

# Mystery Ranger Answer Key

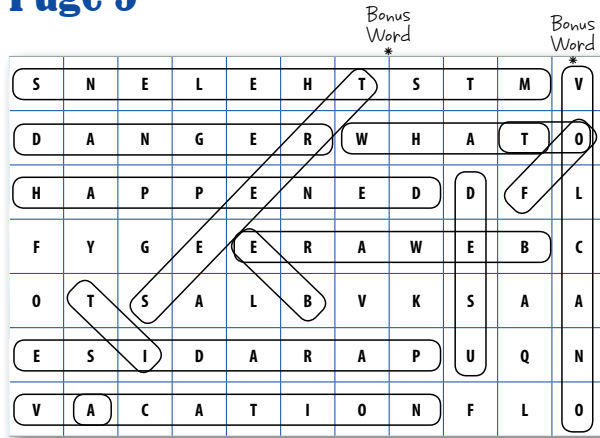
## Page 3

3. What is the abbreviation for Mount? **MT**
4. What does St. in "Mount St. Helens" stand for?  
**SAINT**

## Page 4

Watch Out! There could be **DANGER!**

## Page 5



## Page 7

Danger lurked quietly under Mount St. Helens, a paradise of clear **LAKES** and beautiful forests full of **WILDLIFE**. Unaware of danger, people vacationed and worked on the mountain.

Suddenly, Mount St. Helens woke up! Thousands of minor earthquakes signaled magma movement! Pushing with mighty force, magma created a giant **BULGE** 450 feet tall, near the top of the mountain on the **NORTH** side.

As the **MONSTROUS** bulge filled with fiery hot melted rock called **MAGMA**, it grew. snow and ice on top of the mountain melted and seeped into tiny **CRACKS** created by the minor earthquakes.

## Page 8

On May 18, 1980, a very powerful **EARTHQUAKE** shook Mount St. Helens, causing the north side bulge of the mountain to start to plunge into the valley below.

As the bulge slid off, super hot water inside the mountain exploded to **STEAM** causing the clay layers inside the mountain to be very **SLIPPERY**.

Zoom! Zoom! Zoom! In three sections, the bulge, along with the top on quarter, and then half of the mountain's insides slid off into the largest **LANDSLIDE** in recorded history!

## Page 9

When the ground slid away, it was like shaking up a bottle of soda, and taking off the cap! It released the **PRESSURE** inside the mountain with huge lateral (sideways) and vertical blasts!

In just **THREE** to **FOUR** minutes, most of the damage to the area was done! The mountain was disfigured beyond recognition. The valley was filled with the landslide, and forest as large as a big **CITY** were destroyed.

The main eruption continued for **NINE** hours, forming an ash cloud over 12 miles high!

Mount St. Helens did not look like it did before the eruption! The mountain and area to the north looked like the surface of the **MOON**.

Wow! Scientists were amazed that so much land could be changed so **QUICKLY**.

## Page 11

Multiple lava flows build up to create the wide, gently sloping cone of a shield volcano. Most shield volcanoes erupt **NON-EXPLOSIVELY**. This type of eruption can destroy **PROPERTY**, but rarely causes death or injury. Mauna Loa volcano in Hawaii which rises over 30,000 feet above the ocean floor, is a shield volcano.

Composite volcanoes, usually very steep and tall, are made of alternating layers of lava, ash, and rock fragments. They tend to erupt **EXPLOSIVELY** because the magma is too stiff for gasses to escape easily. Pressure builds as trapped gases expand until it is released in a violent eruption very **DANGEROUS** to people and property. Composite volcanoes are also known as stratovolcanoes. Mount Fuji in Japan is a composite volcano.

Mount St. Helens erupted explosively. It is a **COMPOSITE** volcano.

## Page 12 & 13

Ah ha! There was an explosive eruption at 10. **MT ST HELENS** because it's a 2. **COMPOSITE VOLCANO**. That's why there was a lot of 1. **DANGER!** Many scientists used to think this much change to a landscape took million of years. But most of this change took just **THREE** to **FOUR** 6. **MINUTES!**

Did the volcano really 5. **VANISH?** No, it was still there. But it looked **TOTALLY** different than before the 8. **ERUPTION**. It was no longer a vacation paradise. The **HUGE** debris avalanche left the mountain 1,314 feet shorter, with a **HUGE** horseshoe shaped 9. **CRATER** on top.

