

45 Grade 9 Calculation Questions based on all the GCSE Physics Equations

1. A 1400 kg electric car starts from rest and accelerates to 30 m/s. The battery transfers 900 kJ of energy during the acceleration. Calculate:
 - a) the gain in kinetic energy
 - b) the efficiency of the energy transfer.
2. A 75 kg mountain biker descends a hill with a vertical height of 60 m. At the bottom they are travelling at 28 m/s. Calculate the energy transferred to the surroundings.
3. A 0.25 kg football is kicked vertically upwards at 20 m/s. Calculate:
 - a) its initial kinetic energy
 - b) the maximum height reached.
4. A spring with a spring constant of 1800 N/m is compressed by 0.20 m. Only 65% of the stored energy becomes kinetic energy of a 0.080 kg ball. Calculate the launch speed of the ball.
5. A 2.0 kg kettle of water is heated from 15°C to 100°C. The kettle is 85% efficient. Calculate the electrical energy supplied.
6. A 0.15 kg mass of water at 100°C is completely converted to steam. Calculate the energy required.
7. A 12 V battery supplies a current of 8 A for 15 minutes. The motor connected to it is 75% efficient. Calculate the useful energy transferred.
8. A battery transfers 360000 J of useful energy while operating at 24 V and 80% efficiency. Calculate the total charge moved.
9. A 3.0 kW heater is connected to a 230 V supply. Calculate:
 - a) the current drawn
 - b) the charge transferred in 10 minutes.

10. A resistor connected to a 12 V supply transfers 2880 J in 4 minutes. Calculate its resistance.
11. A 2.4 kW tumble dryer is used for 1 hour 45 minutes. Electricity costs 33 p per kWh. Calculate the cost.
12. A steel beam measures 3.0 m × 0.15 m × 0.12 m and has a density of 7850 kg/m³. Calculate its mass.
13. A 1.2 kg aluminium block cools from 220°C to 40°C. Calculate the energy transferred to the surroundings.
14. A gas occupies 0.75 m³ at 120 kPa. It is compressed until the volume is 0.20 m³. Calculate the final pressure.
15. A submarine is 500 m below the sea surface. Calculate:
 - a) the pressure due to the water
 - b) the force on a hatch of area 0.80 m².
16. A hydraulic lift supports a 2000 kg vehicle. The hydraulic pressure is 400000 Pa. Calculate the minimum piston area required.
17. A 1500 kg car brakes from 32 m/s to rest in 64 m. Calculate:
 - a) the deceleration
 - b) the braking force.
18. A 0.058 kg tennis ball travelling at 52 m/s rebounds at 38 m/s in the opposite direction. The collision lasts 0.004 s. Calculate the average force on the ball.
19. A 1600 kg car accelerates from 12 m/s to 30 m/s over a distance of 210 m. Calculate:
 - a) the acceleration
 - b) the resultant force.
20. A 600 kg rollercoaster starts from rest at the top of a 55 m hill. During the descent, 75 kJ is transferred to the surroundings. Calculate its speed at the bottom.
21. A 900 kg lift rises 25 m in 20 s. The motor is 70% efficient. Calculate the input power.
22. A crane with an input power of 10 kW and an efficiency of 80% lifts a 750 kg load. Calculate the time taken to raise the load by 30 m.

23. A spring stores 120 J of elastic potential energy when compressed. The spring constant is 2400 N/m. Calculate:
 - a) the compression
 - b) the force applied.
24. A spring launcher stores 60 J of energy and launches a 0.12 kg ball vertically. Calculate the maximum height reached.
25. A transformer changes 230 V to 12 V and supplies a current of 8 A on the secondary side. Calculate the primary current.
26. A transformer has 80 turns on the secondary coil and produces 16 V. The primary voltage is 240 V. Calculate the number of primary turns.
27. A transformer takes in 240 V at 0.90 A and is 85% efficient. The output voltage is 24 V. Calculate the output current.
28. A wire carrying 12 A experiences a force of 2.4 N in a magnetic field of strength 0.50 T. Calculate the length of wire in the field.
29. A loudspeaker coil contains 0.18 m of wire in a 0.40 T magnetic field. The force on the coil is 0.72 N. Calculate the current.
30. A water wave has a wavelength of 0.60 m and a frequency of 8 Hz. Calculate:
 - a) the wave speed
 - b) the distance travelled in 3 minutes.
31. An FM radio wave has a frequency of 95 MHz. Calculate its wavelength.
32. A wave has a speed of 320 m/s and a period of 0.004 s. Calculate its wavelength.
33. An object 0.25 mm high produces an image 30 mm high. Calculate the magnification.
34. A cyclist travels 12 km in 24 minutes, rests for 6 minutes, then travels 8 km in 15 minutes. Calculate the average speed for the entire journey in m/s.
35. A car accelerates from 10 m/s to 34 m/s over 132 m. Calculate:

- a) the acceleration
 - b) the time taken.
36. A rocket sled accelerates from rest to 100 m/s over 500 m. Calculate:
- a) the acceleration
 - b) the time taken.
37. A 0.16 kg cricket ball is bowled at 38 m/s and struck back at 42 m/s in the opposite direction. Calculate the change in momentum.
38. A 65 kg skateboarder travelling at 5.5 m/s jumps onto a stationary 3 kg skateboard. Calculate the final velocity.
39. A chair has four legs. The total weight acting on the chair is 720 N. Each leg touches the ground over an area of 0.0005 m². Calculate the pressure under each leg.
40. A diver experiences a pressure of 980000 Pa due to water. Calculate the depth.
41. A 1.2 kW motor lifts a 40 kg mass vertically. The motor is 75% efficient. Calculate the maximum lifting speed.
42. A 1400 kg car travelling at 28 m/s brakes with a force of 5600 N. Calculate the stopping distance.
43. A spring stretches by 0.25 m and stores 180 J of energy. Calculate:
- a) the spring constant
 - b) the force applied.
44. A 1.0 kg metal block is heated by a 120 W heater for 15 minutes. Its temperature rises by 60°C. Calculate the specific heat capacity of the metal.
45. A 0.50 kg sample of wax requires 110000 J to melt. Calculate the specific latent heat.