

Numerical 9th

CHAPTER # ①

پری فکس حل کریں

$$5 \text{ pm} = 5 \times 10^{-12} \text{ m}$$

$$15 \text{ ns} = 15 \times 10^{-9} \text{ s}$$

$$6 \mu\text{s} = 6 \times 10^{-6} \text{ s}$$

$$5 \text{ fs} = 5 \times 10^{-15} \text{ s}$$

لیسٹ کاؤنٹ لکالیں

$$\text{ms} = 0.5 \text{ mm}$$

$$\text{vs} = 10$$

$$\text{LC} = \text{ms}/\text{vs} = 0.5/10$$

$$\text{LC} = 0.05 \text{ mm}$$

اعداد جمع کریں

$$5.123 \times 10^4 + 3.28 \times 10^5$$

$$= 5.123 \times 10^4 + 32.8 \times 10^4 =$$

$$(5.123 + 32.8) \times 10^4$$

$$= 37.923 \times 10^4$$

$$= 3.79 \times 10^5 \text{ m}$$

اعداد نفی کریں

$$2.57 \times 10^{-2} - 3.43 \times 10^{-3}$$

$$= 2.57 \times 10^{-2} - 0.343 \times 10^{-2}$$

$$= (2.57 - 0.343) \times 10^{-2}$$

$$= 2.227 \times 10^{-2} \text{ mm}$$

اعداد کو ضرب دیں

$$(4 \times 10^3 \text{ kg})(6 \times 10^6 \text{ m})$$

$$= (4 \times 6) \times 10^{3+6} \text{ kgm}$$

$$= 24 \times 10^9 \text{ kgm}$$

$$= 2.4 \times 10^{10} \text{ kgm}$$

اعداد کو تقسیم کریں

$$6 \times 10^6 \text{ m}^3 / 2 \times 10^{-2} \text{ m}^2$$

$$= (6/2) \times 10^{6+2} \text{ m}^{3-2}$$

$$= 3 \times 10^8 \text{ m}$$

سیکنڈ معلوم کریں

$$(a) 1 \text{ دن} = 24 \text{ hours}$$

$$= 1 \times 24 \times 60 \times 60$$

$$= 86400 \text{ s} = 86.4 \times 10^3 \text{ s}$$

$$= 86.4 \text{ ks}$$

$$(b) 1 \text{ ہفتہ} = 7 \text{ days}$$

$$= 1 \times 7 \times 24 \times 60 \times 60$$

$$= 604800 \text{ s}$$

$$= 604.8 \times 10^3 \text{ s}$$

$$= 604.8 \text{ ks}$$

$$(c) 1 \text{ ماہ} = 30 \text{ days}$$

$$= 1 \times 30 \times 24 \times 60 \times 60$$

$$= 2592000 \text{ s}$$

$$= 2.592 \times 10^6 \text{ s}$$

$$= 2.592 \text{ Ms}$$

سائنسی نوٹیشن بنائے

$$(a) 1 \text{ دن} = 24 \text{ hours}$$

$$= 1 \times 24 \times 60 \times 60$$

$$= 86400 \text{ s} = 8.64 \times 10^4 \text{ s}$$

$$(b) 1 \text{ ہفتہ} = 7 \text{ days}$$

$$= 1 \times 7 \times 24 \times 60 \times 60$$

$$= 604800 \text{ s} = 6.04 \times 10^5 \text{ s}$$

$$(c) 1 \text{ ماہ} = 30 \text{ days}$$

$$= 1 \times 30 \times 24 \times 60 \times 60$$

$$= 2592000 \text{ s}$$

$$= 2.592 \times 10^6 \text{ s}$$

اعداد جمع کریں

$$4 \times 10^{-4} + 3 \times 10^{-5}$$

$$= 4 \times 10^{-4} + 0.3 \times 10^{-4}$$

$$= (4 + 0.3) \times 10^{-4}$$

$$= 4.3 \times 10^{-4} \text{ kg}$$

اعداد کو نفی کریں

$$5.4 \times 10^{-6} - 3.2 \times 10^{-5}$$

$$= 0.54 \times 10^{-5} - 3.2 \times 10^{-5}$$

$$= (0.54 - 3.2) \times 10^{-5}$$

$$= -2.66 \times 10^{-5} \text{ m}$$

اعداد کو ضرب دیں

$$(5 \times 10^4 \text{ m})(3 \times 10^{-2} \text{ m})$$

$$= (3 \times 5) \times 10^{4-2} \text{ m} \times \text{m}$$

$$= 15 \times 10^2 \text{ m}^2$$

$$= 1.5 \times 10^3 \text{ m}^2$$

اعداد کو تقسیم کریں

$$6 \times 10^8 \text{ kg} / 3 \times 10^4 \text{ m}^3$$

$$= (6/3) \times 10^{8-4} \text{ kgm}^{-3}$$

$$= 2 \times 10^4 \text{ kgm}^{-3}$$

سائنسی نوٹیشن بنائے

$$(3 \times 10^2 \text{ kg})(4 \text{ km}) / 500 \text{ s}^2$$

$$= \frac{3 \times 10^3 \cdot 4 \times 10^3 \text{ kgm}}{5 \times 10^2 \text{ s}^2}$$

$$= 12 \times 10^{3+3-2} \text{ kgms}^{-2} / 5$$

$$= 2.4 \times 10^4 \text{ kgms}^{-2}$$

نمایاں ہندسے بتائیں

$$(a) 0.0045 \text{ m} = 2$$

$$(b) 2.047 \text{ m} = 4$$

$$(c) 3.40 \text{ m} = 3$$

$$(d) 3.420 \times 10^2 \text{ m} = 4$$

پری فکس ڈالیں

$$(a) 5 \times 10^4 \text{ m}$$

$$= 5 \times 10^1 \times 10^3 \text{ m}$$

$$= 50 \text{ km}$$

$$(b) 580 \times 10^2 \text{ g}$$

$$= 58.0 \times 10^1 \times 10^2 \text{ g}$$

$$= 58 \times 10^3 \text{ g} = 58 \text{ kg}$$

$$(c) 45 \times 10^{-4} \text{ s}$$

$$= 4.5 \times 10^1 \times 10^{-4} \text{ s}$$

$$= 4.5 \times 10^{-3} \text{ s} = 4.5 \text{ ms}$$

فاصلہ معلوم کریں

$$v = 3 \times 10^8 \text{ m/s}$$

$$v = 3 \times 10^8 \text{ m/s}$$

$$t = 1 \text{ year}$$

$$1 \text{ y} = 1 \times 365 \times 24 \times 60 \times 60$$

$$1 \text{ y} = 31536000 \text{ s}$$

$$\text{فاصلہ} = S = ?$$

$$v = S/t$$

$$S = vt = (3 \times 10^8)(3.15 \times 10^7)$$

$$S = 9.4608 \times 10^{15} \text{ m}$$

یونٹس تبدیل کریں

$$d = 13.6 \text{ gcm}^{-3}$$

$$= 13.6 \times \frac{\text{g}}{\text{cm}^3} \times \frac{\text{cm}^3}{\text{m}^3}$$

$$= 13.6 / 10^3 \times \frac{1}{10^3} \text{ kg/m}^3$$

$$= 0.0136 \times \frac{1}{(10^{-2})^3} \text{ kg/m}^3$$

$$= 0.0136 \times \frac{1}{10^{-6}} \text{ kg/m}^3$$

$$= 0.0136 \times 10^6 \text{ kg/m}^3$$

$$= 13600 \text{ kg/m}^3$$

$$= 1.36 \times 10^4 \text{ kgm}^{-3}$$

CHAPTER # ②

گرتی ہوئی بال کا طے کردہ فاصلہ لکالیں

$$v_i = 0$$

$$g = 10 \text{ ms}^{-2}$$

$$t = 1 \text{ s}$$

$$S = v_i t + \frac{1}{2} g t^2$$

$$S = \frac{1}{2} (10)(1)^2 = 5 \text{ m}$$

سیکنڈ میں ریست سے 144 کلومیٹر فی گھنٹہ کی سپیڈ حاصل کرنے میں کتنا فاصلہ نک ہوگا۔

$$v_i = 0$$

$$v_f = 144 \text{ km/h}$$

$$v_f = \frac{144 \times 1000 \text{ m}}{3600 \text{ s}} = 40 \text{ m/s}$$

$$t = 20 \text{ s}$$

$$a = (v_f - v_i)/t$$

$$= (40 - 0)/20 = 2 \text{ m/s}^2$$

$$S = v_i t + \frac{1}{2} a t^2$$

$$S = \frac{1}{2} (2)(20)^2 = 400 \text{ m}$$

چوتھائی فاصلہ کیے وقت میں طے ہوگا

$$v_i = 0$$

$$S = S$$

$$t = 4 \text{ s}$$

$$S = v_i t + \frac{1}{2} a t^2$$

$$S = \frac{1}{2} a (4)^2 = 8a$$

$$\text{Now for } S/4 = 8a/4 = 2a$$

$$S = v_i t + \frac{1}{2} a t^2$$

$$2a = \frac{1}{2} a t^2$$

$$4 = t^2$$

$$t = 2 \text{ s}$$

فاصلہ معلوم کریں

$$\text{فاصلہ} = S = 300 \text{ m}$$

$$v = 60 \text{ m/s}$$

$$t = ?$$

$$v = S/t$$

$$t = S/v = 300/60 = 5 \text{ s}$$

سیکنڈ میں ریست سے 252 کلومیٹر فی گھنٹہ کی سپیڈ حاصل کرنے میں ایکسپلریشن ریہے گا۔

$$v_i = 0$$

$$v_f = 252 \text{ km/h}$$

$$v_f = \frac{252 \times 1000 \text{ m}}{3600 \text{ s}} = 70 \text{ m/s}$$

$$t = 20 \text{ s}$$

$$a = ?$$

$$a = (v_f - v_i)/t$$

$$a = (70 - 0)/20$$

$$a = 3.5 \text{ m/s}^2$$

4 سیکنڈ میں ٹاور سے بال کرتی ہے تو ٹاور کی بلندی اور بال کی ٹکراؤ والی ولاسٹی نکالیں۔

$$v_i = 0$$

$$g = 10 \text{ ms}^{-2}$$

$$t = 4 \text{ s}$$

$$S = ?$$

$$v_f = ?$$

$$S = v_i t + \frac{1}{2} g t^2$$

$$h = (0 \times 4) + \frac{1}{2} (10)(4)^2$$

$$h = 0 + \frac{1}{2} (10)(16) = 80 \text{ m}$$

$$v_f = v_i + g t$$

$$v_f = (0 \times 4) + (10 \times 4)$$

$$v_f = 0 + 40 = 40 \text{ m/s}$$

30 میٹر فی سیکنڈ سے اوپر جاتی بال کی بلندی اور وقت معلوم کریں۔

$$v_i = 30 \text{ m/s}$$

$$v_f = 0$$

$$g = -10 \text{ ms}^{-2}$$

$$h = ?$$

$$t = ?$$

$$2aS = v_f^2 - v_i^2$$

$$2 \times (-10) \times h = (0)^2 - (30)^2$$

$$-20h = -900$$

$$h = 900/20 = 45 \text{ m}$$

$$v_f = v_i + g t$$

$$0 = 30 + (-10)t$$

$$-30 = -10t$$

$$t = 30/10 = 3 \text{ s}$$

72 کلومیٹر فی گھنٹہ سے 360 میٹر طے کرنے والی کار کتنا وقت لے گی۔

$$v = 72 \text{ km/h}$$

$$S = 360 \text{ m}$$

$$t = ?$$

$$v = S/t$$

$$t = S/v = 360/72 = 5 \text{ h}$$

50 سیکنڈ میں ریست سے 90 کلومیٹر فی گھنٹہ کی سپیڈ حاصل کرنے میں ایکسپلریشن ریہے گا۔

