

Physics Problems for Python Containers

Problems

1. Calculate the average velocity of a car given its initial velocity of 10 m/s and final velocity of 20 m/s.
2. Determine the gravitational force between two masses of 5 kg and 10 kg separated by a distance of 2 meters.
3. Find the kinetic energy of an object with a mass of 2 kg moving at a velocity of 3 m/s.
4. Calculate the potential energy of an object with a mass of 2 kg at a height of 5 meters.
5. Determine the work done by a force of 10 N over a distance of 5 meters.
6. Calculate the power output of a machine that does 100 J of work in 5 seconds.
7. Find the acceleration of an object that goes from 0 m/s to 20 m/s in 4 seconds.
8. Determine the momentum of an object with a mass of 2 kg moving at a velocity of 3 m/s.
9. Calculate the impulse experienced by an object when a force of 10 N is applied for 2 seconds.
10. Find the frequency of a wave with a wavelength of 2 meters traveling at a speed of 340 m/s.
11. Determine the period of a pendulum with a length of 2 meters.
12. Calculate the electric force between two charges of $1\text{e-}6$ C and $2\text{e-}6$ C separated by a distance of 0.5 meters.
13. Find the electric field at a point 0.5 meters away from a point charge of $1\text{e-}6$ C.
14. Determine the potential difference between two points in an electric field of 1000 N/C separated by a distance of 0.1 meters.
15. Calculate the capacitance of a parallel plate capacitor with an area of 1 m^2 and a separation of 0.01 meters.
16. Find the magnetic force on a charge of $1\text{e-}6$ C moving at 10 m/s in a magnetic field of 0.1 T.
17. Determine the magnetic flux through a loop of wire with an area of 0.01 m^2 in a magnetic field of 0.1 T at an angle of 30 degrees.
18. Calculate the inductance of a coil with 100 turns, an area of 0.01 m^2 , and a length of 0.1 meters.
19. Find the energy stored in an inductor with an inductance of 0.01 H and a current of 2 A.
20. Determine the resonant frequency of an LC circuit with an inductance of 0.01 H and a capacitance of $1\text{e-}6$ F.
21. Calculate the pressure exerted by a fluid with a density of 1000 kg/m^3 at a depth of 10 meters.
22. Find the buoyant force on an object with a volume of 0.01 m^3 submerged in a fluid with a density of 1000 kg/m^3 .
23. Determine the flow rate of a fluid through a pipe with an area of 0.01 m^2 and a velocity of 2 m/s.
24. Calculate the heat transferred in a thermodynamic process for a mass of 1 kg with a specific heat of 4200 J/(kg K) and a temperature change of 10 K.
25. Find the efficiency of a heat engine that does 100 J of work with a heat input of 200 J.
26. Determine the entropy change in a reversible process where 100 J of heat is transferred at a temperature of 300 K.
27. Calculate the wavelength of light with a frequency of $5\text{e}14$ Hz.
28. Find the energy of a photon with a wavelength of 500 nm.
29. Determine the refractive index of a medium where the speed of light is $2\text{e}8$ m/s.
30. Calculate the focal length of a lens with object and image distances of 10 cm and 20 cm, respectively.

Hints:

$$\text{average velocity} = \frac{\text{initial velocity} + \text{final velocity}}{2} \quad F = G \frac{m_1 m_2}{r^2}$$

$$KE = \frac{1}{2} m v^2$$

$$PE = mgh$$

$$W = Fd$$

$$P = \frac{W}{t}$$

$$a = \frac{v_f - v_i}{t}$$

$$p = mv$$

$$J = Ft$$

$$f = \frac{v}{\lambda}$$

$$T = 2\pi \sqrt{\frac{L}{g}}$$

$$F = k \frac{q_1 q_2}{r^2}$$

$$E = k \frac{q}{r^2}$$

$$V = Ed$$

$$C = \frac{\epsilon_0 A}{d}$$

$$F = qvB$$

$$\Phi = BA \cos(\theta)$$

$$L = \frac{\mu_0 N^2 A}{l}$$

$$E = \frac{1}{2} L I^2$$

$$f = \frac{1}{2\pi \sqrt{LC}}$$

$$P = \rho gh$$

$$F_b = \rho V g$$

$$Q = A v$$

$$Q = mc\Delta T$$

$$\eta = \frac{W}{Q_H}$$

$$\Delta S = \frac{Q}{T}$$

$$\lambda = \frac{c}{f}$$

$$E = \frac{hc}{\lambda}$$

$$n = \frac{c}{v}$$

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i} \quad \text{average velocity} = \frac{\text{initial velocity} + \text{final velocity}}{2} \quad F = G \frac{m_1 m_2}{r^2}$$

$$KE = \frac{1}{2} m v^2$$

$$PE = mgh$$

$$W = Fd$$

$$P = \frac{W}{t}$$

$$a = \frac{v_f - v_i}{t}$$

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$$\Delta S = \frac{Q}{T}$$

$$\lambda = \frac{c}{f}$$

$$E = \frac{hc}{\lambda}$$

$$n = \frac{c}{v}$$

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

Additional Problems Requiring For Loops

31. Calculate the sum of the first 10 natural numbers.
32. Determine the factorial of a given number, e.g., 5.
33. Find the sum of all even numbers between 1 and 20.
34. Calculate the average of a list of numbers: [2, 4, 6, 8, 10].
35. Determine the maximum value in a list of numbers: [3, 1, 4, 1, 5, 9, 2, 6, 5].
36. Find the number of occurrences of the number 3 in a list: [3, 1, 4, 3, 5, 3, 2, 3, 5].
37. Calculate the sum of the squares of the first 5 natural numbers.
38. Determine the product of all odd numbers between 1 and 10.
39. Find the sum of all prime numbers less than 20.
40. Calculate the Fibonacci sequence up to the 10th term.