Efficiency Questions for GCSE Physics

1. What is the general formula for efficiency?

Efficiency = useful energy output / total energy input

It can also be expressed as a percentage by multiplying by 100%

2. Why does efficiency have no units?

Efficiency is a ration of two energies. The units for energy therefore cancel out.

3. What is "useful energy out" in the context of efficiency?

The useful energy is the energy that is output in the form and use that is intended.

4. A device wastes 200 joules of energy from a total input of 800 joules. Calculate the useful energy output.

800 – 200 = ***600J***

5. Why is no device 100% efficient?

Energy is always wasted as heat during any energy transfer.

6. If a kettle uses 1200 joules of energy and 1000 joules goes into heating water, calculate its efficiency.

*1000 / 1200 = **0.83*** *or* *(1000/1200) x 100% = **83%***

7. A heater converts 1500 joules of energy to 1200 joules of useful energy. Calculate the wasted energy.

*1500 – 1200 = **300 J***

8. A light bulb is 25% efficient. What fraction of its total energy input is wasted?

100% - 25% = 75% *so the fraction is* ***¾*** *or* ***0.75***

9. A wind turbine produces 3000 joules of electrical energy with 7500 joules of energy input. Calculate its efficiency.

*3000 / 7500 = **0.4*** *or* *(3000/7500) x 100% = **40%***

10. If a machine has an efficiency of 85%, what percentage of energy is wasted?

*100% - 85% = **15%***

11. Why is streamlining important for fast-moving objects like cars and planes?

Streamlining reduces air resistance, minimizing the energy lost as heat due to friction with the air.

This improves the efficiency of the object by reducing wasted energy.

12. A light bulb uses 100 joules of energy to produce 20 joules of light. What is its efficiency as a ratio and as a percentage?

*20 / 100 = **0.2*** *or* *(20/100) x 100% = **20%***

13. A solar panel has an efficiency of 15% and produces 450 joules of electricity. How much energy input does it require?

$15\% = (450 / E_{in}) \times 100\ \%$

$E = (450 / 15\%) \times 100\%$

$= \mathbf{3000\ J}$

14. A motor is 75% efficient and produces 450 joules of mechanical energy. Calculate the total energy input required.

$75\% = (450 / E_{in}) \times 100\ \%$

$E = (450 / 75\%) \times 100\%$

$= \mathbf{600\ J}$

15. A machine has an efficiency of 80% and an energy input of 5000 joules. Calculate the useful energy output.

$80\% = (E_{out} / 5000) \times 100\%$

$80\% / 100\% = E_{out} / 5000$

$(80\% / 100\%) \times 5000 = E_{out}$

$= \mathbf{4000J}$

16. A power plant operates at an efficiency of 35% and generates 10,500 joules of electrical energy. How much energy does it require as input?

$35\% = (10{,}500 / E_{in}) \times 100\ \%$

$E_{in} = (10{,}500 / 35\%) \times 100\%$

$= \mathbf{30{,}000\ J}$

17. An engine has an efficiency of 25% and receives 2000 joules of energy input. How much energy is converted into useful work?

$25\% = (E_{out} / 2000) \times 100\%$

$(25\% / 100\%) \times 2000 = E_{out}$

$= \mathbf{500\ J}$

18. A wind turbine is 60% efficient and produces 1,200 joules of electrical energy. How much energy does it require from the wind?

$60\% = (1200 / E_{in}) \times 100\ \%$

$E_{in} = (1200 / 60\%) \times 100\%$

$= \mathbf{2000J}$

19. A light bulb uses 150 joules of energy, but its efficiency is only 30%. How much energy is wasted as heat?

$30\% = (E_{out} / 150) \times 100\%$

$(30\% / 100\%) \times 150 = E_{out}$

$= 45\ J$ so: $150J - 45J = \mathbf{105\ J}$

20. A power plant has an efficiency of 40% and uses 10,000 joules of energy. How much energy is wasted during the process?

$40\% = (E_{out} / 10{,}000) \times 100\%$

$(40\% / 100\%) \times 10{,}000 = E_{out}$

$= 4000\ J$

$10{,}000J - 4000J = \mathbf{6000\ J}$