$$v_i = 0$$

$$v_f = 90 \text{ km/h}$$

$$v_f = \frac{90 \times 1000 \text{ m}}{3600 \text{ s}} = 25 \text{ m/s}$$

$$t = 50 \text{ s}$$

$$a = ?$$

$$a = (v_f - v_i)/t$$

$$a = (25 - 0)/50$$

$$a = 0.5 \text{ m/s}^2$$

1.5 ایکسپلریشن کے ساتھ 5 سیکنڈ تک 5 کار 5 میٹر فی سیکنڈ سے چلے تو ولاسٹی کیا ہوگی۔

$$v_i = 5 \text{ m/s}$$

$$a = 1.5 \text{ ms}^{-2}$$

$$t = 5 \text{ s}$$

$$v_f = ?$$

$$v_f = v_i + a t$$

$$v_f = 5 + (1.5)(5) = 5 + 7.5$$

$$v_f = 12.5 \text{ m/s}$$

2 کے ایکسپلریشن کے ساتھ 10 سیکنڈ تک 5 [2.5] میٹر فی سیکنڈ سے کار چلے تو کتنا فاصلہ طے کرے گی۔

$$v_i = 18 \text{ km/h}$$

$$v_i = \frac{18 \times 1000 \text{ m}}{3600 \text{ s}} = 5 \text{ m/s}$$

$$a = 2 \text{ m/s}^2$$

$$t = 10 \text{ s}$$

$$S = ?$$

$$S = v_i t + \frac{1}{2} a t^2$$

$$S = (5)(10) + \frac{1}{2} (2)(10)^2$$

$$S = 50 + \frac{1}{2} (2)(100) = 150 \text{ m}$$

بریک لگنے پر کار 25 میٹر طے کرے تو 54 [2.6] کومیٹر فی گھنٹہ سے چلے پر ایکسپلریشن کیا ہوگا۔

$$v_i = 54 \text{ km/h}$$

$$v_i = \frac{54 \times 1000 \text{ m}}{3600 \text{ s}} = 15 \text{ m/s}$$

$$v_f = 0$$

$$S = 25 \text{ m}$$

$$a = ?$$

$$2aS = v_f^2 - v_i^2$$

$$2 \times a \times 25 = (0)^2 - (15)^2$$

$$50a = -225$$

$$a = -225/50 = -4.5 \text{ m/s}^2$$

45 میٹر سے گرنے پر بال کی ٹکراؤ والی ولاسٹی [2.7] کیا ہوگی اور کتنا وقت لے گی

$$v_i = 0$$

$$g = 10 \text{ ms}^{-2}$$

$$S = 45 \text{ m}$$

$$v_f = ?$$

$$t = ?$$

$$2aS = v_f^2 - v_i^2$$

$$2 \times 10 \times 45 = v_f^2 - (0)^2$$

$$900 = v_f^2$$

$$\sqrt{v_f^2} = \sqrt{900}$$

$$v_f = 30 \text{ m/s}$$

$$v_f = v_i + at$$

$$30 = 0 + (10) \times t$$

$$t = 30/10 = 3 \text{ s}$$

اوسط ولاسٹی کیا ہوگی اگر کار 20 میٹر فی [2.8] سیکنڈ کے ساتھ 10 کومیٹر طے کرے اور 4 میٹر فی سیکنڈ کے ساتھ 0.8 کومیٹر طے کرے۔

$$v_1 = 20 \text{ m/s}$$

$$v_2 = 4 \text{ m/s}$$

$$S_1 = 10 \text{ km}$$

$$S_2 = 0.8 \text{ km}$$

$$S_1 = 10 \times 1000 \text{ m} = 10000 \text{ m}$$

$$S_2 = 0.8 \times 1000 \text{ m} = 800 \text{ m}$$

$$v_{ave} = ?$$

$$t_1 = S_1/v_1$$

$$t_2 = S_2/v_2$$

$$t = t_1 + t_2 = 700 \text{ s}$$

$$S_1 + S_2$$

$$= 10000 + 800 = 10800 \text{ m}$$

$$v_{ave} = \frac{\text{total distance}}{\text{total time}} = 10800/700 = 15.4 \text{ m/s}$$

5 سیکنڈ میں گرنے والی بال کی بلندی اور ٹکراؤ [2.9] والی ولاسٹی کیا ہوگی۔

$$v_i = 0$$

$$g = 10 \text{ ms}^{-2}$$

$$t = 5 \text{ s}$$

$$v_f = ?$$

$$h = ?$$

$$S = v_i t + \frac{1}{2} a t^2$$

$$h = (0)(5) + \frac{1}{2} (10)(5)^2$$

$$h = 0 + \frac{1}{2} (10)(25) = 125 \text{ m}$$

$$v_f = v_i + at$$

$$v_f = 0 + (10) \times 5 = 50 \text{ m/s}$$

اگر 1 میٹر بلندی سے اوپر بال پٹ کی جائے تو [2.10] 3 سیکنڈ میں کتنی بلندی حاصل کرے گی۔

$$g = -10 \text{ ms}^{-2}$$

$$t = 3 \text{ s}$$

$$v_f = 0$$

$$h_1 = 1 \text{ m}$$

$$h_2 = ?$$

$$v_i = ?$$

$$v_f = v_i + at$$

$$0 = v_i + (-10)(3)$$

$$v_i = 30 \text{ m/s}$$

$$S = v_i t + \frac{1}{2} a t^2$$

$$h = (30)(3) + \frac{1}{2} (-10)(3)^2$$

$$h = 90 - \frac{1}{2} (10)(9) = 45 \text{ m}$$

$$1 + 45 = 46 \text{ m}$$

Chapter # 3

4 میٹر فی سیکنڈ ولاسٹی والا 60 کلو کا ایک بندہ [X] 80 کلو کے دوسرے بندے کو دھکا دے تو دوسرے بندے کی ولاسٹی کیا ہوگی۔

$$m_1 = 60 \text{ kg}$$

$$v_1 = 4 \text{ m/s}$$

$$m_2 = 80 \text{ kg}$$

$$v_2 = ?$$

$$0 = m_1 v_1 + m_2 v_2$$

$$0 = (60)(4) + (80)(v_2)$$

$$v_2 = -240/80 = -3 \text{ m/s}$$

5 کلو گرام کا ایک ماس 10 میٹر فی سیکنڈ کے [Y] ساتھ چلے اور 5 سیکنڈ بعد 2 میٹر فی سیکنڈ کی ولاسٹی کے موڑے تو اس پر فورس کتنی لگی ہوگی۔

$$m = 5 \text{ kg}$$

$$v_i = 10 \text{ m/s}$$

$$v_f = -2 \text{ m/s}$$

$$t = 5 \text{ s}$$

$$F = \Delta P/t = m(v_f - v_i)/t$$

$$F = 5(-2 - 10)/5 = -12 \text{ N}$$

2 میٹر فی مربع سیکنڈ کے ایکسپلریشن کے ساتھ [A] 10 کلو گرام کے بلاک پر کتنی فورس لگے گی۔

$$m = 10 \text{ kg}$$

$$a = 2 \text{ m/s}^2$$

$$F = ?$$

$$F = ma = 10 \times 2 = 20 \text{ N}$$

3 ہزار کلو گرام کی کار پر 7500 نیوٹن فورس لگے [ii] تو ایکسپلریشن کیا ہوگا۔ اس کی ولاسٹی 36 سے 72 کومیٹر فی گھنٹہ ہونے پر کتنا وقت لگے گا۔

$$m = 3000 \text{ kg}$$

$$F = 7500 \text{ N}$$

$$v_i = 36 \text{ km/h}$$

$$v_f = 72 \text{ km/h}$$

$$v_f = \frac{72 \times 1000 \text{ m}}{3600 \text{ s}} = 20 \text{ m/s}$$

$$t = ?$$

$$a = ?$$

$$a = F/m \quad (F = ma)$$

$$a = 7500/3000 = 2.5 \text{ m/s}^2$$

$$v_f = v_i + at$$

$$20 = 10 + (2.5) \times t$$

$$t = 10/2.5 = 4 \text{ s}$$

150 میٹر فی سیکنڈ کے ساتھ جاتی ہوئی 15 [iii] گرام کی گولی کا مومینٹم کیا ہوگا۔

$$m = 15 \text{ g} = 15 \text{ kg/k}$$

$$v = 150 \text{ m/s}$$

$$P = ?$$

$$P = mv = 0.015 \times 150$$

$$P = 2.25 \text{ kgm/s}$$

160 گرام کی بال کی ولاسٹی 0.004 سیکنڈ میں [iv] منفی 28 سے 52 میٹر فی سیکنڈ ہو جائے تو بال پر کتنی فورس لگی ہوگی۔

$$m = 160 \text{ g} = 160 \text{ kg/k}$$

$$v_i = -28 \text{ m/s}$$

$$v_f = 52 \text{ m/s}$$

$$t = 4 \times 10^{-3} \text{ s}$$

$$F = m(v_f - v_i)/t$$

$$F = 0.16[52 - (-28)]/4 \times 10^{-3}$$

$$F = 0.16(52 + 28)/0.004$$

$$F = (0.16 \times 80)/0.004$$

$$F = 3200 \text{ N}$$

بندوق کی ریکوائل ولاسٹی لکائی [v] m_1 گولی کا ماس

$$v_1 = ?$$

$$M_2 = ?$$

$$V_2 = ?$$

$$P_i = P_f$$

$$0 = m_1 v_1 + M_2 V_2$$

$$V_2 = -m_1 v_1 / M_2$$

ایک 3 کلو گرام کی بال 5 میٹر فی سیکنڈ کے ساتھ [vi] 2 کلو گرام کی دوسری بال سے ٹکرائی ہے۔ ٹکرائے کے بعد دونوں کی اکٹھی ولاسٹی کیا ہوگی۔

