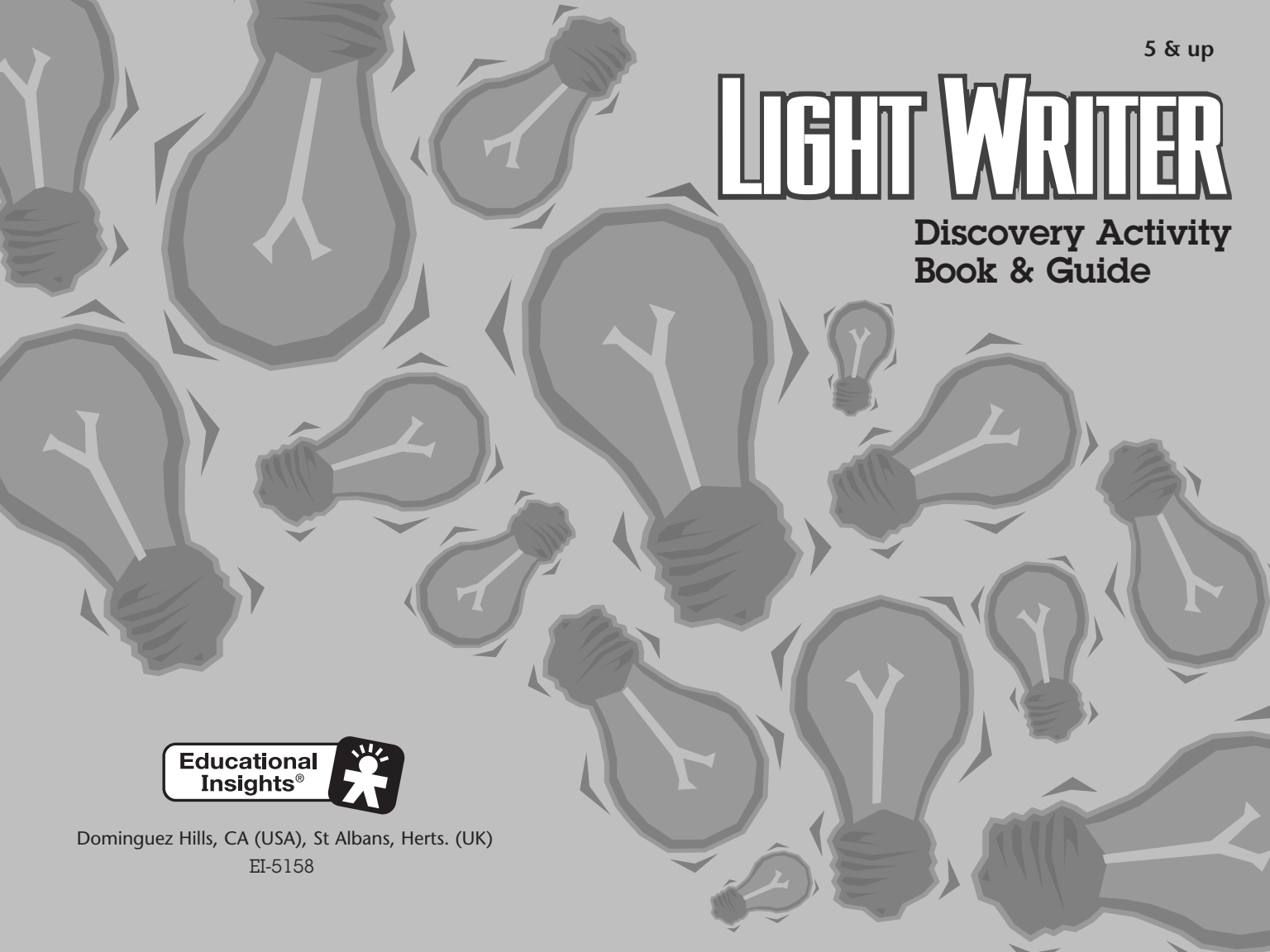
5 & up

LIGHT WRITER

Discovery Activity Book & Guide



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⚠**WARNING: CHOKING HAZARD — Small parts.**
Not for children under three (3) years.

