

45 Hard Calculation Questions based on all the GCSE Physics Equations

1. A 1500 kg electric car increases its speed from 12 m/s to 28 m/s. Calculate the increase in kinetic energy.
2. A skateboarder loses 4500 J of gravitational potential energy while descending a ramp. If the skateboarder and board have a total mass of 60 kg, calculate the vertical drop.
3. A 0.80 kg spring-powered launcher stores 32 J of elastic potential energy. The spring constant is 2500 N/m. Calculate the extension of the spring.
4. A 2.5 kg pan of water is heated from 20°C to 100°C. The heater is only 75% efficient. Calculate the total energy supplied by the mains.
5. A battery transfers 1.08 MJ of energy in 20 minutes. Calculate its average power output in kW.
6. A lift motor has a power output of 3.2 kW. It lifts a load through 15 m in 12 s. Calculate the maximum mass it can lift.
7. A motor receives 18000 J of energy and wastes 5400 J. Calculate its efficiency.
8. A machine is 65% efficient and produces 390 W of useful power. Calculate the total power supplied.
9. A phone charger delivers a current of 2.4 A for 1 hour 45 minutes. Calculate the charge transferred.
10. A resistor transfers 960 J of energy in 4 minutes while carrying a current of 0.50 A. Calculate the resistance.
11. A 3.3 kW kettle is connected to a 230 V supply. Calculate the current drawn.
12. A heater has a resistance of 24 Ω and transfers 864 kJ of energy in 20 minutes. Calculate the current flowing.
13. An electric oven rated at 2.4 kW is used for 35 minutes. Calculate the energy transferred in MJ.
14. A battery transfers 18000 J of energy while moving 750 C of charge. Calculate the potential difference.

15. A steel beam has dimensions $4.0\text{ m} \times 0.20\text{ m} \times 0.15\text{ m}$ and a mass of 942 kg . Calculate its density.
16. A 1.8 kg block of ice at 0°C melts completely. Calculate the thermal energy required if the specific latent heat of fusion is 330000 J/kg .
17. A gas occupies 0.80 m^3 at a pressure of 250000 Pa . It expands until the pressure falls to 100000 Pa . Calculate the new volume.
18. A loaded lift has a weight of 18000 N . Calculate its mass.
19. A warehouse robot does 12000 J of work moving a crate. If the system is only 60% efficient, calculate the total energy supplied.
20. A spring extends by 0.18 m when a force of 135 N is applied. Calculate the spring constant.
21. A mechanic uses a 40 cm spanner to loosen a bolt. If the moment needed is 180 Nm , calculate the force required.
22. A stiletto heel exerts a force of 650 N on an area of 0.00025 m^2 . Calculate the pressure produced.
23. A submarine is operating at a depth of 420 m . The density of seawater is 1030 kg/m^3 . Calculate the pressure due to the water.
24. A high-speed train travels at 83 m/s for $2\text{ hours } 15\text{ minutes}$. Calculate the distance travelled in kilometres.
25. A racing car accelerates from 15 m/s to 45 m/s over a distance of 180 m . Calculate its acceleration.
26. A motorbike accelerates from rest at 4.5 m/s^2 . Calculate the distance travelled when it reaches 27 m/s .
27. A 1400 kg car increases its speed from 8 m/s to 20 m/s in 5.0 s . Calculate the resultant force.
28. A 0.16 kg cricket ball travelling at 32 m/s rebounds from a bat at 18 m/s in the opposite direction. Calculate the change in momentum.
29. The collision in Question 28 lasts for 0.015 s . Calculate the average force acting on the ball.

30. A sound wave has a wavelength of 0.75 m and travels at 330 m/s. Calculate the frequency.
31. A loudspeaker emits a sound with a frequency of 400 Hz. Calculate the period.
32. An insect 3.0 mm high produces an image 75 mm high in a microscope. Calculate the magnification.
33. A wire 0.45 m long carries a current of 12 A in a magnetic field of 0.35 T. Calculate the force acting on the wire.
34. A transformer has 3600 turns on the primary coil and 120 turns on the secondary coil. The primary voltage is 240 V. Calculate the secondary voltage.
35. A transformer has a primary voltage of 230 V and a primary current of 1.2 A. The secondary voltage is 24 V. Calculate the secondary current.
36. A wave travelling through water has a speed of 12 m/s and a wavelength of 0.30 m. Calculate the frequency.
37. A satellite travels at 7800 m/s for 95 minutes. Calculate the distance travelled in kilometres.
38. A hydraulic press exerts a force of 24000 N over an area of 0.08 m². Calculate the pressure produced.
39. A diver experiences a pressure due to water of 620000 Pa. The density of seawater is 1000 kg/m³. Calculate the depth.
40. A spring stores 18 J of elastic potential energy when stretched by 0.12 m. Calculate the spring constant.
41. A cyclist loses 12000 J of GPE while descending a hill. If all of this becomes kinetic energy and the cyclist has a mass of 75 kg, calculate their speed at the bottom.
42. A 0.25 kg tennis ball is dropped from a height of 18 m. Calculate its speed just before hitting the ground.
43. A 2000 kg lift rises 25 m in 40 s. Calculate the minimum power needed by the motor.
44. A 60 W lamp is left on for 18 hours. Electricity costs 30 p per kWh. Calculate the cost.

45. A transformer supplies a 12 V lamp drawing 4 A. If the primary voltage is 240 V, calculate the primary current assuming 100% efficiency.