Got It? 3. Write each radical expression in exponential form.

a. $\sqrt[3]{s^2}$ b. $12\sqrt[3]{x^4}$ c. $\sqrt{(4y)^5}$ d. $\sqrt[4]{256a^8}$

Problem 4 Using a Radical Expression STEM

Biology **You can estimate the metabolic rate of living organisms based on body mass using Kleiber's law. The formula $R = 73.3\sqrt[4]{M^3}$ relates metabolic rate R measured in Calories per day to body mass M measured in kilograms. What is the metabolic rate of a dog with a body mass of 18 kg?**

Think

How can you find the approximate value of the expression?
You can use 18^(3/4) to simplify the radical using a calculator.

$R = 73.3\sqrt[4]{M^3}$

$= 73.3\sqrt[4]{18^3}$ Substitute 18 for M.

≈ 640.5578436 Use a calculator to simplify.

The metabolic rate is about 641 Calories per day.

Got It? 4. What is the metabolic rate of a man with a body mass of 75 kg?

Lesson Check

Do you know HOW?

Simplify each expression.

1. $\sqrt[6]{64}$ 2. $\sqrt[4]{81}$ 3. $\left(\sqrt[3]{125}\right)^4$

Write each expression using rational exponents in radical form and each radical expression in exponential form.

4. $\sqrt{x}$ 5. $c^{\frac{1}{5}}$ 6. $(8d)^{\frac{2}{3}}$ 7. $\sqrt[4]{16y^3}$

Do you UNDERSTAND? MATHEMATICAL PRACTICES

8. **Error Analysis** What is the error in the problem at the right? What is the correct answer?

$$(27y)^{\frac{2}{3}} \quad \sqrt[3]{27y^2} \quad 3y^{\frac{2}{3}}$$

9. Write a rule for multiplying two radicals with the same radicand. Justify why your rule works.

10. Does $\sqrt{4^3} - \sqrt{4} = 4$? Explain why or why not.

Practice and Problem-Solving Exercises MATHEMATICAL PRACTICES

A Practice

What is the value of each expression? See Problem 1.

11. $\sqrt[2]{49}$ 12. $\sqrt[5]{1}$ 13. $\sqrt[4]{625}$

14. $\sqrt[2]{81}$ 15. $\sqrt[3]{216}$ 16. $\sqrt[4]{81}$

Write each expression in radical form. See Problem 2.

17. $a^{\frac{2}{3}}$ 18. $(64b)^{\frac{3}{4}}$ 19. $25x^{\frac{1}{2}}$

20. $z^{\frac{3}{4}}$ 21. $(25x)^{\frac{1}{2}}$ 22. $27a^{\frac{2}{3}}$

23. $(98d)^{\frac{1}{2}}$ 24. $18b^{\frac{1}{4}}$ 25. $(24c)^{\frac{2}{3}}$

Write each expression in exponential form. See Problem 3.

26. $\sqrt[5]{a^3}$ **27.** $\sqrt{(2c)^4}$ **28.** $\sqrt[4]{256a^3}$

29. $\sqrt[3]{(8x)^2}$ **30.** $\sqrt[3]{27c^2}$ **31.** $\sqrt[4]{625y^3}$

32. $\sqrt{36x}$ **33.** $\sqrt[4]{x^3}$ **34.** $\sqrt[3]{8b^5}$

35. Manufacturing A company that manufactures memory chips for digital cameras uses the formula $c = 120\sqrt[3]{n^2} + 1300$ to determine the cost c, in dollars, of producing n chips. How much will it cost to produce 250 chips? See Problem 4.

STEM **36. Archaeology** Carbon-14 is present in all living organisms and decays at a predictable rate. To estimate the age of an organism, archaeologists measure the amount of carbon-14 left in its remains. The approximate amount of carbon-14 remaining after 5000 years can be found using the formula $A = A_0(2.7)^{-\frac{3}{5}}$, where A_0 is the initial amount of carbon-14 in the sample that is tested. How much carbon-14 is left in a sample that is 5000 years old and originally contained 7.0×10^{-12} grams of carbon-14?

B Apply

Simplify each expression using the properties of exponents, and then write the expression in radical form.

37. $\left(x^{\frac{3}{4}}\right)\left(x^{\frac{1}{2}}\right)$ **38.** $\left(a^{\frac{2}{3}}\right)\left(a^{\frac{1}{4}}\right)$ **39.** $\left(cd\right)^{\frac{1}{2}}\left(d^{\frac{1}{3}}\right)$

40. $(3x^{\frac{1}{3}})(8x^2)$ **41.** $\left(36x\right)^{\frac{1}{2}}\left(49x\right)^{\frac{1}{2}}$ **42.** $\left(x^{\frac{2}{5}}\right)\left(8x\right)^{\frac{1}{3}}$

Write each expression in exponential form. Simplify when possible.

43. $\sqrt[3]{b^2} - \sqrt[3]{b}$ **44.** $3\sqrt[4]{a^3} - 2\sqrt[4]{a^3}$ **45.** $\left(\sqrt[3]{8b^5}\right) - \left(\sqrt[4]{256a^3}\right)$

46. $\sqrt[4]{(9x)^2} + \sqrt[4]{625y^3}$ **47.** $\left(\sqrt[3]{y}\right)\left(\sqrt[3]{y}\right)\left(\sqrt[3]{y}\right)$ **48.** $\sqrt{(2c)^4} + \sqrt[3]{c^6}$

49. Sports The radius r of a sphere that has volume V is $r = \sqrt[3]{\frac{3V}{4\pi}}$. The volume of a basketball is approximately 434.67 in.^{3}. The radius of a tennis ball is about one fourth the radius of a basketball. Find the radius of the tennis ball.

50. a. Show that $\sqrt{x^2} = x$ by rewriting $\sqrt{x^2}$ in exponential form.

b. Show that $\sqrt[4]{x^2} = \sqrt{x}$ by rewriting $\sqrt[4]{x^2}$ in exponential form.

51. Think about a Plan You want to simplify the expression $4x^{\frac{3}{2}} + 3\sqrt{x^3}$.

- How can you write the radical expression using a rational exponent?
- Can you add the resulting terms?
- What is the result in simplest form?
- Can you write the result in two equivalent forms?

52. Open-Ended Write an expression using rational exponents. Then write an equivalent expression using radicals.