How far did the 3. **BLAST** reach? It reached up to 17 miles on the 7. **NORTH** side

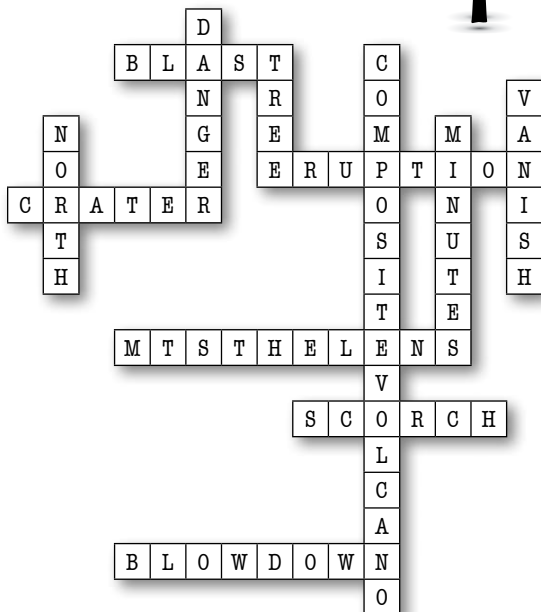
1. **TREE** (4)  
Removal Zone  
(No trees left)



2. **BLOW DOWN** (12) Zone  
(Trees blown over)



3. **SCORCH** (11) Zone  
(Trees were standing but scorched.)



## Page 14 & 15

Unscramble words

(brCano xDoiedi) **CARBON DIOXIDE**

This volcano model represents a (dsiehl) **SHIELD** volcano.

Magma, which is melted (rcko) **ROCK** inside of a volcano, is called (aalv) **LAVA** when it reaches the earth's (srfaceu) **SURFACE!**

## Page 16

The bubbles in the bottle are like **GAS** bubbles rising out of the magma of a volcano. They are **TRAPPED** against the lid, and the pressure builds.

When the cap was taken off the bottle, and the **PRESSURE** was released, what happened?

This is a great comparison to what happened at Mount St. Helens. When the **LAND** slid off the top of the **MOUNTAIN**, the pressure was released, and there was a gigantic **BLAST!**

## Page 17

All of these volcano models are a little different from real (noeslovca) **VOLCANOES**.

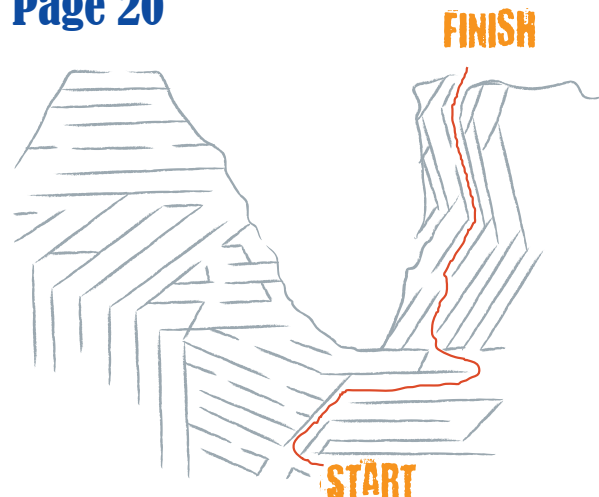
In this volcano model, (bonrac xdioeid) **CARBON DIOXIDE** caused the eruption.

In most volcanoes, (twrea vproa) **WATER VAPOR** is the main gas causing most eruptions, not carbon dioxide.

## Page 18

**HARNESS AND ROPE**

## Page 20



## Page 21-23

Clue #1 - LANDSLIDES

Clue #2 - HOT ASH

Clue #3 - STEAM, EXPLOSIONS

Clue #4 - PUMICE, RILLS, GULLIES

Clue #5 - BADLANDS

Clue #6 - EROSION, SEDIMENTARY, PINNACLES

Clue #7 - RAIN, PLANTS, SEDIMENTS

Clue #8 - VOLCANIC, EXPLOSIONS, LOOSE, PLANTS, GRAVITY

Clue #9 - CATASTROPHE, NOAH'S FLOOD

## Page 24

This evidence demonstrates that it did NOT have to take HUNDREDS or THOUSANDS of YEARS for the BADLANDS of South DAKOTA to form!

