Tutorial Sheet for Beginners

PHC 501/643 COMPUTER PROGRAMMING SPRING 2024

1. Write a function that calculates the distance travelled by an object given its initial velocity v_0, time t, and constant acceleration a: distance $= v_0 \cdot t + \frac{1}{2} a \cdot t^2$.

```
def distance(v0, t, a):
    d = v0 * t + 0.5 * a * t**2
    return d

u = float(input("Enter initial velocity (m/s): "))
t = float(input("Enter time (s): "))
a = float(input("Enter acceleration (m/s^2): "))
d1 = distance(u, t, a)
print("The distance traveled is %9.2f meters." % d1)
```

2. Create a function that calculates the kinetic energy of an object with mass m and velocity v: kinetic_energy $= \frac{1}{2} m v^2$.

3. Define a function that calculates the gravitational force between two objects with masses m_1 and m_2 separated by a distance r: force $= \frac{G \cdot m_1 \cdot m_2}{r^2}$, where $G = 6.674 \times 10^{11} \text{m}^3\text{kg}^1\text{s}^2$ is the gravitational constant.

4. Write a function that calculates the horizontal distance travelled by a projectile launched with an initial velocity v_0 at an angle θ to the horizontal: distance $= \frac{v_0^2 \cdot \sin(2\theta)}{g}$, where $g = 9.8$ m/s^2 is the acceleration due to gravity.

5. Create a function that calculates the electric current I given the voltage V and resistance R in an electrical circuit: $I = \frac{V}{R}$.

6. Define a function that calculates the electric force F between two point charges q_1 and q_2 separated by distance r: $F = \frac{k \cdot |q_1 \cdot q_2|}{r^2}$, where $k = 8.98 \times 10^9$ N m^2/C^2 is Coulomb's constant.

7. Write a function that calculates the period T of a simple pendulum with length L: $T = 2\pi\sqrt{\frac{L}{g}}$, where $g = 9.8$ m/s^2 is the acceleration due to gravity.

8. Create a function that calculates the escape velocity v_{escape} required for an object to escape the gravitational pull of a planet with mass M and radius R: $v_{\text{escape}} = \sqrt{\frac{2GM}{R}}$.

9. Define a function that calculates the work W done by a force F acting over a distance d in the direction of the force: $W = F \cdot d$.

10. Write a function that calculates the heat Q transferred to an object of mass m with specific heat c and change in temperature ΔT: $Q = m \cdot c \cdot \Delta T$.

11. Create a function that calculates the frequency f of a sound wave given its speed v and wavelength λ: $f = \frac{v}{\lambda}$.

12. Define a function that calculates the density ρ of an object with mass m and volume V: $\rho = \frac{m}{V}$.