| Physics | **UNIT 5 TEST: EQUATION SHEET** | *CLASS COPY* |
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**PHYSICAL CONSTANTS**

$$g = 9.80\ {}^{\mathrm{m}}/_{\mathrm{s}^2}$$

**UNIT 1 CONVERSION FACTORS:**

1 mi = 1609 m
1 in = 2.54 cm
1 hr = 3600 s

1 kg = 2.2 lbs
1 lb = 454 g
1 $cm^3$ = 1 mL

**UNIT 2 (KINEMATICS) EQUATIONS:**

Linear Motion:

$$\bar{\boldsymbol{v}} = \frac{\boldsymbol{d}}{t} \quad \text{so} \quad t = \frac{\boldsymbol{d}}{\bar{\boldsymbol{v}}} \quad \text{and} \quad \boldsymbol{d} = \bar{\boldsymbol{v}} \cdot t$$

$$\bar{\boldsymbol{v}} = \frac{\boldsymbol{v_1} + \boldsymbol{v_2}}{2}$$

$$\Delta \boldsymbol{v} = \boldsymbol{v_2} - \boldsymbol{v_1}$$

$$\boldsymbol{a} = \frac{\boldsymbol{v_2} - \boldsymbol{v_1}}{t}$$

$$\boldsymbol{v_2} = \boldsymbol{v_1} + \boldsymbol{a}t$$

$$\boldsymbol{v_2}^2 = \boldsymbol{v_1}^2 + 2\boldsymbol{a}\boldsymbol{d}$$

$$\boldsymbol{d} = \boldsymbol{v_1}t + \frac{1}{2}\boldsymbol{a}t^2$$

Free Fall Motion:

$$\boldsymbol{v} = \boldsymbol{g} \cdot t$$

$$\boldsymbol{d} = \frac{1}{2}\boldsymbol{g}t^2$$

**UNIT 3 (VECTORS AND PROJECTILES) EQUATIONS:**

Vector Addition:

$$\sin\theta = \frac{opposite}{hypotenuse}$$

$$\cos\theta = \frac{adjacent}{hypotenuse}$$

$$\tan\theta = \frac{opposite}{adjacent}$$

$$a^2 + b^2 = c^2$$

$$R = \sqrt{{R_x}^2 + {R_y}^2}$$

$$\theta = \tan^{-1}\left(\frac{R_y}{R_x}\right)$$

Projectile Motion:

$$v_{vert\ (initial)} = v_{\text{initial}} \cdot \sin\theta$$

$$v_{horizontal} = v_{\text{initial}} \cdot \cos\theta$$

$$\Delta v_{\text{vertical}} = g \cdot t$$

$$d_{\text{horizonal}} = v_{\text{horizonal}} \cdot t_{total}$$

$$v_{\text{vert (final)}} = g \cdot t_{down}$$

$$d_{\text{horizonal}} = \text{range} = \frac{\boldsymbol{v}_{\text{initial}}{}^2 \cdot \sin(2\theta)}{\boldsymbol{g}}$$

$$t_{up} = \frac{v_{\text{vert (initial)}}}{g}$$

$$t_{total} = t_{up} + t_{down}$$

$$d_{vertical} = \frac{1}{2}gt^2$$

**Continued on back →**

**UNIT 4 (FORCES AND NEWTON'S LAWS) EQUATIONS:**

$$\boldsymbol{F_{net}} = m \cdot \boldsymbol{a} \qquad \boldsymbol{F_g} = m \cdot \boldsymbol{g}$$

Vertical Motion:

$$\boldsymbol{F_{up}} = m(\boldsymbol{a} + \boldsymbol{g}) \qquad \boldsymbol{F_{up}} = m(\boldsymbol{g} - \boldsymbol{a})$$

**UNIT 5 (DYNAMICS) EQUATIONS:**

Momentum and Impulse:

$$\boldsymbol{p} = m \cdot \boldsymbol{v} \qquad \boldsymbol{Impulse} = \boldsymbol{F} \cdot \Delta t$$

$$\boldsymbol{p_{before}} = \boldsymbol{p'_{after}} \qquad \boldsymbol{Impulse} = \Delta \boldsymbol{p} = \boldsymbol{p_2} - \boldsymbol{p_1} = m \cdot \Delta \boldsymbol{v}$$

Energy:

$$\boldsymbol{E_K} = \frac{1}{2} m \boldsymbol{v}^2 \qquad \boldsymbol{E_p} = m \boldsymbol{g} h$$

$$\boldsymbol{E_{K1}} + \boldsymbol{E_{P1}} = \boldsymbol{E'_{K2}} + \boldsymbol{E'_{P2}}$$

Work and Power:

$$\boldsymbol{W} = \boldsymbol{F} \cdot d \cdot \cos\theta \qquad \boldsymbol{P} = \frac{\boldsymbol{W}}{t} = \frac{\Delta \boldsymbol{E}}{t}$$

$$\boldsymbol{W} = \Delta \boldsymbol{E_K} = \boldsymbol{E_{K2}} - \boldsymbol{E_{K1}} \qquad \boldsymbol{P} = \frac{\boldsymbol{F} \cdot \boldsymbol{d}}{t} = \boldsymbol{F} \cdot \boldsymbol{v}$$