$$m_1 = 3 \text{ kg}$$

$$m_2 = 2 \text{ kg}$$

$$v_i = 10 \text{ m/s}$$

$$v_f = ?$$

$$v_i = 10 \text{ m/s}$$

$$v_f = ?$$

$$v_i = 10 \text{ m/s}$$

$$v_f = ?$$

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$$v_f = ?$$

$$v_i = 10 \text{ m/s}$$

$$v_f = ?$$

$$v_i = 10 \text{ m/s}$$

$$v_f = ?$$

$$u_1 = 5 \text{ m/s}$$

$$u_2 = 0$$

$$v = ?$$

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

$$(3 \times 5) + (2 \times 0) = 3v + 2v$$

$$15 + 0 = (3 + 2)v$$

$$v = 15/5 = 3 \text{ m/s}$$

ریسٹ سے 10 کلو گرام کے جسم کو 5 سیکنڈ [3.1] تک 5 نیوٹن فورس سے دھکیلے تو ایکسپلریشن اور آخری ولاسٹی معلوم کریں۔

$$m = 10 \text{ kg}$$

$$F = 5 \text{ N}$$

$$v_i = 0$$

$$t = 5 \text{ s}$$

$$a = ?$$

$$v_f = ?$$

$$a = F/m \quad (F = ma)$$

$$a = 5/10 = 0.5 \text{ m/s}^2$$

$$v_f = v_i + at$$

$$v_f = 0 + (0.5)(5) = 2.5 \text{ m/s}$$

80 کلو کے بندے کا زمین اور چاند پر وزن ہوگا۔ [3.2]

$$m = 80 \text{ kg}$$

$$g = 10 \text{ m/s}^2$$

$$g = 1.6 \text{ m/s}^2$$

$$W_e = ?$$

$$W_m = ?$$

$$W_e = mg = (80)(10) = 800 \text{ N}$$

$$W_m = mg = (80)(1.6) = 128 \text{ N}$$

800 کلو گرام کی کار کی 10 سیکنڈ میں [3.3] ولاسٹی 10 سے 30 میٹر فی سیکنڈ کرنے کے لیے کتنی فورس چاہیے۔

$$m = 800 \text{ kg}$$

$$v_i = 10 \text{ m/s}$$

$$v_f = 30 \text{ m/s}$$

$$t = 10 \text{ s}$$

$$F = m(v_f - v_i)/t$$

$$F = 800(30 - 10)/10$$

$$F = 800(20)/10 = 1600 \text{ N}$$

10 کلو گرام کی بندوق کی ریکوائل ولاسٹی کیا [3.4] ہوگی اگر یہ 5 گرام کی گولی 300 میٹر فی سیکنڈ کی سپیڈ کے ساتھ فائر کرے۔

$$m_1 = 5 \text{ g} = 5 \text{ kg/k}$$

$$v_1 = 300 \text{ ms}^{-1}$$

$$M_2 = 10 \text{ kg}$$

$$V_2 = ?$$

$$V_2 = -m_1 v_1 / M_2$$

$$V_2 = -(0.005)(300)/10$$

$$V_2 = -0.15 \text{ m/s}$$

خلا میں 75 کلو گرام کے بندے کی ریکوائل [3.5] ولاسٹی کیا ہوگی اگر وہ 300 گرام کی بال کو 3.5 میٹر فی سیکنڈ کے ساتھ پٹ کرے۔ بندہ 30 منٹ میں کتنا فاصلہ طے کرے گا۔

$$t = 30 \text{ mint} = 1800 \text{ s}$$

$m_1 = 300 \text{ g}$
 $m_1 = 300 \text{ kg/k} = 0.3 \text{ kg}$
 $v_1 = 3.5 \text{ ms}^{-1}$ بال کی سپیڈ
 $M_2 = 75 \text{ kg}$ بندے کا ماس
 $V_2 = ?$ بندے کی ولاسٹی
 $V_2 = -m_1 v_1 / M_2$
 $V_2 = (0.3)(3.5) / 75$
 $V_2 = -0.014 \text{ m/s}$
 $V_2 = -1.4 \times 10^{-2} \text{ m/s}$
 $S = vt$
 $S = 0.014 \times 1800 = 25.2 \text{ m}$
 6500 کوگرام کا ایک ڈبہ 0.8 میٹر فی **3.6**
 سیکنڈ کے ساتھ دوسرے 9200 کوگرام کے ڈبے سے
 ٹکراتا ہے۔ اگر دوسرا ڈبہ 1.2 میٹر فی سیکنڈ کے جا رہا
 ہو تو دونوں ڈبوں کی اکٹھی ولاسٹی نکالیں۔
 $m_1 = 6.5 \times 10^3 \text{ kg}$ پہلے ڈبے کا ماس
 $= 6500 \text{ kg}$
 $m_2 = 9.2 \times 10^3 \text{ kg}$ دوسرے ڈبے کا ماس
 $= 9200 \text{ kg}$
 $u_1 = ?$ پہلے ڈبے کی ولاسٹی
 $= 0.8 \text{ m/s}$
 $u_2 = 1.2 \text{ m/s}$ دوسرے ڈبے کی ولاسٹی
 $v = ?$ ٹکرنے کے بعد دونوں ڈبوں کی اکٹھی
 ولاسٹی
 $m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$
 $m_1 u_1 + m_2 u_2 = m_1 v + m_2 v$
 $v = \frac{(6500 \times 0.8) + (9200 \times 1.2)}{6500 + 9200}$
 $v = 16240 / 15700 = 1.03 \text{ m/s}$
 75 کوگرام کا بندہ 5 کوگرام کی بلیک کو **3.7**
 ریست سے 8 سیکنڈ تک چلاتا ہے۔ مزید 90 نیوٹن
 کی فورس سے 8 سیکنڈ چلاتا ہے۔ کل فاصلہ نکالیں۔
 $m = 5 + 55 = 60 \text{ kg}$ ماس
 $v_i = 0$ ابتدائی ولاسٹی
 $F = 90 \text{ N}$ فورس
 $t_1 = 8 \text{ s}$ پہلا وقت
 $t_2 = 8 \text{ s}$ دوسرا وقت
 $S = ?$ فاصلہ
 $a = F/m = 90/60 = 1.5 \text{ m/s}^2$
 $v_f = v_i + at$
 $v_f = 0 + (1.5)(8) = 12 \text{ m/s}$
 $S = v_i t + \frac{1}{2} at^2$ (for 1st time)
 $S_1 = (0)(8) + \frac{1}{2} (1.5)(8)^2$
 $S_1 = 0 + \frac{1}{2} (1.5)(16) = 48 \text{ m}$
 $S_2 = v_f t$ (for 2nd time)
 $S_2 = 12 \times 8 = 96 \text{ m}$
 $S = S_1 + S_2$
 $S = 48 + 96 = 144 \text{ m}$
 0.4 کوگرام کی بال 1.8 میٹر سے گر کر **3.8** 0.8
 میٹر تک بلند ہو تو امپلس کیا ہوگا۔
 $m = 0.4 \text{ kg}$ ماس
 $h_1 = 1.8 \text{ m}$ پہلی بلندی
 $h_2 = 0.8 \text{ m}$ دوسری بلندی
 $g = 10 \text{ m/s}^2$ ایکسلریشن

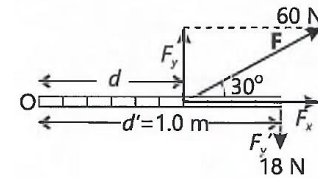
$\Delta P = ?$ امپلس
 پہلی بلندی سے گرتے ہوئے ولاسٹی
 $2aS = v_f^2 - v_i^2$
 $2 \times 10 \times 1.8 = (v_f)^2 - (0)^2$
 $\sqrt{v_f^2} = \sqrt{36}$
 $v_f = 6 \text{ m/s}$
 دوسری بلندی تک جانے کی ولاسٹی
 $2aS = v_f^2 - v_i^2$
 $2 \times (-10) \times 0.8 = (0)^2 - (v_i)^2$
 $\sqrt{v_i^2} = \sqrt{16}$
 $v_i = 4 \text{ m/s}$
 کیونکہ دونوں ولاسٹی مخالف ہیں
 $\Delta v = v_f - v_i$
 $\Delta v = (6) - (-4) = 10 \text{ m/s}$
 $\Delta P = m \Delta v = 0.4 \times 10 = 4 \text{ Ns}$
 سمت اوپر کی طرف ہے
 ایک 0.2 کوگرام کی بال 20 میٹر فی سیکنڈ **3.9**
 کے ساتھ 0.4 کوگرام کی دوسری بال جو منفی 5 کی
 ولاسٹی سے جا رہی ہو، سے ٹکراتی ہے۔ ٹکرنے کے بعد
 پہلی بال کی ولاسٹی 6 میٹر فی سیکنڈ ہو جائے تو
 دوسری بال کی ولاسٹی کیا ہوگی۔
 $m_1 = 0.2 \text{ kg}$ پہلی بال کا ماس
 $m_2 = 0.4 \text{ kg}$ دوسری بال کا ماس
 $u_1 = 20 \text{ m/s}$ ٹکرنے سے پہلے ولاسٹی
 $u_2 = -5 \text{ m/s}$ دوسری ولاسٹی
 $v_1 = 6 \text{ m/s}$ ٹکرنے کے بعد ولاسٹی
 $v_2 = ?$ دوسری ولاسٹی
 $m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$
 $m_1 u_1 + m_2 u_2 - m_1 v_1 = m_2 v_2$
 $v_2 = \frac{m_1 u_1 + m_2 u_2 - m_1 v_1}{m_2}$
 $v_2 = \frac{(0.2)(20) + (0.4)(-5) - (0.2)(6)}{0.4}$
 $v_2 = (4 + 2 - 1.2) / 0.4$
 $v_2 = 0.8 / 0.4 = 2 \text{ m/s}$

Chapter # 4

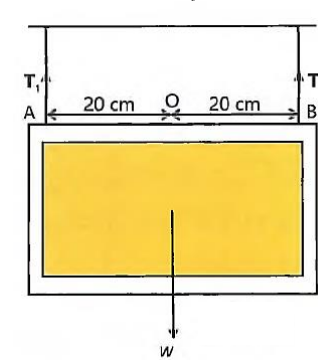
بہت تو تھیل رول سے حاصل فورس بتائیں
 $F_1 = 200 \text{ N}$ پہلی فورس
 $F_2 = 300 \text{ N}$ دوسری فورس
 $F_3 = 250 \text{ N}$ تیسری فورس

$F = 710 \text{ N at } \theta = 43^\circ$

25 سینٹی میٹر رینج پر 400 نیوٹن فورس لگائی **i**
 جائے تو تارک کیا ہوگا۔
 $F = 400 \text{ N}$ فورس
 $L = 25 \text{ cm}$ مومنٹ آرم
 $L = 25 \times 10^{-2} \text{ m} = 0.25 \text{ m}$
 $\tau = F \times L$ تارک
 $\tau = 400 \times 0.25 = 100 \text{ Nm}$
 160 نیوٹن فورس کے **iii**
 افقی اور عمودی جزو لکھیں۔
 $F = 160 \text{ N}$ فورس
 $\theta = 60^\circ$ زاویہ
 $F_x = ?$ افقی جز
 $F_y = ?$ عمودی جز
 $F_x = F \cos \theta = 160 \cos(60)$
 $F_x = 160 \times 0.50 = 80 \text{ N}$
 $F_y = F \sin \theta = 160 \sin(60)$
 $F_y = 160 \times 0.86 = 138.6 \text{ N}$
 60 نیوٹن **iv**
 کے ساتھ 30 ڈگری زاویہ کے ساتھ 60 نیوٹن
 کی فورس مرکز سے کتنے فاصلہ پر لگائی جائے کہ اس راڈ
 کے مخالف 18 نیوٹن کی فورس لگ رہی ہے۔