USING YOUR LIGHT WRITER and ACTIVITY GUIDE

Welcome to the fascinating world of the Light Writer, where art and science come to light! Make glowing art projects and experiment with science. Learn about *luminescence* (LOO muh NEHS uhns)! Discover glowing *phosphorescence* (FOSS fuh REHS ens)! First learn how to set up your Light Writer kit. Then you're ready to start your bright new adventure!

GETTING READY

1. Unpack the Light Writer kit.

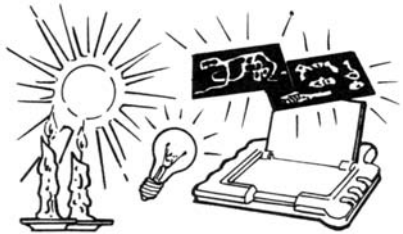
Your kit includes:

- the **Light Writer** pen *(requires 2 AAA-cell batteries, not included)*
  - ✔Do not mix old and new batteries.
  - ✔Do not mix alkaline, standard (carbon-zinc), or rechargeable (nickel-cadmium) batteries.
- storage and light shielding case
- two phospho-sheets: super long-lasting, light-sensitive (phosphorescent) paper
- seven activity stencils
- a planet identification game and stencil
- this discovery and activity book

2. Test Your Light Writer.

Darken the room you are in or go into a closet or other windowless room. Turn on the Light Writer. Open the Light Writer case and place a phospho-sheet on the top of the case. Now, touch the Light Writer to the sheet and move it to make a design. Keep the Light Writer in contact with the phospho-sheet as you "write". You are now designing with light! Turn off the Light Writer and your design will shine back at you in the darkness!

ALL ABOUT LIGHT AND PHOSPHORESCENCE



Where does light come from? Most light comes from our star the sun. Even when clouds hide the sun, there is enough light for us to see. At night the moon and stars give us a gentle light. The moon and planets are reflecting light from the sun to the earth, while stars shine with their own light since they are also suns—very far away.

Where else does light come from? Fire gives off light. People used to burn candles for light. Now we use electric lights or battery powered lights.

Some objects can take in light and give it off again. These objects are luminescent. Examples of "glow in the dark" luminescent objects are paints, watch faces, and some toys. Luminescent things shine because they absorb light energy from other light sources, such as electric light bulbs.

Luminescence that lasts for a few seconds or even days after the light energy source is gone is called phosphorescence. The special sheets (phospho-sheets) in your Light Writer kit are phosphorescent—that's why you see glowing pictures in the dark after you turn off the Light Writer.

1 BRIGHT IDEA ACTIVITY

What does light do to your eyes?

You Will Need:

- a mirror

Follow These Steps:

1. Stand in front of the mirror.
2. Look at the dark center openings of your eyes. They are called the pupils. They let light pass into your eyes so you can see.

3. Close your eyes for 15 seconds (count slowly to 15). Open your eyes and watch the pupils of your eyes in the mirror.

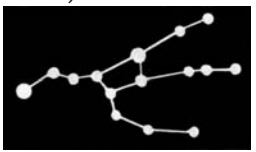
   What happens to your pupils? Try this a few times to test the results.

FUN FACT

The more light there is, the smaller the pupils become. When you are in the dark or when you close your eyes, the pupils open wider allowing more light into your eyes.

2 BRIGHT IDEA ACTIVITY

Can you create sparkling stars and constellations (groups of stars)?



You Will Need:

- Light Writer kit
- Stencil A
- paper, pencil, and crayons

Try creating constellations using the Photon-Blaster method.

