organizer provided by your teacher.
   teacher, you may begin bringing in
   ur experiment.
   riment, make sure you record the
   well as how you created your object to go
   w much external weight was added.
   onclusion/results section, please answer
   t float or sink?
   tionship between the object you made
   eight that was added?
   nade your object stronger?
   sis correct? Explain why or why not.
   you would've done differently? Explain.
   copy of your lab. Be sure to answer all

(e.g., aluminum foil, plastic wrap, clay,

CASE STUDY: CANADA'S WONDERLAND

Canada's Wonderland is an amusement park located near Toronto, Ontario. Canada's Wonderland specializes in rollercoasters that use a lot of fluids (hydraulic and pneumatic systems) to operate safely.

Hydraulic Systems	Pneumatic Systems
Hydraulic systems in rollercoasters are often used to launch people throughout the ride. The pressure from the system supports the weight of the ride and people to project them at a fast speed. The Sle Wonder compre transm valves. moves the san pressur locked in securely. Bumper cars also use hydraulic systems to deflect shock that might occur.	Most of the safety features at Canada's Wonderland are powered by pneumatic systems. For example, the lap bars that keep people pressed in during rides are powered by pneumatic systems. The compressed air in

ANSWER KEYS

LABS & CASE STUDIES

TEACHER FEEDBACK

"This is a fantastic resource! It was an incredible time saver as I was new to teaching intermediate and was a bit overwhelmed with where to start. This resource was very well laid out, clearly followed the curriculum, and included detailed and clear lesson outlines, relevant activities and experiments, and quizzes to check for understanding. It was also very helpful to have the digital and print options for hybrid teaching." - Val C.

INTRODUCTION

SCIENCE SAFETY RULES

1. LISTEN
- ✓ To ALL the teacher's instructions.
- ✓ Know the location of the safety eyewash

2. ATTIRE
- ✓ Wear safety goggles and/or gloves as
- ✓ Tie-up any loose items (e.g., clothing, h
- ✓ Wear closed-toe, comfortable shoes.

3. READ CAREFULLY
- ✓ Any labels of chemicals/items being used
- ✓ t.

4.
- ✓ y shar
- ✓ pment is there is a spill.
- ✓ Do not taste test any items in the scienc

5. CLEAN-UP
- ✓ Thoroughly wash all used equipment and
- ✓ Wash hands with soap and water.

FLUIDS INTRODUCTION

What are fluids?

Fluids are everywhere. They can be found in houses, in sto

FLUIDS INTRODUCTION

SAFETY RULES

SCIENCE VOCABULARY WORD #1

SCIENCE VOCABULARY WORD #1

hone or a tablet, scan the QR code below to find the hidden word.

UNIT VOCABULARY

LESSON 1 & 2

THE PARTICLE THEORY OF MATTER

What is the Particle Theory of Matter?
The Particle Theory of Matter, which has 6 points, is used to help people understand matter and how matter changes and interacts with each other.

1. Matter contains particles
2. Par… …e.g., the ele…
3. The… …ugh, dep…
4. Ten… …move quic… …old.
5. Eac… …his is bec… …s also kno…
6. The space in solids are very small. In liquids, there is a little bit more space between particles, and even more space in gases.

How does this relate to density?
Since density looks at how much mass is in a volume, the particle theory can help describe density. A dense solid's particles are tightly combined, whereas a gas has a lot of space in between the particles, making it much less dense.

PARTICLE THEORY OF MATTER

FLOW RATES OF VARIOUS LIQUIDS

…of things, such as …tors, as well as other …

…ely take a long time if it …e honey has …particles …ore thin. As …han a …

…for …w quicker …ngle …ep, the fluid will flow …

VISCOSITY EXPERIMENT INSTRUCTIONS

Instructions: Test a variety of liquids to see how the viscosity of each varies.

Required Materials

- ❑ Cutting board
- ❑ Alumin…
- ❑ Scisso…
- ❑ Variou…
- ❑ A time…

Instructions

1. Grab … and h… proce…
2. Put th… books or a friend to help hold the cutting board.
3. Place your first liquid at the top of the cutting board. Once the liquid is on the cutting board, start the timer.
4. Using a timer, record how long it took for the liquid to reach the bottom.
5. Repeat this process with all of the liquids.
6. Once you're finished, ensure the graphic organizer is finished, and complete the reflection question.

WHAT IS VISCOSITY AND FLOW RATE?