$-F_y = 18 \text{ N}$ پہلی فورس
 $+F = 60 \text{ N}$ دوسری فورس
 $d = ?$ مرکز سے فاصلہ
 $+F_x = +F \cos \theta = 60 \cos 30^\circ$
 $= 60 \times 0.86 = 51.9 \text{ N}$
 $+F_y = +F \sin \theta = 60 \sin 30^\circ$
 $= 60 \times 0.50 = 30 \text{ N}$
 $(-F_y) \text{ اور } (+F_x) \text{ ایک دوسرے کے مخالف فورس}$
 $\tau_{\text{clockwise}} = \tau_{\text{anti clockwise}}$
 $+F_y \times d = -F_x \times d$
 $18 \times 1 = 30 \times d$
 $d = 18/30 = 0.6 \text{ m}$
 40 سینٹی میٹر کی تصویر رسیوں سے **v**
 5 نیوٹن اور 40 سینٹی میٹر کی تصویر رسیوں سے
 لٹکانی گئی ہے۔ ان رسیوں میں تناؤ نکالیں۔



$W = 5 \text{ N}$ وزن
 $AB = 40 \text{ cm} = 40 \times 10^{-2} \text{ m} = 0.4 \text{ m}$ لمبائی
 $OB = OA = 20 \text{ cm} = 20 \times 10^{-2} \text{ m} = 0.2 \text{ m}$ آدھی لمبائی
 $T = ?$ ٹینشن

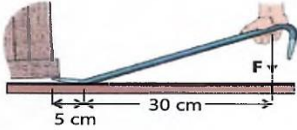
$\Sigma F_x = 0, \Sigma F_y = 0$
 $T_1 + T_2 = W$
 $\Sigma \tau = 0, \tau_{\text{cw}} = \tau_{\text{acw}}$
 اگر (B) کو ایکسز آف روٹیشن لیا جائے
 $T_1 \times AB = W \times OB$
 $T_1 \times 0.4 = 5 \times 0.2$
 $T_1 = 1.0 / 0.4 = 2.5 \text{ N}$
 $\text{as } T_1 + T_2 = W$
 $2.5 + T_2 = 5$
 $T_2 = 5 - 2.5 = 2.5 \text{ N}$
 1.2 میٹر رسی کے سرے پر 150 گرام ماس **vi**
 8 میٹر فی سیکنڈ سے گھوم رہا ہو تو سینٹری پیٹل فورس
 کیا ہوگی۔
 $m = 150 \text{ g} = 150 \text{ kg/k} = 150 \text{ kg/1000} = 0.15 \text{ kg}$ ماس
 $v = 8 \text{ m/s}$ سپیڈ
 $r = 1.2 \text{ m}$ رداس
 $F_c = ?$ سینٹری پیٹل فورس
 $F_c = mv^2/r = (0.15)(8)^2/1.2$
 $F_c = (0.15)(64)/1.2 = 8 \text{ N}$
 200 نیوٹن فورس **4.1**
 کے ساتھ 30 ڈگری زاویہ کے ساتھ 200 نیوٹن
 افقی اور عمودی جزو لکھیں۔
 $F = 200 \text{ N}$ فورس
 $\theta = 30^\circ$ زاویہ
 $F_x = ?$ افقی جز
 $F_y = ?$ عمودی جز
 $F_x = F \cos \theta = 200 \cos(30)$
 $F_x = 200 \times 0.86 = 173.2 \text{ N}$
 $F_y = F \sin \theta = 200 \sin(30)$
 $F_y = 200 \times 0.50 = 100 \text{ N}$
 300 نیوٹن فورس لگائی **4.2**
 1.2 میٹر دروازے پر 300 نیوٹن فورس لگائی
 جائے تو تارک کیا ہوگا۔
 $F = 300 \text{ N}$ فورس
 $L = 1.2 \text{ m}$ مومنٹ آرم
 $\tau = F \times L$ تارک
 $\tau = 300 \times 1.2 = 360 \text{ Nm}$
 40 سینٹی میٹر دور لینے **4.3**
 سٹر آف گریوٹی سے 40 سینٹی میٹر دور لینے
 وزن کو معلوم کریں۔ 4 نیوٹن وزن اسے بیلنس کر رہا ہے

$W_2 = 4 \text{ N}$ معلوم وزن
 $W_2 = 30 \text{ cm} = 30 \times 10^{-2} \text{ m} = 30/100 \text{ m} = 0.3 \text{ m}$ طرف آرم
 $W_1 = ?$ نامعلوم وزن
 $W_1 = 40 \text{ cm} = 40 \times 10^{-2} \text{ m} = 40/100 \text{ m} = 0.4 \text{ m}$ طرف آرم
 $\tau_{\text{clockwise}} = \tau_{\text{anti-clockwise}}$
 $4 \times 0.3 = W_1 \times 0.4$
 $W_1 = (4 \times 0.3) / 0.4 = 3 \text{ N}$
 سی اینڈ سا پر ایک طرف مرکز سے 2 میٹر پر **4.4**
 30 کوگرام کا بندہ اور دوسری طرف 1.5 میٹر پر
 40 کوگرام کا بندہ بیٹھا ہو تو مومنٹس معلوم کریں۔
 $W_1 = m_1 g$ پہلا وزن
 $W_1 = 30 \times 10 = 300 \text{ N}$

$L_1 = 2 \text{ m}$ پہلا مومنٹ آرم
 $W_2 = m_2 g$ دوسرا وزن
 $W_2 = 40 \times 10 = 400 \text{ N}$
 $L_2 = 1.5 \text{ m}$ دوسرا مومنٹ آرم
 $\tau_1 = W_1 \times L_1 = 300 \times 2$
 $\tau_1 = 600 \text{ Nm}$
 $\tau_2 = W_2 \times L_2 = 400 \times 1.5$
 $\tau_2 = 600 \text{ Nm}$

سی اینڈ سا توازن میں ہے

4.5 سینٹی میٹر ہینڈ اور 30 سینٹی میٹر لمبا اور 250 نیوٹن وزنی کروہار کتنا وزن اٹھائے گا۔



$W_1 = 250 \text{ N}$ پہلا وزن
 $L_1 = 30 \text{ cm}$ پہلا مومنٹ آرم
 $L_1 = 30 \times 10^{-2} \text{ m} = 0.3 \text{ m}$
 $L_2 = 5 \text{ cm}$ دوسرا مومنٹ آرم
 $L_2 = 5 \times 10^{-2} \text{ m} = 0.05 \text{ m}$
 $W_2 = ?$ دوسرا وزن

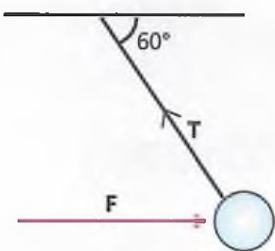
$\tau_{\text{clockwise}} = \tau_{\text{anti clockwise}}$
 $W_2 \times 0.05 = 250 \times 0.3$
 $W_2 = 75/0.05 = 1500 \text{ N}$

4.6 30 سینٹی میٹر رینج پر 150 نیوٹن میٹر ٹارک لگائی جائے تو فورس کیا ہوگی۔

$\tau = 150 \text{ Nm}$ ٹارک
 $L = 30 \text{ cm} = 30 \times 10^{-2} \text{ m} = 30/100 = 0.3 \text{ m}$
 $F = ?$ فورس

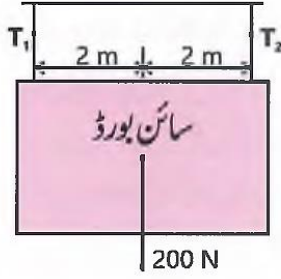
$F = \tau/L$ ($\tau = FL$)
 $F = 150/0.3 = 500 \text{ N}$

4.7 60 ڈگری جھت کے ساتھ 5 نیوٹن وزنی بال پر تناؤ اور فورس معلوم کریں۔



$W = 5 \text{ N}$ وزن
 $\theta = 60^\circ$ زاویہ
 $F = ?$ فورس
 $T = ?$ ٹینشن
 $W = T \sin \theta$
 $5 = T \sin 60$
 $5 = T \times 0.86$
 $T = 5/0.86 = 5.8 \text{ N}$
 $F = T \cos \theta$
 $F = 5.8 \times \cos 60$
 $F = 5.8 \times 0.50 = 2.9 \text{ N}$

4.8 200 نیوٹن اور 4 میٹر کی تصویر رسیوں سے لٹکانی گئی ہے۔ ان رسیوں میں تناؤ نکالیں۔



$W = 200 \text{ N}$ وزن
 $T_1 = T_2 = ?$ ٹینشن
 $T_1 + T_2 = W$
 $T + T = 200$
 $2T = 200$
 $T = 200/2 = 100 \text{ N}$

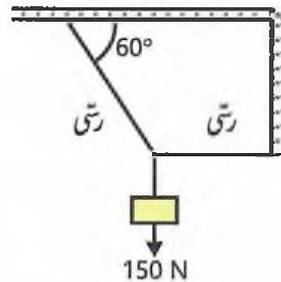
4.9 سی اینڈ سا پر ایک طرف مرکز سے 1.6 میٹر پر 300 نیوٹن کا بندہ اور دوسری طرف کچھ میٹر پر 400 نیوٹن کا بندہ بیٹھا ہوتو میٹر معلوم کریں۔

$W_1 = m_1 g$ پہلا وزن
 $W_1 = 30 \times 10 = 300 \text{ N}$
 $L_1 = 1.6 \text{ m}$ پہلا مومنٹ آرم
 $W_2 = m_2 g$ دوسرا وزن
 $W_2 = 40 \times 10 = 400 \text{ N}$
 $L_2 = ?$ دوسرا وزن

$\tau_1 = \tau_2$ سی اینڈ سا توازن میں ہو تو

$300 \times 1.6 = 400 \times L_2$
 $L_2 = 480/400 = 1.2 \text{ m}$

4.10 60 ڈگری جھت کے ساتھ 150 نیوٹن وزنی بلاک لٹکا ہوتو دونوں رسیوں میں تناؤ معلوم کریں۔



$W = 150 \text{ N}$ وزن
 $T = ?$ ٹینشن
 $W = T_1 \sin \theta$
 $150 = T_1 \times \sin 60$
 $150 = T_1 \times 0.86$
 $T_1 = 150/0.86 = 173.2 \text{ N}$
 $T_2 = T_1 \cos \theta$
 $T_2 = 173.2 \times \cos 60$
 $T_2 = 173.2 \times 0.50 = 86.6 \text{ N}$

Chapter # 5

5.1 باور معلوم کریں اگر 5 جول کی فورس 10 سیکنڈ اور 3 جول کی فورس 5 سیکنڈ ورک فرمیں۔
 $W = 5 \text{ J}, 3 \text{ J}$ ورک
 $t = 10 \text{ s}, 5 \text{ s}$ وقت
 $P = ?$ پاور

