SCIENCE FOUNDATIONS

Power

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how you compare a slow kettle with a fast one, or a cyclist climbing a hill with a car doing the same climb, by how quickly each one does the same job. Two kettles can both boil the same water, but the more powerful one finishes sooner because it delivers energy faster. A cyclist and a car can both climb the same hill, but the car does it in seconds while the cyclist takes minutes. Knowing power tells you that doing the same job faster takes more power, which is why a fast kettle costs more to run per minute.



Rule

Power: power is the rate of doing work. $P = \frac{\text{work}}{\text{time}}$.

One watt is one joule per second, so doing the same work in less time means more power.

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Worked examples

EXAMPLE 1

Q A machine does 1000 J of work in 5 s. Power?

SOLUTION

Write the rule:

power = work ÷ time

Substitute:

power = 1000 ÷ 5 = 200 W

Write the answer in watts.

The result is power 200 W.

EXAMPLE 2

Q A machine does 1000 J in 20 s. Power?

SOLUTION

Write the rule:

power = work ÷ time

Substitute:

power = 1000 ÷ 20 = 50 W

Write the answer in watts.

The result is power 50 W.

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Practice questions

1

Power formula?

A Work multiplied by time

B Time divided by work

C Work divided by time

D Work plus time

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2

1500 J in 5 s: power?

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3 **A machine does 600 J of work at 120 W. How long does it take?**

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4 **Units of power?**

A Joules

B Watts

C Newtons

D Seconds

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5 1 watt equals what?

- **A** 1 joule per second
- **B** 1 joule
- **C** 1 newton per second
- **D** 1 watt per joule

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6 Two machines do the same work. Machine A takes 4 s, Machine B takes 8 s. Which machine is more powerful, and by how much?

- **A** Machine A, twice as powerful
- **B** Machine B, twice as powerful
- **C** They are equally powerful
- **D** Machine A, four times as powerful

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7 Which is more powerful: 1000 J in 5 s or in 20 s?

- A 1000 J in 20 s
- B 1000 J in 10 s
- C 1000 J in 2 s
- D 1000 J in 5 s

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8 Power 100 W for 10 s: work?

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9 Force 20 N at 3 m/s: power?

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10

Same work in half the time: power becomes?

A Double

B Half

C The same

D Four times

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ANSWER KEY

1. Work divided by time

2. 300 W

3. 5 s

4. Watts

5. 1 joule per second

6. Machine A, twice as powerful

7. 1000 J in 2 s

8. 1000 J

9. 60 W

10. Double

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