## Page 25

The 5.1 earthquake at Mount St. Helens caused three (deslInaids) LANDSLIDES which joined together to form one giant landslide!

The giant landslide carried huge amounts of (eic) ICE and (wons) SNOW!

The buried ice and snow were covered with very hot volcanic (sah) ASH.

The buried ice and snow quickly flashed to (tmesa) STEAM.

When the steam built up pressure too quickly it caused large (spoxelnsio) EXPLOSIONS!

These steam explosions created steam explosion (stpi) PITS .

The force of (ygastriv) GRAVITY helped carve rills and gullies into the sides of the pits.

The pumice plain now had huge pits, and looked similar to an area in South Dakota called the (dslBaand) BADLANDS.

The steam explosion pits at Mount St. Helens looked like badlands topography in only (efvi) FIVE days.

## Page 27

Water can wash away small amounts of soil, creating very small channels called RILLS.

If water continues to flow in rill channels, deeper ditches called GULLIES will form.

AMAZING! WATER erosion is usually what forms rills and gullies. HOWEVER, at Mount St. Helens, rills and gullies were formed by STEAM explosions and GRAVITY in just five days!

## Page 28

How fast did pyroclastic flows create 200 layers on this cliff?

## Page 29

Created by melting snow from an eruption, this mighty mudflow muscled its way down the mountain covering and carving through past avalanche DEBRIS. Like icing on a cake, it covered the cliff of secrets, forming the TOP deposit.

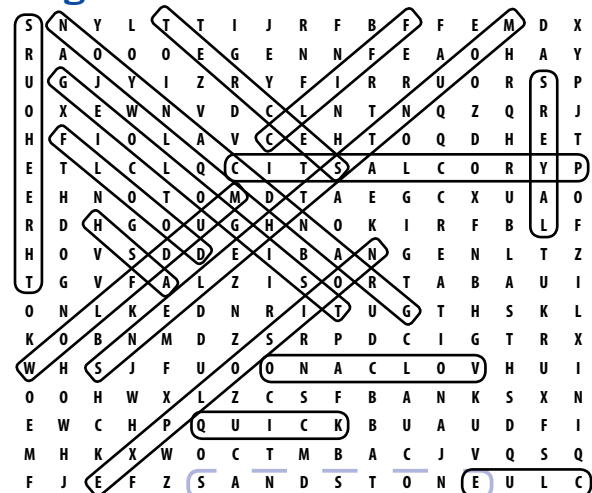
A raging HOT fiery cloud of gas, rocks, and ash called a PYROCLASTIC flow stormed at hurricane speed down the volcano, creating over 200 layers in just three hours!

Volcanic lightning, triggered by swirling ash, flashed all around! Tephra (any kind of ASH and ROCK ejected from a volcano through the air) spewed from Mt. St. Helens for nine hours, creating this 30 foot deep deposit.

## Page 30

FLOOD GEOLOGISTS suspect the TAPEATS LAYERS at the GRAND CANYON were formed during NOAH'S FLOOD!

## Page 31



## Page 33

A hot, fast-moving mixture of (sha) ASH, pumice, (rcko) ROCK fragments, and gas formed during explosive eruptions is called a (citsalcoryp) PYROCLASTIC flow.

The word PYROCLASTIC, comes from the Greek word *pyro* meaning (rife) FIRE and *klastos* meaning (nebokr) BROKEN.

## Page 34-36

There was a MUDSLINGING BATTLE here!

Part of the landslide (about 25 percent) slammed into SPIRIT LAKE.

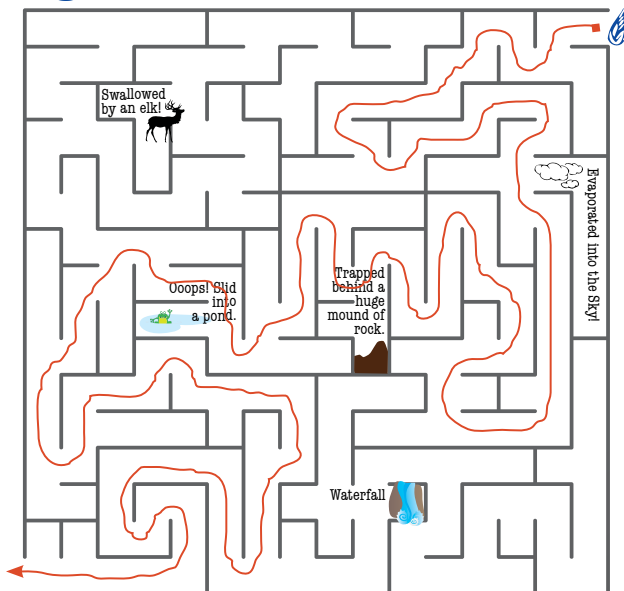
The rest of the landslide (75 percent) pushed and shoved its way through the valley, covering up 14 miles of the North Fork of the TOUTLE RIVER.