$P = W/t = 5/10 = 0.5 \text{ W}$
 $P = W/t = 3/5 = 0.3 \text{ W}$
5 میٹر کی بلندی پر 1 منٹ میں 5 کلو واٹ کا پمپ کتنا پانی اٹھائے گا۔

$P = 2000 \text{ W}$ پاور
 $t = 60 \text{ s}$ وقت
 $h = 5 \text{ m}$ بلندی
 $m = Pt/gh$ ($P = PE/t$)
 $m = (2000 \times 60)/(10 \times 5)$
 $m = 120000/50 = 2400 \text{ L}$
5 0.05 کلوگرام کی بال 300 میٹر فی سیکنڈ کے ساتھ چلے تو کتنی نیٹک انرجی کیا ہوگی۔

$m = 0.05 \text{ kg}$ ماس
 $v = 300 \text{ m/s}$ سپیڈ
 $KE = \frac{1}{2} mv^2 = \frac{1}{2} \times 0.05 \times (300)^2 = 2250 \text{ J}$

5 دوگنا سپیڈ پر کتنی نیٹک انرجی کیا ہوگی۔
 $KE = \frac{1}{2} mv^2 = \frac{1}{2} m (2v)^2 = \frac{1}{2} m (4v^2) = 4(\frac{1}{2} mv^2)$

5 دوگنا مومنٹم پر کتنی نیٹک انرجی کیا ہوگی۔
 $KE = P^2/2m = (2P)^2/2m = 4P^2/2m = 4(P^2/2m)$

5 میٹر تک 200 جول ورک سے دھکا دینے پر کتنی فورس لگے گی۔

$W = 200 \text{ J}$ ورک
 $S = 5 \text{ m}$ فاصلہ
 $F = ?$ فورس
 $F = W/S$ ($W = FS$)
 $F = 200/5 = 40 \text{ N}$

5 میٹر تک 30 ڈگری کے زاویہ پر 65 نیوٹن کی فورس لگے تو ورک کیا ہوگا۔

$F = 65 \text{ N}$ فورس
 $S = 20 \text{ m}$ فاصلہ
 $\theta = 30^\circ$ زاویہ
 $W = ?$ ورک
 $W = FS \cos \theta$

$W = 65 \times 20 \times \cos 60$
 $W = 1300 \times 0.86 = 1125.8 \text{ J}$
54 کلومیٹر فی گھنٹہ سے چلی 3000 کلوگرام کی کار کی کتنی نیٹک انرجی کیا ہوگی۔

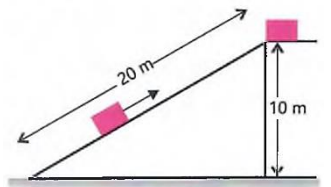
$m = 3000 \text{ kg}$ ماس
 $v = 54 \text{ km/h} = 54 \times 10^3 \text{ m}/3600 \text{ s} = 15 \text{ m/s}$
 $KE = ?$ کتنی نیٹک انرجی
 $KE = \frac{1}{2} mv^2$
 $KE = \frac{1}{2} \times 3000 \times (15)^2$
 $KE = 1500 \times 225$
 $KE = 337500 = 337.5 \times 10^3 \text{ J}$

12 میٹر بلندی پر 180 گرام کی بال کی پوٹینشل انرجی کیا ہوگی۔
 $m = 180 \text{ g} = 180 \text{ kg}/1000 = 0.18 \text{ kg}$ ماس
 $h = 12 \text{ m}$ بلندی
 $PE = ?$ پوٹینشل انرجی

$PE = mgh = 0.18 \times 10 \times 12$
 $PE = 21.6 \text{ J}$
1000 کلوگرام کے کار انجن کی پاور کیا ہوگی اگر یہ 4 میٹر فی مربع سیکنڈ کے ایکسلریشن کے ساتھ 5 سیکنڈ میں 50 میٹر تک چلے۔

$m = 1000 \text{ kg}$ ماس
 $a = 4 \text{ m/s}^2$ ایکسلریشن
 $S = 50 \text{ m}$ فاصلہ
 $t = 5 \text{ s}$ وقت
 $P = ?$ پاور
 $P = W/t = FS/t = maS/t$
 $P = (1000 \times 4 \times 50)/5$
 $P = 200000/5 = 40000 \text{ W}$
 $P = 4 \times 10^3 \text{ W} = 4 \text{ kW}$

120 نیوٹن بلاک کی ایفی شینٹی کیا ہوگی۔ اگر **100** نیوٹن کی فورس سے 10 میٹر بلند اور 20 میٹر لمبے سلوپ پر حرکت دی ہو۔



$W = 120 \text{ N}$ وزن
 $F = 100 \text{ N}$ فورس
 $S = 20 \text{ m}$ فاصلہ
 $h = 10 \text{ m}$ بلندی
 $E = ?$ ایفی شینٹی
 $W = FS$ بلاک پر کیا گیا ورک
 $W = 100 \times 20 = 2000 \text{ J}$
 $PE =$ بلندی پر حاصل کردہ انرجی
 $Wh = 120 \times 10 = 1200 \text{ J}$
 $E = \frac{\text{output energy}}{\text{input energy}} \times 100$
 $E = (1200 \times 100)/2000$
 $E = 60\%$

60 ڈگری کے ساتھ 3 میٹر تک 20 نیوٹن کی فورس کتنا ورک کرے گی۔

$F = 20 \text{ N}$ فورس
 $\theta = 60^\circ$ زاویہ
 $S = 3 \text{ m}$ فاصلہ
 $W = ?$ ورک
 $W = FS \cos \theta$
 $W = 20 \times 3 \times \cos 60$
 $W = 60 \times 0.50 = 30 \text{ J}$

5.2 20 جول ورک کی وجہ سے 8 نیوٹن فورس لگے تو فورس کا زاویہ کیا ہوگا۔
 $W = 20 \text{ J}$ ورک
 $F = 8 \text{ N}$ فورس
 $S = 5 \text{ m}$ فاصلہ
 $\theta = ?$ زاویہ
 $W = FS \cos \theta$
 $20 = 8 \times 5 \cos \theta$
 $20/40 = \cos \theta$
 $0.5/\cos \theta$
 $\theta = \cos^{-1}(0.5) = 60^\circ$

