I Name: _____ Date: _____ CP: ____

Physics team that discovered new light bulb wins Nobel Prize

By Scientific American, adapted by Newsela staff

The Nobel Prize is the highest award a scientist can receive. Each year it is given out in different fields of science and the arts. A committee in Sweden votes on who deserves the award.

In addition, each winner receives a $1.1 million prize.

This year the award in physics went for a discovery of a new light bulb. It was given to Isamu Akasaki, Hiroshi Amano and Shuji Nakamura. In the 1990s they discovered blue light-emitting diodes. We call them simply LEDs.

LED lights can make bright light bulbs. They are also found in flat-screen TVs and computers. Cellphone screens now use them. LEDs use much less electricity than other types of lights.

They Knew They Could Do It

One-fourth of our electricity use is from lights, said Olle Inganäs. He is on the committee that chose the Nobel Prize winner. "Having much more light for much less electricity is really going to have a big impact." The new Nobel award winners worked for years on blue LEDs. Red and green LEDs have been around since the 1960s. But no one could make white light. Blue LEDs can make white light when combined with red and green LEDs. Creating blue LEDs took about another 30 years.

"A lot of big companies really tried to do this and they failed," said Per Delsing in Sweden. He is also on the Nobel committee. But these three scientists "tried and tried again and eventually they actually succeeded."

★ **LEDs Are Brighter And Better For The Environment**

The achievement required the growth of high-quality crystals. They were used as semiconductors. The team grew the crystals from a semiconductor that produces blue light. Semiconductors allow electricity to flow between a conductor, such as copper, and an insulator, like glass.

The color depends on the energy applied to the crystals. The energy applied to these crystals creates ultraviolet and blue light.

LED bulbs use much less energy than traditional light bulbs. The old bulbs you see are called incandescent. They use electricity to heat a thin metal strand inside the glass bulb. It is called a filament. It wastes energy by giving off both heat and light. Instead, LEDs change energy directly into light. They do

not produce heat.

LEDs also avoid problems of fluorescent lights, which are long, thin lights. Many offices use them. They rely on mercury, which pollutes the environment when it is thrown away.

LED Technology Is Everywhere

LED technology now lights our cellphone screens and phone flashlights. Many homes use them as well. Even the twinkling lights put on Christmas trees are LEDs.

There also may be more uses in the future. Ultraviolet light kills bacteria. So blue LEDs could be used to make clean drinking water, Delsing said.

He said the invention benefits all humans.

Akasaki and Amano worked together at a university in Japan to make the discovery. Nakamura worked at a chemicals company in Japan. He improved upon the discovery by Akasaki and Amano.

Nakamura is now a professor at the University of California. He learned of his award in the middle of the night.

Patiently Waiting

"It's unbelievable," Nakamura said. "It's amazing. Unbelievable."

Akasaki was also called by phone. Yet, the Nobel Prize committee had not yet reached Amano when it made the announcement. He happened to be flying from Japan to France.

Every year, likely winners wait near their telephones on the day the prize is announced. They are hoping to get a call saying they are the lucky winner.

"I think actually they were not prepared for it," said Staffan Normark. He is with the Royal Swedish Academy of Sciences, which runs the Nobel Prize committee. "They had not been waiting all day or all night for this call."

Answer/complete the following:

1. Highlight concepts in this article connected our unit on energy.

2. Drawing Conclusions: Why was the discovery of blue LED light significant? **(Hint: Bulbs that give off white light are most common. Bulbs that give off white light are used in our homes, at school, and by businesses.)**

The answer for questions 3, 4, and 5 can be found in the ★ section of the article.

3. Why are LED bulbs more efficient than incandescent blubs?

4. Why are LED bulbs more environmentally friendly than fluorescent bulbs?

5. What determines the color of light emitted from the crystals of LED bulbs?

6. What is a conductor? (**Need help finding the answer? Use your notes on heat transfer)**

7. What is an insulator? **(Need help finding the answer? Use your notes on heat transfer)**

8. What does the term *semiconductor* mean? **(Hint: the prefix "semi" means having characteristics of or partially)**

9. How has LED technology improved our daily lives? **(Hint: What useful items use LED light)**

10. Classify each of the following as (I) insulators or (C) conductors. (**Need help? Use your phone or textbook.)**

___Silver	___Wood	___ Mercury	___ water
___Copper	___ Glass	___ Rubber	___ Oil

M

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The Nobel Prize is the highest award a scientist can receive. Each year it is given out in different fields of science and the arts — even poetry. A committee in Sweden votes on who deserves the award.