LESSON 3A & 3B

MASS, VOLUME, AND DENSITY

What is Mass?
To understand mass, it's im
Matter
lunch, e
has a m

Mass is
think th
much f
float w
us dow

If we went to a different p
weight would be different, b
Weight is measured in Newt

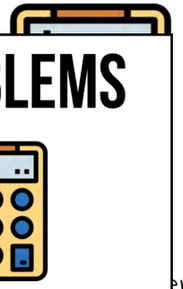
What is Volume?
Volume is concerned with h
occupies. Think about pourin
up with water, the volume o
fill it halfway, the volume of

MASS, VOLUME, AND DENSITY

In your own words, describe	
In your own words, explain density.	
What do you think is the relationship between mass, volume, and density?	

MASS, VOLUME, AND DENSITY

CALCULATING DENSITY



en we will be able to
measurement unit for
g/mL, and gases are in

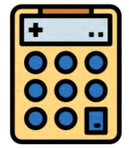
volume

nes the

ass and volume, you simply
n order to get the density.

CALCULATING DENSITY PROBLEMS

Density = mass/volume
Or
D=m/v



Instructions: Calculate density with the following questions. Be sure to show your work.

1. Cold water has a mass of 11.8g in a water jug that has a volume of 203 mL. Calculate the density of the water.

2. 400 grams of flou
density of the flour.

CALCULATING DENSITY

LESSON 4 & 5

MASS-TO-VOLUME RATIO

Instructions: To reinforce your understanding of density, you are going to calculate the mass-to-volume ratios of different amounts

Materials Needed:

- ❑ Beaker or measuring
- ❑ Granulated Cylinder
- ❑ 3
- ❑ M

Instruct

1. (
2. T
3. Next, pour 25mL o
the volume
4. Then, measure the
the mass in the de
5. When you have the
record the mass-t
6. Once you've done th
but add more volu
50mL of the liquid,
7. After you've compl
two substances wit
8. Be sure to complet
9. Once the sheets ha
your teacher to be

© http:

MASS-TO-VOLUME RATIO

Substance #2: _____

Volume of	Mass of the	Mass of	Mass of the ance ly	Density of Substance

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MASS-TO-VOLUME RATIO EXPERIMENT

COMPRESSIBILITY

e making it
e ability to put
which _____ its
the particles move

tter is _____. This is
_ between the particles.
compress. _____
ometimes are

dro suggests, use
With applied or external
_____. There are a lot
ike _____.

ressed
over a

nple of this system is

USAGES OF COMPRESSED FLUIDS

Photo of Hydraulic Devices

Hydraulic Systems

Many people use compressed fluids for a variety of reasons. People use hydrau
water) to p
useful, bec
problem wi
whereas pneumatic systems cannot. This also makes it so the liquid flows throughout their container or volume. The hydraulic system is used in a lot of daily machines, like car brakes, elevators, or cranes.

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COMPRESSIBILITY

LESSON 6 & 7

CASE STUDY: CANADA'S WONDERLAND

Canada's Wonderland is an amusement park located ne Toronto, Ontario. Canada's Wonderland specializes in rollercoasters that use a lot fluids (hydraulic and pneum systems) to operate safely

H
Hydraulic rollercoas launch pe ride. The system s the ride them at

The Sledgehammer at Canad Wonderland, for example, us compressed liquid that is transmitted through the ric valves. The hydraulic pulley moves the claws around, an the same system also uses pressure to keep its passer locked in securely. Bumper c also use hydraulic systems deflect shock that might oc

CASE STUDY: CANADA'S WONDERLAND

What are the two types of systems that Canada's	
How do hydraulic systems work? Which fluid is used? How is this system beneficial to rollercoasters?	

CASE STUDY: CANADA'S WONDERLAND

ARCHIMEDES' PRINCIPLE

VIDEO ACTIVITY

circle the most correct tence.

king to determine old / silver) to his mage the crown bath, he noticed the e / sunk) when his ve the king's to check the ee if it was the ld is (very / not) was also added in would be less dense. the crown's (mass / e crown a bath, and as (as dense / not solved the king's

SCIENCE LAB

Hypothesis Why do you think your particular object will float?
List you u objec alu This li by your teacher.

WHAT IS BUOYANCY? (WITH LAB)

LESSON 8 & 9

LESSON #8

Lesson Overview:
Students will demonstrate t
past few lessons with a quiz

Materials Needed:
❑ Class set of the Fluid Sys

Teacher Instructions:
1. Ha
2. Se
3. On

Additi
❑ A d
For

© htt

FLUIDS SYSTEMS MID-UNIT QUIZ /10

Name: _____

Complete the following True/False questions on fluid systems by circling the correct answer.