5.3 80 میٹر کی بلندی پر 25 سیکنڈ میں 100

کلوگرام پانی پمپ کرنے کے لیے پاور کیا ہوگی۔

$$m = 100 \text{ kg}$$

$$h = 80 \text{ m}$$

$$t = 25 \text{ s}$$

$$P = ?$$

$$P = W/t = mgh/t$$

$$P = (100 \times 10 \times 80)/25$$

$$P = 3200 \text{ W}$$

5.4 20 کلوگرام کا جسم ریست پر بہو اور اس پر

40 نیوٹن کی فورس 5 سیکنڈ تک لگے تو کتنی نیٹک

انرجی کیا ہوگی۔

$$m = 20 \text{ kg}$$

$$v_i = 0$$

$$F = 40 \text{ N}$$

$$t = 5 \text{ s}$$

$$KE = ?$$

$$a = F/m = 40/20 = 2 \text{ m/s}^2$$

$$v_f = v_i + at = 0 + 2 \times 5 = 10 \text{ m/s}$$

$$KE = \frac{1}{2} mv^2 = \frac{1}{2} \times 20 \times (10)^2$$

$$KE = 10 \times 100 = 1000 \text{ J}$$

5.5 20 میٹر بلندی پر 160 گرام کی بال کی

پوٹینشل انرجی کیا ہوگی۔

$$m = 160 \text{ g} = 160 \text{ kg/k}$$

$$= 160 \text{ kg}/1000 = 0.16 \text{ kg}$$

$$h = 20 \text{ m}$$

$$PE = ?$$

$$PE = mgh = 0.16 \times 10 \times 20$$

$$PE = 32 \text{ J}$$

5.6 140 گرام کی بال 35 میٹر فی سیکنڈ سے اوپر

جائے تو کہاں تک جائے گی۔

$$m = 140 \text{ g} = 140 \text{ kg/k}$$

$$= 140 \text{ kg}/1000 = 0.14 \text{ kg}$$

$$v_i = 35 \text{ m/s}$$

$$v_f = 0$$

$$g = -10 \text{ ms}^{-2}$$

$$h = ?$$

$$2aS = v_f^2 - v_i^2$$

$$2 \times (-10) \times h = (0)^2 - (35)^2$$

$$-20h = -1225$$

$$h = 1225/20 = 61.25 \text{ m}$$

5.7 زیادہ سے زیادہ کتنی سپیڈ پر جھولا جھولے گا

اگر بلندی 1.2 سے 2 میٹر تک ہو۔

$$h_1 = 1.2 \text{ m}$$

$$h_2 = 2 \text{ m}$$

$$h = h_2 - h_1$$

$$h = 2 - 1.2 = 0.8 \text{ m}$$

$$v_f = 0$$

$$v_i = ?$$

$$2aS = v_f^2 - v_i^2$$

$$2(-10)(0.8) = (0)^2 - (v_i)^2$$

$$-16 = -v_i^2$$

$$\sqrt{v_i^2} = \sqrt{16}$$

$$v_i = 4 \text{ m/s}$$

زیادہ سے زیادہ ولاسٹی نچلی بلندی پر ہوگی

5.8 45 ڈگری کے ساتھ 20 میٹر تک 50 نیوٹن

سے مشین چلے تو ورک کیا ہوگا۔

$$F = 50 \text{ N}$$

$$\theta = 45^\circ$$

$$S = 20 \text{ m}$$

$$W = ?$$

$$W = F \cos \theta$$

$$W = 50 \times 20 \times \cos 45$$

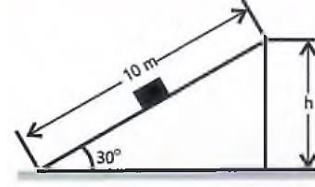
$$W = 1000 \times 0.707$$

$$W = 707 \text{ J}$$

5.9 30 ڈگری زاویہ پر 10 میٹر لمبے سلوب پر

کلوگرام بلاک کو حرکت دیں تو ورک کیا ہوگا۔ سلوب

کی چوٹی پر ورک کیا ہوگا۔



$$m = 5 \text{ kg}$$

$$\theta = 30^\circ$$

$$S = 10 \text{ m}$$

$$W = ?$$

$$(a) W = FS = mgsin \theta \times S$$

$$W = 5 \times 10 \times \sin 30 \times 10$$

$$W = 500 \times 0.50 = 250 \text{ J}$$

$$(b) \sin \theta = \sin 30 = h/10$$

$$h = 10 \sin 30 = 10 \times 0.5 = 5 \text{ m}$$

$$W = PE = mgh$$

$$W = 5 \times 10 \times 5 = 250 \text{ J}$$

5.10 10 کلوگرام کے بلاک کی ایفی شینٹی کیا

ہوگی۔ اگر اسے 80 نیوٹن کی فورس سے 5 میٹر بلند اور

15 میٹر لمبے سلوب پر حرکت دی ہو۔

$$m = 10 \text{ kg}$$

$$S = 15 \text{ m}$$

$$F = 80 \text{ N}$$

$$h = 5 \text{ m}$$

$$E = ?$$

$$E_i = W = FS$$

$$E_i = 80 \times 15 = 1200 \text{ J}$$

$$E_o = PE = mgh$$

$$E_o = 10 \times 10 \times 5 = 500 \text{ J}$$

$$E = \frac{\text{output energy}}{\text{input energy}} \times 100$$

$$E = (500 \times 100)/1200$$

$$E = 41.7\%$$

5.11 600 نیوٹن کی فورس بلاک کو 5 میٹر تک

15 سیکنڈ میں لے جائے تو پاور کیا ہوگی۔

$$F = 600 \text{ N}$$

$$S = 5 \text{ m}$$

$$t = 15 \text{ s}$$

$$P = ?$$

$$P = W/t = FS/t$$

$$P = (600 \times 5)/15 = 200 \text{ W}$$

5.12 40 کلو کا جسم 8 سیکنڈ میں 10 میٹر تک

اوپر جائے تو پاور کیا ہوگی۔

$$m = 40 \text{ kg}$$

$$h = 10 \text{ m}$$

$$t = 8 \text{ s}$$

$$P = ?$$

$$P = W/t = mgh/t$$

$$P = (40 \times 10 \times 10)/8 = 500 \text{ W}$$

5.13 اگر ایک فورس کچھ فاصلہ تک لے تو ورک

کیا ہوگا۔ اگر فورس اور فاصلہ دوگنا ہو جائیں تو ورک

کیا ہوگا۔ کل ورک کیا ہوگا۔

$$(a) F = F$$

$$S = L$$

$$Work = W = FS = F \times L$$

$$(b) F = 2F$$

$$S = 2L$$

$$Work = W = FS$$

$$W = 2F \times 2L = 4FL$$

$$FL + 4FL = 5FL$$

Chapter # 6

40 سیکنڈ میں اور 50 سیکنڈ میں جہت والے ایریا

پر فورس معلوم کریں جب 100 کلو پاسکل فضائی

پریشر ہو۔

$$P = 100000 \text{ Pa}$$

$$A = 40 \text{ cm} \times 50 \text{ cm}$$

$$= 2000 \text{ cm}^2 = 2 \times 10^3 \text{ cm}^2$$

$$= 2 \times 10^3 (10^{-2})^2 \text{ m}^2$$

$$= 2 \times 10^3 \times 10^{-4} \text{ m}^2$$

$$= 2 \times 10^{-1} \text{ m}^2 = 0.2 \text{ m}^2$$

$$F = PA \quad (P = F/A)$$

$$F = 100000 \times 0.2$$

$$F = 20000 \text{ N} = 20 \text{ kN}$$

قطر کے لحاظ سے تاری لمبائی بتائیں

$$F = W$$

$$L =$$

$$A = \pi r^2 = \pi (d/2)^2$$

$$A = \pi d^2/4$$

$$\Delta L = FL/AY \quad (Y = FL/A\Delta L)$$

$$\Delta L = \frac{FL}{Y \pi d^2/4} = 4FL/Y \pi d^2$$

$$\Delta L \propto 1/d^2$$

قطر آدھا ہو تو لمبائی چار گنا ہو جاتی ہے

$$\Delta L \propto 1/(d/2)^2 \propto 4(1/d^2)$$

قطر کے لحاظ سے تاری لمبائی بتائیں

$$as \Delta L \propto 1/d^2$$

پس وہ تاری جس کا قطر سب سے کم ہوگا

اس کی لمبائی میں اضافہ زیادہ ہوگا

2 اور 3 مربع میٹر پلیٹ پر پریشر کیا ہوگا

$$P = \rho gh$$

پس پریشر کا ایریا پر انحصار نہیں ہے

94 گرام بلاک جس کی جہتیں 2، 3، 4 سیکنڈ

میٹریں اس کی ڈینسٹی کیا ہوگی۔

$$m = 94 \text{ g} = 94 \text{ kg/k}$$

$$= 94 \text{ kg}/1000 = 0.094 \text{ kg}$$

$$L \times W \times B$$

$$V = 3 \text{ cm} \times 2 \text{ cm} \times 2 \text{ cm}$$

$$V = \frac{3m}{100} \times \frac{2m}{100} \times \frac{2m}{100}$$

$$V = 0.03 \text{ m} \times 0.02 \text{ m} \times 0.02 \text{ m}$$

$$V = 0.000012 \text{ m}^3$$

$$d = ?$$

$$d = m/V = 0.094/0.000012$$

$$d = 7833 \text{ kg/m}^3$$

ii 13600 کلوگرام فی کیوبک میٹر ڈینسٹی والے 76

سینٹی میٹر مرکزی کالم کا پریشر کیا ہوگا۔

$$h = 76 \text{ cm}$$

$$h = 76 \times 10^{-2} \text{ m}$$

$$\rho = 13.6 \times 10^3 \text{ kgm}^{-3}$$

$$P = ?$$

$$P = \rho gh = 13.6 \times 10^3 \times 10 \times$$

$$76 \times 10^{-2} = 10336 \times 10^{-2}$$

$$P = 103360 = 1.034 \times 10^5 \text{ Pa}$$

iii 20 میٹر بلندی پر پڑے 2 میٹر گہرے ٹینک کے

پینل پر پریشر کیا ہوگا۔

$$h = 20 + 2 = 22 \text{ m}$$

$$\rho = 1000 \text{ kg/m}^3$$

$$P = ?$$

$$P = \rho gh = 1000 \times 10 \times 22$$

$$P = 220000 = 2.2 \times 10^5 \text{ Pa}$$

iv 25 سینٹی میٹر قطر کے بڑے پستن پر پریشر کیا

ہوگا۔ اگر 5 سینٹی میٹر قطر کے چھوٹے پستن پر

160 نیوٹن کی فورس لگائی جائے۔ یہ کتنا وزن اٹھائے گا۔

$$f_1 = 160 \text{ N}$$

$$d = 5 \text{ cm} = 5 \times 10^{-2}$$

$$m = 5/100 = 0.05 \text{ m}$$

$$D = 25 \text{ cm} = 25 \times 10^{-2}$$

$$m = 0.25 \text{ m}$$

$$P = ?$$

$$W = ?$$

$$a_1 = \pi r_1^2$$

$$a_1 = \pi (d/2)^2 = 3.14(0.05/2)^2$$

$$a_1 = 0.0019625 \text{ m}^2$$

$$A_2 = \pi R_2^2$$

$$A_2 = \pi (D/2)^2 = 3.14(0.25/2)^2$$

$$A_2 = 0.0490625 \text{ m}^2$$

$$F_2 = f_1 \left(\frac{A_2}{a_1} \right) \quad \left(\frac{F_2}{A_2} = \frac{f_1}{a_1} \right)$$