Melting ice and snow flowed rapidly over the landslide, gobbling up SOIL rocks, and trees from the landslide.

The menacing mudflow roared down the valley, snatching up everything in its path! Huge piles of cut LOGS were sucked into the muddy mass when it smashed into logging camps.

It ripped and roared for many miles until it reached the COLUMBIA River where it settled down as a humongous mud pie, filling the river channel with so much mud that it was too shallow for big boats.

## Page 37



## Page 38-41

MIGHTY MUDFLOW is here! With a quake and shake, another eruption melted SNOW in the crater of Mount St. Helens, and a second HUGE MUDFLOW was born.

The MIGHTY MUDFLOW thundered down the mountain with speed, power, and lot's of mud. It was 20 miles long and ready to pack a punch through the lumpy landslide on the TOUTLE RIVER.

The landslide held its ground, but very quickly MIGHTY MUDFLOW swept away massive amounts of jumbled ROCK, ASH, and dirt.

The MIGHTY MUDFLOW had used its super erosion powers and carved a CANYON in the new river system that was 140 deep in just 9 hours.

It was nicknamed "The Little GRAND Canyon" because it appeared to be 1/40th the size of the Grand Canyon in Arizona!

For two years the water level at SPIRIT LAKE was getting higher!

A temporary pipeline was used to pump water out of the lake for 28 months while a 1.5 mile drainage TUNNEL was built through a ridge to Spirit Lake.

They used a machine they nicknamed "The Mole" to dig the tunnel. It looked like a giant DENTIST DRILL.

The massive amount of water pumped out of Spirit Lake by the temporary pipeline for 28 months eroded a deep canyon named ENGINEERS CANYON.

## Page 42

HOW LONG DID IT TAKE THESE LANDFORMS TO DEVELOP?

