Name Date

Section 11.1 Summary

Stars

Textbook pages 368–381

Before You Read

What is a star made from? How long does a star last? Write your ideas on the lines below.

Mark the Text

Reinforce Your Understanding

As you read this section, highlight the main point of each paragraph. Use a different colour to highlight an example that helps explain the main point, or write your own example.

Reading Check

1. What is a star?

What is a star?

A **star** is a massive, gaseous, spherical object in space that gives off light and other forms of energy due to nuclear reactions that take place at its core. These nuclear reactions transform elements of one kind into elements of another kind. For instance, during most of the life of a star, atoms of hydrogen gas fuse and become atoms of helium gas. This nuclear change, called nuclear **fusion**, releases tremendous amounts of energy.

What does the colour of a star reveal?

If a piece of metal is heated, its colour changes. The colour is red at first. Then, as the metal gets hotter, the colour becomes orange, then yellow, and then blue-white. Stars differ in colour, and we can infer their surface temperature based on their colour. Yellow stars, such as our Sun, are fairly hot, with a surface temperature of about 6000°C. Red stars are fairly cool, about 3000°C. Whitish-blue stars are extremely hot, ranging from 20 000°C to 40 000°C.

The colour of a star also reveals clues about what the star is made of and how it is moving. When the wavelength of the light from an object changes due to its motion, the change is called the **Doppler effect**.

How long do stars last?

The "life" of a star depends on its mass. Low mass stars (red dwarf stars) use up their hydrogen slowly and can last as long as 100 billion years. As they use up their hydrogen, they lose mass and end their lives as small, dim white dwarf stars.

Intermediate mass stars like our Sun use up their hydrogen more quickly—over about 10 billion years. When the hydrogen is used up, the core of the star contracts, the temperature rises, and the outer layers of the star expand. These cooler outer layers have a red colour, so stars at this stage of their lives are called red giants. As they continue to age, they get smaller, cooler, and dimmer, becoming a white dwarf and, eventually, an even cooler, darker black dwarf star.

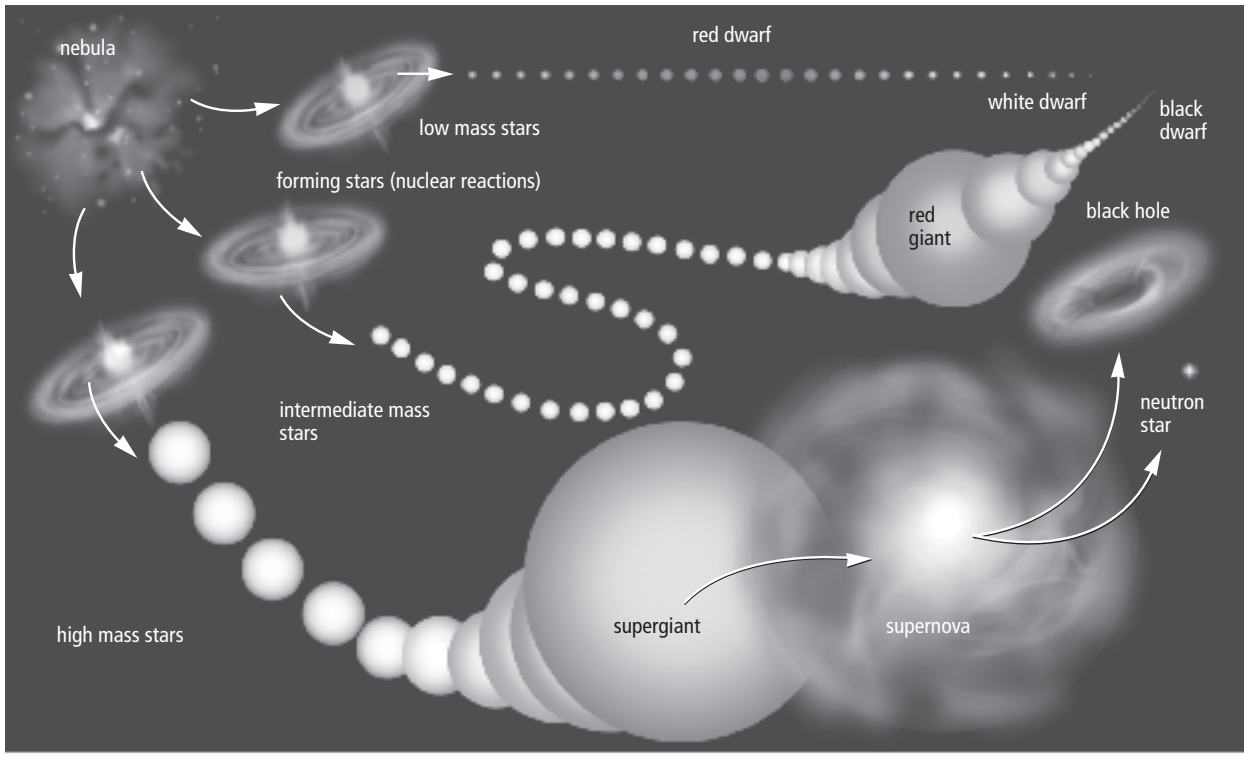
High mass stars use up their hydrogen relatively quickly, and may only last millions of years. When nearing the end of its life, the core of a high mass star collapses in a dramatic, powerful explosion called a **supernova**. For very high mass stars, the remaining core contracts further, resulting in a rapidly rotating, unimaginably dense neutron star. ✔

✔ *Reading Check*

2. When does a supernova occur?

What is a black hole?

Astronomers believe that the core of an extremely massive star can contract greatly into a super-compact, super-dense object called a **black hole**. The force of gravity in a black hole is so great that not even light can escape it.