1. Darken the room you are in or go into a closet or other windowless room. Turn on the Light Writer. Open the Light Writer case and place a phospho-sheet in position on the top of the case, green side up.
2. Put Stencil A on the phospho-sheet. Now turn the Light Writer off.
3. Blast the stencil with light from a table lamp or bright flashlight. To do this, place the phospho-sheet with the stencil on it directly under the light source. Turn the light source on for 15 seconds. Then turn the light source off.
4. Remove the stencil and watch the stars and constellations sparkle in the night sky. Now turn on the Light Writer and draw lines to connect the stars in each constellation.

EXPLORE SOME MORE

- Draw the constellations you made.
- Go to the library and get books to learn more about starlight and the names and shapes of the constellations.

BIOLUMINESCENT "CRITTERS" AND PLANTS

Have you ever seen glowing animals or plants at night? This "glowing light" or phosphorescence given off by living things is called bioluminescence (BY oh LOO muh NEHS uhns). This light is made by special plants and animals because they make biochemicals which allow them to shine with this special kind of light.

You might see firefly beetles or "lightning bugs" flash their greenish lights in the evening. Male fireflies use these flashes of light to find female partners. Each firefly family has its own signal. *Larvae* (LAHR ve) are wormlike young fireflies. They give off light and are often called glowworms. Some frogs and toads eat lots of fireflies. They can glow in the dark as a result!

Bacteria (bak TEER ee uh) are tiny organisms. Some are bioluminescent and give off a blue-green glow. If you are in a forest at night, you might see this glowing light on dead wood. This glow is sometimes called *foxfire.*

Another large group of plants, the *fungi* (FUHN ji) have bioluminescent members. Fungi have no stems, leaves, or flowers. They live off other plants or animals. Mushrooms and toadstools are examples of fungi.

Jack-my-lanterns by day *Jack-my-lanterns at night*

3 BRIGHT IDEA ACTIVITY

Can you catch fireflies?

In warmer months you can find fireflies in many area The best time to catch them is at sunset. The best way to catch them is with a net.

You Will Need:

• a net • a liter (quart) jar and lid

Follow These Steps:

1. Go with a trusted adult into a meadow or field in the early evening to gather fireflies in your net.
2. Carefully move the captured fireflies from your net into the jar.
3. Take your fireflies home and refrigerate them for 3 minutes. Cold fireflies become sleepy or inactive. When you take them out of the refrigerator and they begin to warm up again, watch to see how they behave.
4. Take your fireflies outside in the evening, remove the jar lid, and let them go blinking back into the night.

4 BRIGHT IDEA ACTIVITY

Can you find your way through the forest maze to create glowing animals and plants?

You Will Need:

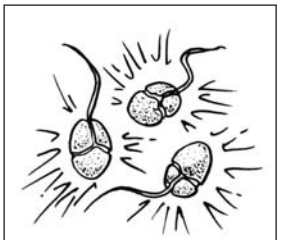
• Light Writer kit • Stencil B

Follow These Steps:

1. Darken the room you are in or go into a closet or other windowless room. Turn on the Light Writer. Open the Light Writer case and place a phospho-sheet on the top of the case.
2. Put Stencil B on the phospho-sheet.
3. Move the Light Writer across the stencil, making sure each thing receives light from the Light Writer. Keep the Light Writer on the stencil or you can use the **Photon-Blaster** method.
4. Turn off the light source. Remove the stencil and watch the fireflies and toadstools glow!
5. Draw a path for yourself with the Light Writer to get out of the forest.

BIOLUMINESCENT SEA CREATURES

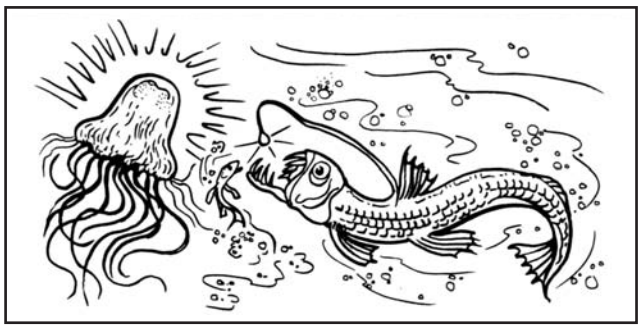
If you live near an ocean or sea you may see the waves glowing at night. The surface or top of the warm ocean water is home to billions and billions of tiny creatures called *dinoflagellates* (Dy no FLAJ uh layts). Scientists believe that their light helps them get food. When a small fish swims by, it disturbs the water. The dinoflagellates make the disturbed dark water glow, and that may attract bigger fish. The bigger fish eat the smaller fish, leaving tiny bits of food floating on the water. Some types of dinoflagellates eat these leftovers!