Engineer's Canyon     28 MONTHS

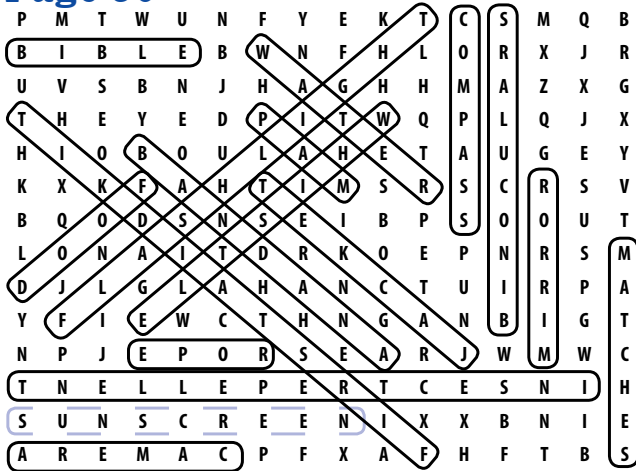
Little Grand Canyon     9 HOURS

North Fork Toutle River System     9 HOURS new system

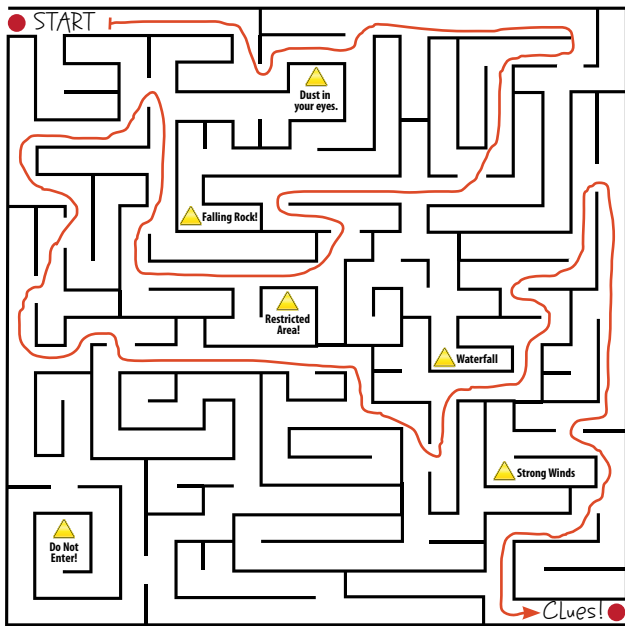
## Page 48

Estimated age of tree BETWEEN 19-21 YEARS

## Page 50



## Page 51



## Page 52

seeatqhkrua **EARTHQUAKES**

irenghaewt **WEATHERING**

gwionrg alav eomd **GROWING LAVA DOME**

eci wnso esplolac **ICE or SNOW COLLAPSE**

## Page 54-56

**STEP CANYON and LOOWIT CANYON**

**FIVE MONTHS**

**MUDFLOWS and PYROCLASTIC FLOWS**

**AVALANCHE DEBRIS and SOLID ROCK**

**FIVE MONTHS**

**LOWER LOOWIT CANYON**

**CAVITATION and PLUCKING**

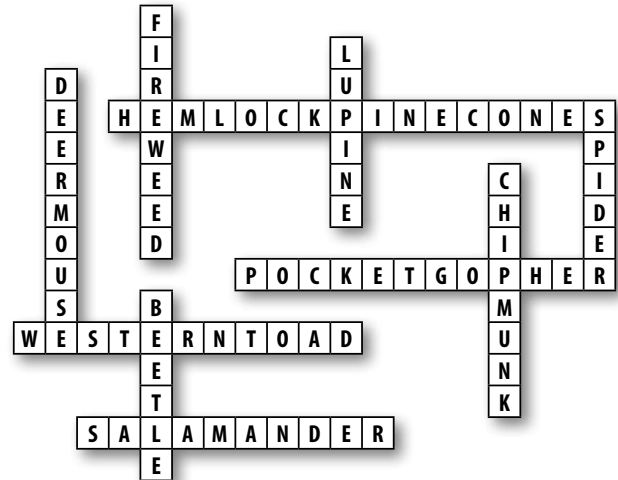
## Page 59-60

Hike through the Hummocks and you will see another clue to this MYSTERY.

The **LANDSLIDE** surged with **SUPER SPEED** 14 miles down the North Fork of the Toutle River. It filled the valley to an average thickness of 150 feet.

Mounds of rock from the volcano, called **HUMMOCKS** stick up like huge beached whales in the landslide deposit.

## Page 61



## Page 62-64

eedr mseou - **DEER MOUSE**

vrbaee - **BEAVER**

lsamdrenaa - **SALAMANDER**

drspie - **SPIDER**

tgrare enask - **GARTER SNAKE**

ntas - **ANTS**

fri eters - **FIR TREES**

yotceo - **COYOTE**

cificap teer frgo - **PACIFIC TREE FROG**

tgrie eeeblt - **TIGER BEETLE**

uotrt - **TROUT**

gndrou rrleqsui - **GROUND SQUIRREL**

kle - **ELK**

Discovering plant and animal **SURVIVORS** in the wasteland was surprising.

Few survived, but these "bug bodies" became food for animals, insects, and spiders, and **FERTILIZER** for plants!

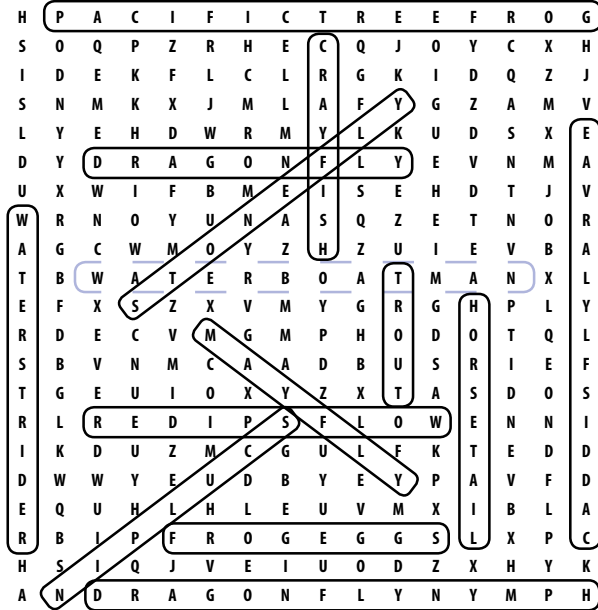
Growing on top of bug body buildup, wildflowers like **LUPINE** and fireweed, were some of the first plants to spring up after the eruption, were pioneer plants!