$$W = 160 \times \left(\frac{0.0490625}{0.0019625} \right)$$

$$W = 4000 \text{ N} = 4 \text{ kN}$$

$$P = f_1/a_1 = 160/0.0019625$$

$$P = 81528.66 \text{ Pa}$$

6.1 40 نیوٹن کا وزن سپرنگ کو 20 ملی میٹر

لمبا کرے تو سپرنگ کونسٹنٹ کیا ہوگا۔ اگر لمبائی

16 ملی میٹر ہو تو پھر وزن کیا ہوگا۔

$$x = 20 \text{ mm} =$$

$$20 \times 10^{-3} \text{ m} = 0.02 \text{ m}$$

$$F = 40 \text{ N}$$

$$k = ?$$

$$k = F/x \quad (F = kx)$$

$$k = 40/0.02 = 2000 \text{ N/m}$$

$$k = 2 \text{ kN}$$

$$(b) x = 16 \text{ mm} =$$

$$16 \times 10^{-3} \text{ m} = 0.016 \text{ m}$$

$$F = 40 \text{ N}$$

$$W = F = ?$$

$$F = kx = 2000 \times 0.016$$

$$W = 32 \text{ N}$$

$$6.2 \text{ 4.5 kg ماس والے 5 لیٹر دودھ کی ڈینسٹی}$$

کیا ہوگی۔

$$m = 4.5 \text{ kg}$$

$$V = 5 \text{ L}$$

$$V = 5 \times 0.001 = 0.005 \text{ m}^3$$

$$d = ?$$

$$d = m/V = 4.5/0.005$$

$$d = 900 \text{ kg/m}^3$$

$$6.3 \text{ 60 گرام ماس والے بلاک کی ڈینسٹی کیا ہوگی}$$

جسے بانی میں ڈبوئے پر والیوم 40 سے 44 کیوبک

سینٹی میٹر تک جاتا ہے۔

$$m = 60 \text{ g} = 60 \text{ kg/k}$$

$$= 60 \text{ kg/1000} = 0.06 \text{ kg}$$

$$V = V_2 - V_1$$

$$V = 44 - 40 = 4 \text{ cm}^3$$

$$V = 4 \text{ cm}^3 = 4 \times (10^{-2})^3 \text{ m}^3$$

$$V = 4 \times 10^{-6} \text{ m}^3$$

$$d = ?$$

$$d = m/V = 0.06/4 \times 10^{-6}$$

$$d = 0.015 \times 10^6 = 15000$$

$$d = 15 \times 10^3 \text{ kg/m}^3$$

$$6.4 \text{ 60 کیوبک سینٹی میٹر والیوم اور 8000}$$

کلوگرام کی کیوبک سینٹی میٹر ڈینسٹی والے ڈبے کا ماس کیا

ہوگا۔

$$d = 8 \times 10^3 \text{ kg/m}^3$$

$$V = 60 \text{ cm}^3$$

$$V = 60 \text{ cm}^3 = 60 \times (10^{-2})^3 \text{ m}^3$$

$$V = 60 \times 10^{-6} \text{ m}^3$$

$$m = dV \quad (d = m/V)$$

$$m = 8 \times 10^3 \times 60 \times 10^{-6}$$

$$m = 480 \times 10^{-3} = 0.48 \text{ kg}$$

$$6.5 \text{ 5 کلوگرام کا ڈبہ جس کی جہتیں 20، 10، 5}$$

سینٹی میٹر ہیں۔ اس پر کم سے کم اور زیادہ سے زیادہ کتنا

پریشی لگ سکتے ہیں۔

$$m = 5 \text{ kg}$$

$$A = 5 \times 10 = 50$$

$$\text{cm}^2 = 50 \text{ cm}^2 = 50 \times (10^{-2})^2$$

$$\text{m}^2 = 50 \times 10^{-4} \text{ m}^2$$

$$A = 10 \times 20 =$$

$$200 \text{ cm}^2 = 200 \text{ cm}^2 = 200$$

$$\times (10^{-2})^2 \text{ m}^2 = 200 \times 10^{-4} \text{ m}^2$$

$$F = mg$$

$$F = 5 \times 10 = 50 \text{ N}$$

$$P = ?$$

$$P = F/A = 50/50 \times 10^{-4}$$

$$P = 1/10^{-4} = 10000 \text{ Pa}$$

$$(b) \text{ پریشی کم} \rightarrow \text{ایریا زیادہ}$$

$$P = F/A = 50/200 \times 10^{-4}$$

$$P = 50/2 \times 10^{-2} = 2500 \text{ Pa}$$

$$6.6 \text{ ہیرومیٹر میں پانی کے کالم کی بلندی کیا}$$

ہوگی۔ اگر مرکری کی جگہ پانی استعمال کیا جائے۔

$$\rho_1 = 13.6 \times 10^3 \text{ kg/m}^3$$

$$h_1 = 0.76 \text{ cm}$$

$$\rho_2 = 1000 \text{ kg/m}^3$$

$$h_2 = ?$$

$$h_2 = \frac{\rho_1 g h_1}{\rho_2 g} \quad (\rho_2 g h_2 = \rho_1 g h_1)$$

$$h_2 = \frac{13.6 \times 10^3 \times 10 \times 0.76}{1000 \times 10}$$

$$h_2 = 13.6 \times 0.76 = 10.3 \text{ m}$$

$$6.7 \text{ 20 مربع سینٹی میٹر کے بڑے پستن پر پریشی}$$

اور فورس کیا ہوگا۔ اگر 5 مربع سینٹی میٹر کے چھوٹے

پستن پر 500 نیوٹن کی فورس لگائی جائے۔

$$F_1 = 500 \text{ N}$$

$$a_1 = 5 \text{ cm}^2 = 5 \text{ cm}^2$$

$$= 5 \times (10^{-2})^2 \text{ m}^2 = 5 \times 10^{-4} \text{ m}^2$$

$$a_1 = 20 \text{ cm}^2 = 20 \text{ cm}^2$$

$$= 20 \times (10^{-2})^2 \text{ m}^2$$

$$= 20 \times 10^{-4} \text{ m}^2$$

$$P = ?$$

$$F_2 = ?$$

$$F_2 = F_1 \left(\frac{A_2}{A_1} \right) \quad \left(\frac{F_2}{A_2} = \frac{F_1}{A_1} \right)$$

$$F_2 = 500 \times \left(\frac{20 \times 10^{-4}}{5 \times 10^{-4}} \right)$$

$$F_2 = 500 \times 4 = 2000 \text{ N}$$

$$P = F_1/A_1 = 500/5 \times 10^{-4}$$

$$P = 100 \times 10^{-4} = 1 \times 10^6 \text{ Pa}$$

$$6.8 \text{ 10 میٹر گہرائی پر پانی میں پریشی کیا ہوگا۔ اگر}$$

پانی کی ڈینسٹی 1030 کلوگرام فی کیوبک میٹر ہو۔

$$h = 10 \text{ m}$$

$$\rho = 1030 \text{ kg/m}^3$$

$$P = ?$$

$$P = \rho g h = 1030 \times 10 \times 10$$

$$P = 103000 = 1.03 \times 10^5 \text{ Pa}$$

$$6.9 \text{ 4 کلو نیوٹن کا وزن اٹھانے کے لیے چھوٹے پستن پر}$$

کتنی فورس لگانی پڑے گی۔ اگر اس کا ایریا 10 مربع

سینٹی میٹر ہو اور بڑے پستن کا ایریا 100 مربع سینٹی

میٹر ہو۔

$$F_2 = 4000 \text{ N}$$

$$a_1 = 10 \text{ cm}^2$$

$$= 10 \text{ cm}^2 = 10 \times (10^{-2})^2 \text{ m}^2$$

$$= 10 \times 10^{-4} \text{ m}^2 = 10^{-3} \text{ m}^2$$

$$A_2 = 100 \text{ cm}^2$$

$$= 100 \text{ cm}^2 = 100 \times (10^{-2})^2 \text{ m}^2$$

$$= 100 \times 10^{-4} \text{ m}^2 = 10^{-2} \text{ m}^2$$

$$F_1 = ?$$

$$F_2/A_2 = F_1/A_1$$

$$4000/10^{-2} = F_1/10^{-3}$$

$$4 \times 10^3 \times 10^2 = 10^3 \times F_1$$

$$F_1 = 400 \text{ N}$$

$$6.10 \text{ سچ سمندر پر پریشی معلوم کریں۔}$$

$$h = 0.76 \text{ m}$$

$$\rho = 13600 \text{ kg/m}^3$$

$$P = ?$$

$$P = 13600 \times 10 \times 0.76$$

$$P = 103360 = 1.03 \times 10^5 \text{ Pa}$$

P (kPa)	h (m)
99.5	150
95.7	500
92.4	800
88.9	1140
87.2	1300
85.3	1500

گراف سے ہم نے بلندی 1.02 کلو میٹر لی

اور 90 کلو پاسکل حاصل ہوا۔

$$6.11 \text{ 50 مربع سینٹی میٹر ایریا کے چیک پر 10}$$

پاسکل پریشی لگایا جائے تو یہ کتنا وزن اٹھائے گا۔

$$P = 10 \text{ N/cm}^2 = 10$$

$$\text{N/cm}^2 = 10 \text{ Nm}^{-2}/(10^{-2})^2 =$$

$$10/10^{-4} \text{ Pa} = 10^5 \text{ Pa}$$

$$A = 50 \text{ cm}^2$$

$$= 50 \text{ cm}^2 = 5 \times (10^{-2})^2 \text{ m}^2$$

$$= 50 \times 10^{-4} \text{ m}^2 = 5 \times 10^{-3} \text{ m}^2$$

$$F = PA \quad (P = F/A)$$

$$W = 10^5 \times 5 \times 10^{-3}$$

$$W = 5 \times 10^2 = 500 \text{ N}$$

$$6.12 \text{ 20 مربع سینٹی میٹر کے بڑے پستن پر}$$

پریشی اور فورس کیا ہوگا۔ اگر 5 مربع سینٹی میٹر کے

چھوٹے پستن پر 500 نیوٹن کی فورس لگائی جائے۔

$$F_1 = 500 \text{ N}$$

$$a_1 = 5 \text{ cm}^2$$

$$= 5 \text{ cm}^2 = 5 \times (10^{-2})^2 \text{ m}^2$$

$$= 5 \times 10^{-4} \text{ m}^2$$

$$a_1 = 20 \text{ cm}^2$$

$$= 20 \text{ cm}^2 = 20 \times (10^{-2})^2 \text{ m}^2$$

$$= 20 \times 10^{-4} \text{ m}^2$$

$$P = ?$$

$$F_2 = ?$$

$$F_2 = F_1 \left(\frac{A_2}{A_1} \right) \quad \left(\frac{F_2}{A_2} = \frac{F_1}{A_1} \right)$$