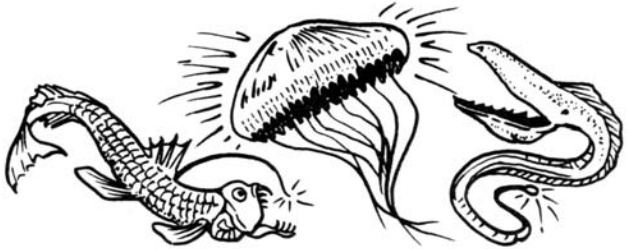


Dinoflagellates

Many sea animals use light for different purposes. They may use their light to escape from enemies. Some animals in the dark water deep in the oceans use their lights to find their way around. Lights also make good signals for "talking" to other members of their family. They use light signals to find a partner or food, too.

Look at the sharp-toothed Anglerfish in the picture. Its light looks like a lantern on a fishing pole dangling in front of its mouth! Smaller fish swim up to the light, and, snap, they are gobbled up!





5 BRIGHT IDEA ACTIVITY

Have you ever wanted to go deep down into the sea?

You will be able to get a good idea of what life is like deep down in the dark oceans and seas by doing this activity.

You Will Need:

- Light Writer kit
- Stencil C

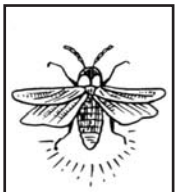
Follow These Steps:

1. Darken the room you are in or go into a closet or other windowless room. Turn on the Light Writer. Open the Light Writer case and place a phospho-sheet on the top of the case.
2. Put Stencil C on the phospho-sheet.
3. Move the Light Writer across the stencil, making sure each thing receives light from the Light Writer. Keep the Light Writer close to the stencil or use the **Photon Blaster** method.
4. Turn off the Light Writer. Remove the stencil and watch your underwater scene shine! Now turn the Light Writer on and draw lines to show how fish might swim through the water leaving glowing trails behind.

EXPLORE SOME MORE

- Draw and color some imaginary "glowing creatures" that might be in the darkest and deepest parts of the oceans.
- Get library books to learn more about bioluminescence.

MEDICAL AND OTHER USES OF BIOLUMINESCENCE



Firefly beetle

Aequorea jellyfish

Can light from fireflies and jellyfish help your doctor find out what kind of sickness you have? Yes! By mixing the glowing light from fireflies with chemicals, the doctor can figure out what's making you sick. Scientists and doctors use the glowing light from some types of jellyfish to help them find the early signs of diseases in human bones, muscles, nerves, and other body tissues.

Light from bioluminescent animals helps people in other ways too. The chemical that makes the light helps scientists find out if water is too polluted (dirty) to drink. This special light also helps fishermen find large groups (schools) of fish. Some researchers are studying bioluminescence to see if they can make a light that does not create heat.

Many children in the USA gather fireflies in the summer months and send them to companies that help scientists and doctors do research on this special kind of light.

6 BRIGHT IDEA ACTIVITY

Did you know humans have 206 bones?

You Will Need:

- Light Writer kit
- Stencil D

Follow These Steps:

1. Darken the room you are in or go into a closet or other windowless room. Turn on the Light Writer. Open the Light Writer case and place a phospho-sheet on the top of the case.
2. Put Stencil D on the phospho-sheet.