Name Date

Cloze Activity
Section 11.1

Use with textbook pages 368–377.

Describing stars

Vocabulary	
black dwarf	red
black hole	red dwarf
Doppler	red giants
fusion	supernova
helium	white dwarf
hydrogen	whitish-blue
mass	yellow
neutron	

Use the terms in the vocabulary box to fill in the blanks. Each term can be used more than once. You will not need to use every term.

1. During most of the life of a star, atoms of _____ gas fuse and become atoms of _____ gas. This nuclear change, called nuclear _____, releases tremendous amounts of energy.

2. Stars that are _____ in colour, such as our Sun, are fairly hot, with a surface temperature of about 6000°C.

3. Stars that are _____ in colour are fairly cool, about 3000°C.

4. Stars that are _____ in colour are extremely hot, ranging from 20 000°C to 40 000°C.

5. When the wavelength of a star's light changes due to its motion, the change is called the _____ effect.

6. The "life" of a star depends on its _____.

7. Low mass stars, called _____ stars, use up their hydrogen slowly.

8. As they continue to age, intermediate mass stars get smaller, cooler, and dimmer, becoming a _____ and, eventually, an even cooler, darker _____ star.

9. When nearing the end of its life, the core of a high mass star collapses in a dramatic, powerful explosion called a _____. For very high mass stars, the remaining core contracts further, resulting in a rapidly rotating, unimaginably dense _____ star.

10. The core of an extremely massive star can contract greatly into a super-compact, super-dense object called a _____.

Use textbook pages 370–372.

The evolution of stars

The diagrams below illustrate the changes two types of stars go through as they age. Describe the life cycle of each type of star and answer the question that follows.

Different life paths for stars

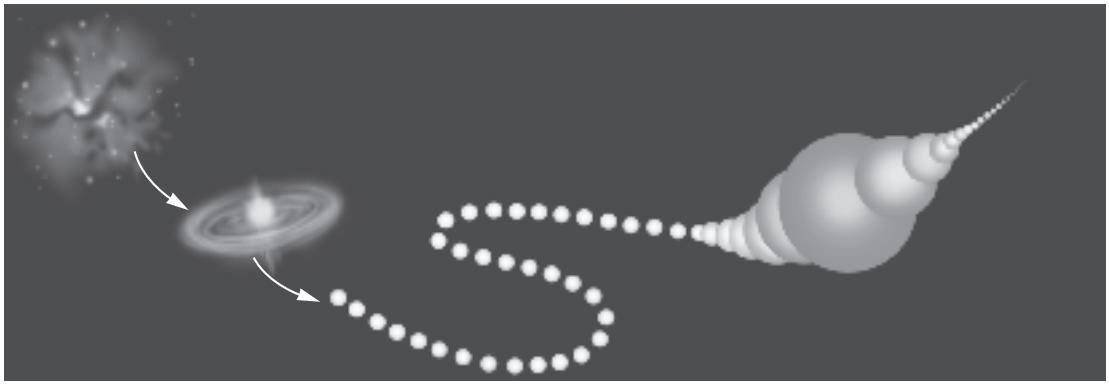
1. Low mass stars

Description

_____

_____

2. Intermediate mass stars



Description

_____

_____

3. How does a high mass star end its life? _____

_____

Use with textbook pages 368–377.

True or false?

Read the statements given below. If the statement is true, write "T" on the line in front of the statement. If it is false, write "F" and then rewrite the statement so it is true.

1. _____ A star gives off light due to interstellar reactions that take place at its core.

2. _____ During most of the life of a star, atoms of helium gas fuse and become atoms of hydrogen gas.

3. _____ Yellow stars, such as our Sun, are the hottest types of stars.

4. _____ The colour of a star reveals information about what the star is made of, its temperature, and how it is moving.

5. _____ Intermediate mass stars expand into red giants and then become part of a supernova.

6. _____ A high mass star may last only millions of years.

7. _____ The force of gravity is so strong in black holes that not even light can escape from them.

Use with textbook pages 368–377.

Stars

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ black hole	**A.** a dramatic, massive explosion that occurs when a large, high mass star collapses in on itself
2. _____ fusion	**B.** super-compact, super-dense celestial object
3. _____ star	**C.** a spherical celestial body of hot gases that gives off light due to nuclear reactions
4. _____ supernova	**D.** the process in which atoms fuse together to form other atoms
	E. a rapidly rotating, unimaginably dense celestial body

Circle the letter of the best answer.

5. Hydrogen atoms combine to form helium in a process called

A. nuclear fusion

B. nuclear fission

C. supernova

D. nuclear burnout

6. Which type of star has an average life of 10 billion years?

A. low mass star

B. intermediate mass star

C. high mass star

D. all stars

7. A low mass star will eventually become a

A. red giant

B. nebula

C. supernova

D. white dwarf

8. When comparing the sizes of stars, our Sun is

A. the largest star discovered to date

B. one of the larger stars discovered to date

C. medium size as compared to other stars

D. one of the smallest stars discovered to date

9. What is the temperature range for whitish-blue stars?

A. 1000°C to 3000°C

B. 2000°C to 4000°C

C. 5000°C to 6000°C

D. 20 000°C to 40 000°C

10. What information can astronomers gain from the colour of a star?

A. the star's temperature and composition

B. the nebula the star came from

C. the stage of development the star is in

D. the direction the star might go in next

11. Which of the following is not true of high mass stars?

A. They use up hydrogen relatively slowly.

B. They last only millions of years.

C. They collapse in a supernova.

D. Their core may contract further into a neutron star.