In addition, each winner, or team of winners, receives a $1.1 million prize.

This year the award in physics went for a discovery of a new light bulb. It was given to Isamu Akasaki, Hiroshi Amano and Shuji Nakamura. In the 1990s they discovered blue light-emitting diodes — we call them LEDs.

The lights have made possible very bright lamps and screens like the ones used on flat-screen TVs,

computers and cellphones. They use very little energy when compared with older types of light bulbs.

“Something like a fourth of our electricity consumption goes to illumination,” Nobel Prize committee member Professor Olle Inganäs of Sweden said. He spoke on Oct. 7 when the award was announced. “Having much more light for much less electricity is really going to have a big impact.”

They Never Gave Up

The new Nobel award winners worked for years to achieve blue LEDs. When combined with red and green LEDs, they can create white light. Red and green LEDs have been around since the 1960s. Creating blue LEDs took about another 30 years.

“A lot of big companies really tried to do this and they failed,” said Nobel committee member Per Delsing in Sweden. “But these guys persisted and they tried and tried again and eventually they actually succeeded.”

The achievement required the growth of high-quality crystals, used as semiconductors. The team grew the crystals from gallium nitride, a semiconductor that produces blue light. Semiconductors allow electricity to flow between a conductor, such as copper, and an insulator, like glass.

Crystals Play A Big Role

Inside semiconductors, electrons and “holes,” or spaces without electrons, can move around the crystal structure. Their movement allows electrical current to flow.

When current is applied to the semiconductor, electrons and holes join and give off light. The wavelength of the light — the color — depends on the type of crystals. The gallium nitride crystals create ultraviolet and blue light.

LED bulbs are much brighter, last much longer and use much less energy than old-fashioned incandescent light bulbs. Incandescent bulbs use electricity to heat a thin metal strand called a filament. It wastes energy by giving off both heat and light. Instead, LEDs change energy into light, without the heat.

LEDs also avoid problems of fluorescent lights. They are the long, thin bulbs that light office ceilings. They rely on mercury, which pollutes the environment when it is thrown away.

LED technology now lights our smart phone screens and phone flashlights, as well as many household lights. Even the twinkling lights put on Christmas trees are LEDs. And because ultraviolet light kills bacteria, blue LEDs could potentially be used to purify drinking water in the future, Delsing said.

The prize is "to be given for inventions that benefited mankind.”

"It's Amazing"

Akasaki and Amano worked together at the University of Nagoya to make the discovery. Nakamura worked independently at a chemicals company in Japan and improved upon the discovery by Akasaki and Amano.

Nakamura is now a professor of engineering at the University of California, Santa Barbara. He learned of

his award in the middle of the night. “It’s unbelievable,” Nakamura said. “It’s amazing. Unbelievable.”

Akasaki was also informed by phone. Yet, the Nobel Prize committee had not yet reached Amano when it made the announcement, because he happened to be flying from Japan to France.

Every year, likely winners wait near their telephones on the day the prize is announced. They're hoping to receive a call notifying them that they're Nobel Prize winners.

“I think actually they were not prepared for it,” said Staffan Normark, of the Royal Swedish Academy of Sciences, which runs the Nobel Prize committee. “They had not been waiting all day or all night for this call.”

Answer/complete the following:

1. Highlight concepts in this article connected our unit on energy.
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3. Why are LED bulbs more efficient than incandescent blubs?
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5. What determines the color of light emitted from the crystals of LED bulbs?
6. What is a conductor?
7. What is an insulator?
8. What does the term *semiconductor* mean? **(Hint: the prefix “semi” means having characteristics of or partially)**
9. How has LED technology improved our daily lives?

10. **Research:** Generate a list of insulators and conductors (3 of each). Use your phone or textbook.