3. Move the Light Writer across the stencil, making sure each bone receives light from the Light Writer. Keep the Light Writer close to the stencil or use the **Photon Blaster** method.
4. Turn off the light source. Remove the stencil and watch the bones glow!
5. Use the Light Writer to write the names of the bones you recognize.

7 BRIGHT IDEA ACTIVITY

Can you name the prehistoric animals and dinosaurs on this stencil?

You Will Need:

- Light Writer kit
- Stencil E

Follow These Steps:

1. Follow each step from Bright Idea Activity 6 to highlight Stencil E. Be sure to move the Light Writer over the list of animal names and family names on the side of the stencil or use the **Photon Blaster** method.
2. Turn off the light source. Remove the stencil and watch these prehistoric creatures and their bones come to life!

   Do you know the family name of each of the prehistoric creatures?
3. Use the Light Writer to draw a light line to match each animal to its correct name and family group. You can check your answers at the bottom of this page.

Fun Fact

Did you know that one reason scientists know dinosaurs were not lizards is because of the way they stood on their legs? The legs of a lizard come out of the side of its body, so the animal looks like it is always near to the ground. As the lizard moves quickly, it seems to wiggle as it runs on its sprawled out legs.

Dinosaur legs came straight down from their bodies. Scientists know how dinosaurs stood by studying the shape of their bones and by looking at their footprints left in mud, which later hardened into rock (fossils).

Answers: *1. Pterodactyl–reptile 2. Tyrannosaurus rex–dinosaur 3. Woolly mammoth–mammal 4. Triceratops–dinosaur 5. Dimetrodon–reptile*

ADDITIONAL LIGHT WRITER BRIGHT IDEA ACTIVITIES

Follow These Steps Each Time You Use the Light Writer.

1. Darken the room you are in or go into a closet or other windowless room.

   Turn on the Light Writer. Open the Light Writer case and place a phospho-sheet on the top of the case.
2. Move the Light Writer across the stencil or object(s), making sure each thing receives light from the Light Writer. Keep the Light Writer close to the stencil or object(s), or use the **Photon Blaster** method.
3. Turn off the Light Writer. Remove the object(s) or stencil and watch it glow!

EXPLORE SOME MORE BRIGHT IDEA ACTIVITIES

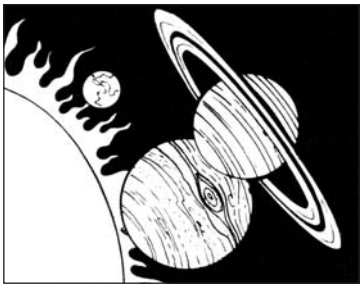
- Play tic-tac-toe with a friend using the tic-tac-toe Stencil F in your kit. Use the Light Writer to make your X's and O's.
- Write a secret "ghost writing" message to a pal. Make sure your friend reads the secret message quickly before it disappears!
- Create a silhouette by placing an object on the Light Writer and outlining the area around it with the Light Writer.
- Make a glowing collage (collection) with a group of objects, such as keys, leaves, flowers, toys, or any small, interesting items.
- Make your very own stencils for the Light Writer! Use paper 15cm x 10cm (6in x 4in), a pencil, and scissors. Trace an interesting object on the paper. Cut out your drawing, and you have your own stencil. You know how to "doodle" the rest!
- Get "glow in the dark" crayons, paints, or marking pens. Create a fantastic design and move it into a darkened room to enjoy your dazzling creation!

BRIGHT IDEA SOLAR SYSTEM IDENTIFICATION GAME

You Will Need:

- Light Writer kit
- Stencil G
- this activity book and a pencil

Follow These Steps:



1. Darken the room you are in or go into a closet or other windowless room.

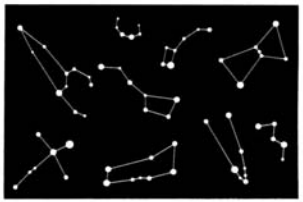
   Turn on the Light Writer. Open the Light Writer case and place a phospho-sheet on the top of the case.
2. Put Stencil G on the sheet.
3. Move the Light Writer across the stencil, making sure each name and object receives light from the Light Writer. Keep the Light Writer close to the stencil or use the **Photon Blaster** method.
4. Remove the stencil and watch the solar system "glow."
5. Turn on the light and aim it at page 12 of this book. Read the solar system hints on page 12. Using a pencil, write the name of the object the hint describes on the line.