Elk began having **TWINS** and **TRIPLETS** causing the elk herd to grow very large and healthy!

## Page 65

- EA EI AE EE NN EI EI IT **NOTEBOOK**
- NT EE EA TE NA TN **PENCIL**
- NN EI IE TN TA **BOWLS**
- EA EE AE **NET**
- TE II AI EE NE II **CAMERA**

## Page 66



## Page 71

Rearranged ⇒ **Mud**

Ash ⇒ **Sea**

Unite, Power ⇒ **Hour**

Landscapes that changed (**yqlciuk**) **QUICKLY!**

Large deposits of (**umd**) **MUD** and debris.

Powerful (**nesorio**) **EROSION**

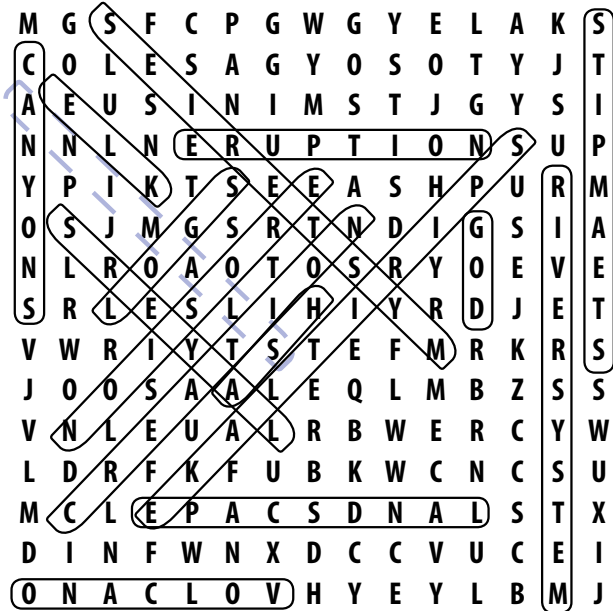
## Page 72-73

- |                |                 |              |
|----------------|-----------------|--------------|
| Landslide (12) | Catastrophe (3) | Around (1)   |
| Mat (13)       | World (23)      | Earth (5)    |
| Trees (20)     | Mat (13)        | Land (12)    |
| Down (4)       | Lake (12)       | Mystery (13) |
| Appear (1)     | Gone (7)        | Eyes (5)     |
| Locations (12) | Surprise (19)   |              |

## Page 74

- [Ear] - a + ↑↑ + tion = **ERUPTION** (BOOM! Water vapor helped cause this!)
- [Gi + ant] [WAVE ON] - ear + irit = **SPIRIT** L + [Lake] - C = **LAKE**
- De + [t] + sit + ion = **DEPOSITION** (Some deposits were laid down by water.)
- E + [e] + ion = **EROSION**

## Page 75



## Page 77

Oh, that you would rend the heavens! That you would come down! That the **MOUNTAINS** (**soutmnina**) might shake at your presence — As fire burns brushwood, As fire causes the water to **BOIL** (**lbio**) — To make your name known to Your adversaries, That the nations may tremble at your presence! (Isaiah 64:1–2; NKJV).

The mountains will **MELT** (**mlte**) under Him, And the valleys will split, Like **WAX** (**xwa**) before the fire, Like waters poured down a steep place (Micah 1:4; NKJV).

He who looks on the earth, and it **TREMbles**, (**stmlbre**) He touches the hills, and they **SMOKE** (**esmko**) (Psalm 104:32; NKJV).

God is our refuge and strength, A very present help in **TROUBLE**. (**blteuor**) Therefore we will not fear, Even though the mountains be carried into the midst of the sea; Though its waters **ROAR** (**aror**) and be troubled, Though the mountains shake with its swelling. Selah (Psalms 46:1–3; NKJV).