1.	Every fluid has the same viscosity.	T	F
2.	On different planets, your mass stays the same, but your weight changes.	T	F
		T	F
		T	F
5.	Most objects can float, and as such, have the same density.	T	F
6.	Learning if an object floats or sinks in a fluid refers to its buoyancy.	T	F
7.	Compressing an object with pressure or force decreases its volume.	T	F
8.	Hydraulic systems use liquid fluids to operate.	T	F
9.	Pneumatic systems use oil to operate.	T	F
10.	Pneumatic systems use fluids in gas form.	T	F

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FLUID SYSTEMS MID-UNIT QUIZ

PRESSURE, VOLUME, AND TEMPERATURE

OOBLECK EXPERIMENT

Task: You are going to create Oobleck (slime) to understand the relationship between pressure and temperature.

Materials Needed:
- Bowl
- Spoon
- 2 cups of cornstarch
- 1
- Fo

1. C
o
2. P
c
3. A
M
4. N
o
5. A
o
6. W
th
   - changing states of the Oobleck?
   - What did you learn from this experience?
   - How would you describe this experiment to a friend in a younger grade?
7. Once complete, hand in a copy of your lab. Be sure to answer all questions.

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ssure Cooker?
d to a fluid in a
ual amounts of
ssure cooker,
to release the

case, the area
cold something is.
nderstood by looking

nds because the molecules
ords, the particles of a liquid

PRESSURE, VOLUME, AND TEMPERATURE (WITH OPTIONAL EXPERIMENT)

LESSON 10 & 11

PASCAL'S LAW

What is Pascal's Law?

Blaise Pascal, a French philos
learn what happens to a flu
applied to it. For example, he
went, what happened to the
Pascal's Law was created. H
pressure applied to a fluid,
container or volume.

Examples of Pascal's Law

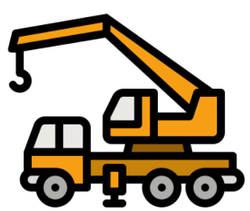
Have you ever seen a syring
medicin
end of
flows a
body). Similarly, if you squee
will travel equally throughou
holes or openings for the w
external force will cause the

Toothpaste

Another example that uses
apply pressure to the end o
of the toothpaste, the fluid
tube. Since there is an open
flows out since it needs to
pressure has been applied.

PASCAL'S LAW EXPLANATION

Task: Look at the following three images. In your own words, explain how Pascal's Law is being used based on what you see. Be sure to include words like force, pressure, transmitting, flow, etc.

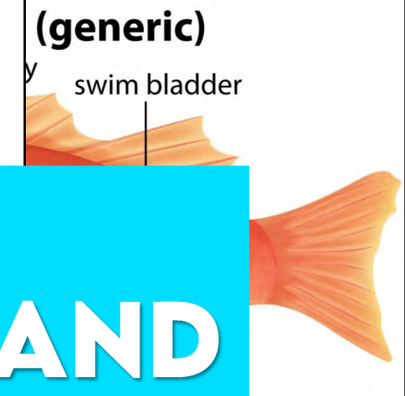
Image	Explanation
	
	
	

PASCAL'S LAW

FISH SWIM BLADDERS

How do Fish Swim Bladders Work?

Fish are able to swim at the surface level of water, as well as near the
ause they have swim bladders.
When you inflate a balloon,
wn. Similarly, when you deflate
de, which causes the balloon to



FISH'S SWIM BLADDER & BALLAST TANK

Fish's Swim Bladder	
What is the purpose and the swi	
What is the purpose and function of a ballast tank in a submarine?	

s hold air
air. When fish
to get oxygen, and this oxygen
ace level of water. The extra
hore buoyant. When fish want
release the oxygen from their
e water. The lack of oxygen in
and the force of gravity pulls

FLUIDS IN CONTROLLED AND MANUFACTURED DEVICES

LESSON 12

SCIENCE LAB: DEVICE CREATION

Task: You are going to create
performs a function.

Due Date: _____

1. Brain
   func
2. Com
   Scien
3. On th
   of th
4. Be s
5. Whe
   the
   -
   -
   -
6. Once
   ques

SCIENCE LAB

Design:

1. Which type of device are you going to create? How will the device function?
2. Is it hydraulic or pneumatic?

OPTION 1 – CREATING A PNEUMATIC OR HYDRAULIC SYSTEM

HYDRAULIC OR PNEUMATIC DIAGRAM

Using the space
device. When yo
properly.

DIAGRAM ASSESSMENT

After you have drawn your diagram, you are going to complete a
arned while examining a

ferred

life

	vel 4
and included labels and relevant vocabulary.	Students diagram was thoroughly completed and included extensive vocabulary and labels.
Lab report reflection is complete. Some elements could use more detail.	Lab report reflection is well-written and organized. Attention to detail is demonstrated.

om

OPTION 2 – DIAGRAM OF A HYDRAULIC OR PNEUMATIC SYSTEM

LESSON 13 & 14

FLUID MECHANICS

What is Fluid Mechanics?
Fluid mechanics is a subsect
buoyancy, visco
interested in h
task.