   Compare your answers on page 12 with the objects and names shining at you from the Light Writer. You can check for the correct answers on the bottom of this page.

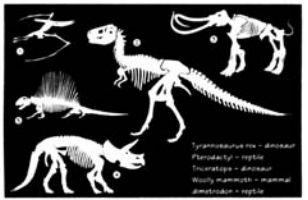
   How did you do? Did you correctly match the objects to the hints?

A-Mercury, B-Venus, C-Earth, D-Mars, E-Jupiter, F-Pluto, G-Saturn, H-Asteroid belt, I-Sun, J-Uranus, and K-Neptune.

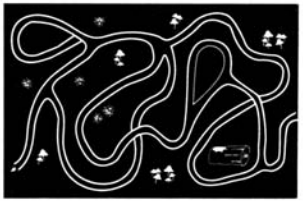
A I am the second smallest planet in the solar system and the planet nearest to the sun. It takes me 88 days to travel around the sun one time. My temperatures range from 425°C (800°F) on the dayside to about -175°C (-280° F) on the nightside. My name is _____.	**G** Several of the other planets have rings, but only my bright rings can be seen with a telescope. Other rings have to be viewed close-up by spacecraft. My rings are mostly made up of ice chunks. I am the second largest planet. Can you guess my name? _____
B I am the closest planet to Earth. I am surrounded by thick clouds, which help make me a hot, bright planet. Many times you can see me in the early evening or predawn sky. Can you guess who I am? _____	**H** We are not planets. We are small, odd-shaped objects of rock or metal. We are mostly found between the orbits of Mars and Jupiter. What are we? _____
C I have only one moon. I have air for you to breathe and water for you to drink. I'm about $4\frac{1}{2}$ billion years old! It takes me 365 days to travel around the sun. You live on me. Do you know me? _____	**I** I am the star at the center of the solar system. All other objects orbit around me. I give off heat and light. I bet you know my name. _____
D I am sometimes called the Red Planet because of the rust in my soil. I am the fourth planet from the sun. I have two moons. Do you have a clue who I am? _____	**J** I have 15 known moons! I am the seventh planet from the sun. Only Neptune and Pluto are farther away. Do you know me? _____
E I am the largest planet in the solar system. I spin on my axis faster than any other planet. I have a large area of swirling clouds called the "Great Red Spot." What's my name? _____	**K** Winds around me blow my clouds up to 1,127km. (700mi.) per hour! I have a dark area of swirling gases in my clouds called "The Great Dark Spot." Who am I? _____
F I am the farthest planet from the sun. Scientists think my surface is mostly made up of methane gas and ice. It takes me about 248 years to travel once around the sun. Do you know me? _____	



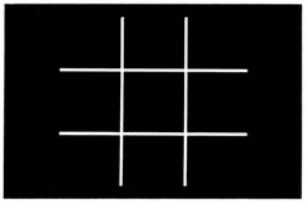
Stencil A — Constellations



Stencil E — Prehistoric Animals

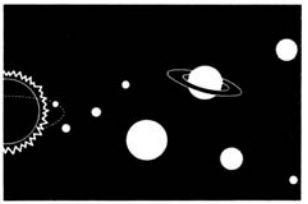


Stencil B — Forest Maze

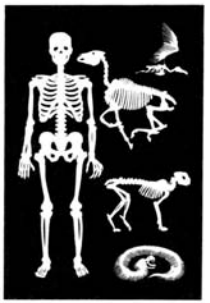


Stencil F — Tic-tac-toe Game

Stencil C — Sea Creatures



Stencil G — Solar System Identification Game



Stencil D — Human and Animal Bones