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By Scientific American, adapted by Newsela staff

This year the Nobel Committee decided to honor a physics discovery that might be overlooked, but benefits us all: light bulbs. The 2014 Nobel Prize in physics went to Isamu Akasaki, Hiroshi Amano and Shuji Nakamura for their discovery of blue light-emitting diodes (LEDs), which have enabled new forms of brighter, more energy-efficient lighting.

"Something like a fourth of our electricity consumption goes to illumination," Nobel Prize committee member Olle Inganäs of Linköping University in Sweden said during a press conference on Oct. 7 announcing the award. "Having much more light for much less electricity is really going to have a big impact."

Blue LEDs A Long Time Coming

The new Nobel laureates worked for years to achieve blue LEDs, finally discovering them in the 1990s. When combined with red and green LEDs, they can create white light. The red and green versions have been around since the 1960s, but the blue took about another 30 years to accomplish. "A lot of big companies really tried to do this and they failed," said Nobel committee member Per Delsing of Chalmers University of Technology in Sweden. "But these guys persisted and they tried and tried again and eventually they actually succeeded."

The achievement required the growth of high-quality gallium nitride crystals, which are semiconductors. Semiconductors allow electricity to flow between a conductor, such as copper, and an insulator, like glass.

Inside semiconductors, electrons and "holes," or spaces without electrons, can move around the crystal lattice structure to allow electrical current to flow. When the right voltage is applied to the semiconductor, electrons and holes join and give off light. The wavelength of the light—the color—depends on the energy required to free an electron in the material. The energy applied to gallium nitride gives off ultraviolet and blue light.

Light Without Heat

The white light sources enabled by the discovery of blue LEDs last much longer and require much less

energy than traditional incandescent light bulbs. Incandescent bulbs use electricity to heat a thin metal strand called a filament. It wastes energy by releasing it in the form of not just light, but heat. Instead, LEDs more efficiently convert energy directly into light, without the heat.
LEDs also avoid pitfalls of fluorescent lights, the long, thin bulbs that typically light offices. Fluorescent lights rely on mercury, which pollutes the environment when it is thrown away.

LED technology now illuminates our smart phone screens and phone flashlights, as well as many household lights, and even the twinkling lights put on Christmas trees. And because ultraviolet light kills bacteria, blue LEDs could potentially be used to sterilize and purify drinking water in the future, Delsing said. "I really think that Alfred Nobel would be very happy about this prize. He wanted his prize to be given for inventions that benefited mankind."

Waiting For The Call ... Or Not

Akasaki and Amano worked together at the University of Nagoya to make the discovery, and Nakamura built on their discovery while working independently at the Nichia Chemicals Company in Japan. He is now a professor of engineering at the University of California, Santa Barbara. He learned of his award Tuesday just before 3 a.m. local time, and phoned into the press conference to describe the feeling of winning. "It's unbelievable," Nakamura said. "It's amazing. Unbelievable."
Akasaki was also informed by phone, but the Nobel Prize committee had not yet reached Amano when it made the announcement, because he happened to be flying from Japan to France.

Every year, likely winners wait near their telephones hoping to receive the call notifying them that they're Nobel Prize winners. In addition to being the most famous award in science, each winner, or team of winners, receives a $1.1 million prize.

"I think actually they were not prepared for it," said Staffan Normark, of the Royal Swedish Academy of Sciences, which runs the Nobel Prize committee. "They had not been waiting all day or all night for this call."

Answer/complete the following:

1-2. Complete the chart below.

1. Word or phrase in Article related to our Energy Unit	2. Description of how word or phrase relates to our Energy Unit
Example: Electricity	Type of kinetic energy

3. Drawing Conclusions: Why was the discovery of blue LED light significant?

4. What determines the color of light emitted from the crystals of LED bulbs?

5. **Related research:** Which color of the rainbow has the most energy? the least energy? Use your phone or textbook.

6. What is the difference between a conductor and an insulator?

7. Using context clues, what does the word *semiconductor* most likely mean?

8. How has LED technology improved our daily lives?

9. **Drawing Conclusions: Suppose a hospital is looking into which bulbs they should buy, incandescent, fluorescent, or LED. Which light bulb do you think they should buy? Use text evidence to support your answer.**

10. **Generate a list of conductors, insulators, and semiconductors (5 of each). Use your phone or textbook.**

Differentiated based on Lexile level and Depth of Questions