Fluid mechanics
including culinar
to everyday life
tasks could be

Roles of Fluid M
Fluid mechanics
remain still, an
fluids have a s
pace – while ot
move at a cons
there are a few
Pascal) that discuss fluids.
fluid mechanics.

Station #3

Explain your topic. How is the topic used on an everyday basis?

ds, which
ancy,

How efficient is this topic thanks to the use of fluids?

INQUIRY: INVESTIGATING APPLICATIONS OF FLUID MECHANICS

FLUID TECHNOLOGIES RESEARCH INQUIRY

gies in the world that use
nps, etc.) to help complete
l of this assessment is to
e of these technologies
hen, using the
graphic, poster,
low are some
with your

uction sites.
onomy, and
nes as a result
ct?
id technologies
ns of this
or environmental impacts?

proved by the teacher.

g.com

FLUID TECHNOLOGIES RESEARCH PROJECT GRAPHIC ORGANIZER

Name of the Topic	
Explain Wha technol does it does	
What are the social implications of this topic?	

FLUID TECHNOLOGIES RESEARCH INQUIRY

LESSON 15A & 15B

THE IMPACT OF OIL SPILLS

OIL SPILLS

What are Oil Spills?

Oil spills occur when oil is spilled
oil spills that spill into a body of
damaging affects on the marin
date is the Deepwater Horizon
April, 2010. The oil spill was an
well deep below the surface. T
throughout the pipes and even
to have killed 11 workers, and i
America
the oced

How do t

This oil s
local bea
dangerou
fish, as
ducks suffered greatly as a re
covered in oil, which made it dif

What is the cost of the cleanu

As one of the largest oil spills i
up all of the oil. It's said to hav
mess, as well as an additional $
involved and the difficulties thi
both physical and chemical met
used. These dispersants are ch
pieces and particles. This meth
break apart the oil, but is also

OIL SPILLS QUESTIONS

Instructions: For this task, read the following statements on the left. In the column on the right, indicate whether you believe the statement to be true or false.

Statement	True or False
Oil spills only occur as accidents.	
The Deepwater Horizon Oil Spill killed and injured workers.	
Marine life is heavily impacted by oil spills.	
Cleaning up oil spills takes a lot of effort and time.	
The dispersant clean up method uses extra oil to remove and break down the oil spill.	
The cleanup fee for Deepwater Horizon was roughly $4 billion dollars.	

FLUID SPILLS

FLUID SPILLS

How Has This Impacted This First Nations Community?	

LESSON 16 & 17

UNIT TEST /20

Name: _____ Class: _____

Multiple Choice Instructions: Select the correct answer from the different options.

1. The term _____ refers to a fluid's resistance to flow.
A) Flow Rate
B) Pressure
C) Compressibility
D) Viscosity

2. [illegible]
A)
B)
C)
D)

3. Particles in a _____ are so tightly packed that they don't move.
A) Solid
B) Liquid
C) Gas
D) Plasma

4. Which of the following states of matter is the most compressible?
A) Solid
B) Liquid
C) Gas
D) Plasma

FLUID SYSTEMS UNIT TEST

BILL NYE - FLUIDS

Name: _____ Class: _____

- ❑ Friction
- ❑ Kayaking
- ❑ Aerodynamic
- ❑ Frozen
- ❑ Cold

hole world would be

eir molecules _____ past
e the _____ of any

be able to read rapids to send

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BILL NYE – BUOYANCY

Name: _____ Class: _____

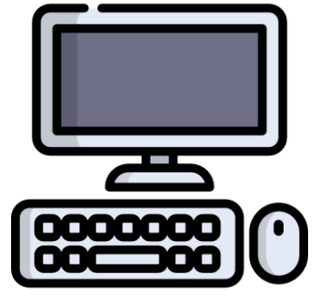
Statement	True or False
The weight of water is what makes things float.	
Everything that's put in the water ends up displacing water.	
The weight of an object doesn't impact its b	
F s	
N o	
W s t	
If you can displace enough air, you'll go up.	
When a boat is in the water, it pushes the water away – the same amount of water that's equal to the boat's weight.	
Less dense objects sink quicker because of their weight.	
Some objects don't displace enough air or water, but that can be changed when the form and shape is rearranged.	

SUB PLANS OR UNIT REVIEW

LESSON FORMATS

PDF

✓ Individual & Whole Unit



DIGITAL

✓ Google Slides

RESOURCE CAN BE USED IN-PERSON OR ONLINE