$$F_2 = 500 \times \left(\frac{20 \times 10^{-4}}{5 \times 10^{-4}} \right)$$

$$F_2 = 500 \times 4 = 2000 \text{ N}$$

$$P = F_1/A_1 = 500/5 \times 10^{-4}$$

$$P = 100 \times 10^{-4} = 1 \times 10^6 \text{ Pa}$$

Chapter # 7

ٹمپریچر کو تبدیل کریں

$$C = 30 \text{ }^\circ\text{C}$$

$$F = 1.8C + 32$$

$$F = (1.8 \times 30) + 32 = 86 \text{ }^\circ\text{F}$$

$$K = 273 + C$$

$$K = 273 + 30 = 303 \text{ K}$$

$$7.1 \text{ ٹمپریچر کو تبدیل کریں}$$

$$F = 98.6 \text{ }^\circ\text{F}$$

$$F = 1.8C + 32$$

$$98.6 = 1.8 \times C + 32$$

$$98.6 - 32 = 1.8 \times C$$

$$C = 66.6/1.8 = 37 \text{ }^\circ\text{C}$$

$$K = 273 + C$$

$$K = 273 + 37 = 310 \text{ K}$$

$$7.2 \text{ کس قیمت پر سینٹی گریڈ اور فارن ہابیت}$$

سکیل برابر ہوتی ہیں۔

$$Let F = C$$

$$F = 1.8C + 32$$

$$F = 1.8 \times F + 32$$

$$F - 1.8F = 32$$

$$(1 - 1.8)F = 32$$

$$-0.8F = 32$$

$$F = -32/0.8 = -40$$

$$7.3 \text{ ٹمپریچر کو تبدیل کریں}$$

$$F = 5 \text{ }^\circ\text{F}$$

$$F = 1.8C + 32$$

$$5 = 1.8 \times C + 32$$

$$5 - 32 = 1.8 \times C$$

$$C = -27/1.8 = -15 \text{ }^\circ\text{C}$$

$$K = 273 + C$$

$$K = 273 - 15 = 258 \text{ K}$$

$$7.4 \text{ ٹمپریچر کو تبدیل کریں}$$

$$C = 25 \text{ }^\circ\text{C}$$

$$F = 1.8C + 32$$

$$F = (1.8 \times 25) + 32 = 77 \text{ }^\circ\text{F}$$

$$K = 273 + C$$

$$K = 273 + 25 = 298 \text{ K}$$

$$6.7.2 \text{ 67.2 ملی میٹر مرکری کالم کا ٹمپریچر کیا ہوگا}$$

جبکہ برف اور بھاپ کے نقطوں کے درمیان فاصلہ

192 ملی میٹر ہے۔

$$0 \text{ }^\circ\text{C}$$

$$100 \text{ }^\circ\text{C}$$

$$67.2 \text{ mm}$$

$$192 \text{ mm} = 100 \text{ }^\circ\text{C}$$

$$1 \text{ mm} = \frac{100}{192} \text{ }^\circ\text{C}$$

$$67.2 \text{ mm} = \frac{100}{192} \times 67.2$$

$$= 35 \text{ }^\circ\text{C}$$

$$7.6 \text{ 4.5 سینٹی میٹر مرکری کالم کا ٹمپریچر کیا ہوگا}$$

اگر نچلے اور بالائی نقاط کے درمیان فاصلہ 20 سینٹی

میٹر ہے۔

$$32 \text{ }^\circ\text{F}$$

$$212 \text{ }^\circ\text{C}$$

$$4.5 \text{ cm}$$

$$20 \text{ cm}$$

$$20 \text{ cm} = 180 \text{ }^\circ\text{F}$$

$$1 \text{ cm} = \frac{100}{20} \text{ }^\circ\text{F}$$

$$4.5 \text{ cm} = \frac{100}{20} \times 4.5$$

$$= 40.5 \text{ }^\circ\text{F}$$

Numerical 9th

CHAPTER # ①

☒ solve these prefixes

$$5 \text{ pm} = 5 \times 10^{-12} \text{ m}$$

$$15 \text{ ns} = 15 \times 10^{-9} \text{ s}$$

$$6 \text{ } \mu\text{s} = 6 \times 10^{-6} \text{ s}$$

$$5 \text{ fs} = 5 \times 10^{-15} \text{ s}$$

☑ LC of vernier calipers

$$\text{Main scale} = \text{ms} = 0.5 \text{ mm}$$

$$\text{Vernier scale} = \text{vs} = 10$$

$$\text{LC} = \text{ms}/\text{vs} = 0.5/10$$

$$\text{LC} = 0.05 \text{ mm}$$

☒ (a) add these digits

$$5.123 \times 10^4 + 3.28 \times 10^5$$

$$= 5.123 \times 10^4 + 32.8 \times 10^4 =$$

$$(5.123 + 32.8) \times 10^4$$

$$= 37.923 \times 10^4$$

$$= 3.79 \times 10^5 \text{ m}$$

(b) substrate these digits

$$2.57 \times 10^{-2} - 3.43 \times 10^{-3}$$

$$= 2.57 \times 10^{-2} - 0.343 \times 10^{-2}$$

$$= (2.57 - 0.343) \times 10^{-2}$$

$$= 2.227 \times 10^{-2} \text{ mm}$$

☒ (a) multiply these digits

$$(4 \times 10^3 \text{ kg})(6 \times 10^6 \text{ m})$$

$$= (4 \times 6) \times 10^{3+6} \text{ kgm}$$

$$= 24 \times 10^9 \text{ kgm}$$

$$= 2.4 \times 10^{10} \text{ kgm}$$

(b) divide these digits

$$6 \times 10^6 \text{ m}^3 / 2 \times 10^{-2} \text{ m}^2$$

$$= (6/2) \times 10^{6+2} \text{ m}^{3-2}$$

$$= 3 \times 10^8 \text{ m}$$

☒ 1.1 find seconds

$$(a) 1 \text{ day} = 24 \text{ hours}$$

$$= 1 \times 24 \times 60 \times 60$$

$$= 86400 \text{ s} = 86.4 \times 10^3 \text{ s}$$

$$= 86.4 \text{ ks}$$

$$(b) 1 \text{ week} = 7 \text{ days}$$

$$= 1 \times 7 \times 24 \times 60 \times 60$$

$$= 604800 \text{ s}$$

$$= 604.8 \times 10^3 \text{ s}$$

$$= 604.8 \text{ ks}$$

$$(c) 1 \text{ month} = 30 \text{ days}$$

$$= 1 \times 30 \times 24 \times 60 \times 60$$

$$= 2592000 \text{ s}$$

$$= 2.592 \times 10^6 \text{ s}$$

$$= 2.592 \text{ Ms}$$

☒ 1.2 scientific notation

$$(a) 1 \text{ day} = 24 \text{ hours}$$

$$= 1 \times 24 \times 60 \times 60$$

$$= 86400 \text{ s} = 8.64 \times 10^4 \text{ s}$$

$$(b) 1 \text{ week} = 7 \text{ days}$$

$$= 1 \times 7 \times 24 \times 60 \times 60$$

$$= 604800 \text{ s} = 6.04 \times 10^5 \text{ s}$$

$$(c) 1 \text{ month} = 30 \text{ days}$$

$$= 1 \times 30 \times 24 \times 60 \times 60$$

$$= 2592000 \text{ s}$$

$$= 2.592 \times 10^6 \text{ s}$$

☒ 1.3 (a) add these digits

$$4 \times 10^{-4} + 3 \times 10^{-5}$$

$$= 4 \times 10^{-4} + 0.3 \times 10^{-4}$$

$$= (4 + 0.3) \times 10^{-4}$$

$$= 4.3 \times 10^{-4} \text{ kg}$$

(b) substrate these digits

$$5.4 \times 10^{-6} - 3.2 \times 10^{-5}$$

$$= 0.54 \times 10^{-5} - 3.2 \times 10^{-5}$$

$$= (0.54 - 3.2) \times 10^{-5}$$

$$= -2.66 \times 10^{-5} \text{ m}$$

☒ 1.4 (a) multiply these digits

$$(5 \times 10^4 \text{ m})(3 \times 10^{-2} \text{ m})$$

$$= (3 \times 5) \times 10^{4-2} \text{ m} \times \text{m}$$

$$= 15 \times 10^2 \text{ m}^2$$

$$= 1.5 \times 10^3 \text{ m}^2$$

(b) divide these digits

$$6 \times 10^8 \text{ kg} / 3 \times 10^4 \text{ m}^3$$

$$= (6/3) \times 10^{8-4} \text{ kgm}^{-3}$$

$$= 2 \times 10^4 \text{ kgm}^{-3}$$

☒ 1.5 scientific notation

$$(3 \times 10^2 \text{ kg})(4 \text{ km}) / 500 \text{ s}^2$$

$$= \frac{3 \times 10^3 \cdot 4 \times 10^3 \text{ kgm}}{5 \times 10^2 \text{ s}^2}$$

$$= 12 \times 10^{3+3-2} \text{ kgms}^{-2} / 5$$

$$= 2.4 \times 10^4 \text{ kgms}^{-2}$$

☒ 1.6 significant figures

$$(a) 0.0045 \text{ m} = 2$$

$$(b) 2.047 \text{ m} = 4$$

$$(c) 3.40 \text{ m} = 3$$

$$(d) 3.420 \times 10^2 \text{ m} = 4$$

☒ 1.7 use prefixes

$$(a) 5 \times 10^4 \text{ m}$$

$$= 5 \times 10^1 \times 10^3 \text{ m}$$

$$= 50 \text{ km}$$

$$(b) 580 \times 10^2 \text{ g}$$

$$= 58.0 \times 10^1 \times 10^2 \text{ g}$$

$$= 58 \times 10^3 \text{ g} = 58 \text{ kg}$$

$$(c) 45 \times 10^{-4} \text{ s}$$

$$= 4.5 \times 10^1 \times 10^{-4} \text{ s}$$

$$= 4.5 \times 10^{-3} \text{ s} = 4.5 \text{ ms}$$

☒ 1.8 find distance d, if

$$\text{Speed} = v = 3 \times 10^8 \text{ m/s}$$

$$\text{Time} = t = 1 \text{ year}$$

$$1 \text{ y} = 1 \times 365 \times 24 \times 60 \times 60$$

$$1 \text{ y} = 31536000 \text{ s}$$

$$\text{Distance} = S = ?$$

$$\text{Speed} \rightarrow v = S/t$$

$$S = vt = (3 \times 10^8)(3.15 \times 10^7)$$

$$S = 9.4608 \times 10^{15} \text{ m}$$

☒ 1.9 convert units of density

$$d = 13.6 \text{ gcm}^{-3}$$

$$= 13.6 \times \frac{\text{kg}}{\text{m}^3} \times \frac{\text{cm}^3}{\text{m}^3}$$

$$= 13.6 / 10^3 \times \frac{1}{10^{-27}} \text{ kg/m}^3$$

$$= 0.0136 \times \frac{1}{(10^{-2})^3} \text{ kg/m}^3$$

$$= 0.0136 \times \frac{1}{10^{-6}} \text{ kg/m}^3$$

$$= 0.0136 \times 10^6 \text{ kg/m}^3$$

$$= 13600 \text{ kg/m}^3$$

$$= 1.36 \times 10^4 \text{ kgm}^{-3}$$

CHAPTER # ②

☒ distance by falling ball in 1st 1 s

$$\text{Initial velocity} = v_i = 0$$

$$\text{Acceleration} = g = 10 \text{ ms}^{-2}$$

$$\text{Time} = t = 1 \text{ s}$$

$$S = v_i t + \frac{1}{2} g t^2$$

$$S = \frac{1}{2} (10)(1)^2 = 5 \text{ m}$$

☒ distance cover by body from

rest to velocity 144 km/h in 20 s

$$\text{Initial velocity} = v_i = 0$$

$$\text{Final velocity} = v_f = 144 \text{ km/h}$$

$$v_f = \frac{144 \times 1000 \text{ m}}{3600 \text{ s}} = 40 \text{ m/s}$$

$$\text{Time} = t = 20 \text{ s}$$

$$\text{Acceleration} = a = (v_f - v_i)/t$$

$$= (40 - 0)/20 = 2 \text{ m/s}^2$$

$$S = v_i t + \frac{1}{2} a t^2$$

$$S = \frac{1}{2} (2)(20)^2 = 400 \text{ m}$$

☒ one fourth of distance

$$\text{From rest} = v_i = 0$$

$$\text{Distance} = S = S$$

$$\text{Time} = t = 4 \text{ s}$$

$$S = v_i t + \frac{1}{2} a t^2$$

$$S = \frac{1}{2} a (4)^2 = 8a$$

$$\text{Now for } S/4 = 8a/4 = 2a$$

$$S = v_i t + \frac{1}{2} a t^2$$

$$2a = \frac{1}{2} a t^2$$

$$4 = t^2$$

$$t = 2 \text{ s}$$

☒ iii find time t, if

$$\text{Distance} = S = 300 \text{ m}$$

$$\text{Speed} = v = 60 \text{ m/s}$$

$$\text{Time} = t = ?$$

$$\text{Speed} \rightarrow v = S/t$$

$$t = S/v = 300/60 = 5 \text{ s}$$

☒ iv find acceleration of a car moves

from rest to velocity 252 km/h

taking time 20 seconds

$$\text{Initial velocity} = v_i = 0$$

$$\text{Final velocity} = v_f = 252 \text{ km/h}$$

$$v_f = \frac{252 \times 1000 \text{ m}}{3600 \text{ s}} = 70 \text{ m/s}$$

$$\text{Time} = t = 20 \text{ s}$$

$$\text{Acceleration} = a = ?$$

$$a = (v_f - v_i)/t$$

$$a = (70 - 0)/20$$

$$a = 3.5 \text{ m/s}^2$$

☒ find height of tower and hitting

velocity of a ball that fall in 4

seconds on earth from tower

$$\text{Initial velocity} = v_i = 0$$

$$\text{Acceleration} = g = 10 \text{ ms}^{-2}$$

$$\text{Time} = t = 4 \text{ s}$$

$$\text{Distance} = S = ?$$

$$\text{Final velocity} = v_f = ?$$

$$S = v_i t + \frac{1}{2} g t^2$$

$$h = (0 \times 4) + \frac{1}{2} (10)(4)^2$$

$$h = 0 + \frac{1}{2} (10)(16) = 80 \text{ m}$$

$$v_f = v_i t + g t$$

$$v_f = (0 \times 4) + (10 \times 4)$$

$$v_f = 0 + 40 = 40 \text{ m/s}$$

☒ find height and time of a ball

fired upward with velocity 30 m/s

$$\text{Initial velocity} = v_i = 30 \text{ m/s}$$

$$\text{Final velocity} = v_f = 0$$

$$\text{Acceleration} = g = -10 \text{ ms}^{-2}$$

$$\text{Height} = h = ?$$

$$\text{Time} = t = ?$$

$$2aS = v_f^2 - v_i^2$$

$$2 \times (-10) \times h = (0)^2 - (30)^2$$

$$-20h = -900$$

$$h = 900/20 = 45 \text{ m}$$

$$v_f = v_i + g t$$

$$0 = 30 + (-10) t$$

$$-30 = -10 t$$

$$t = 30/10 = 3 \text{ s}$$

☒ 2.2 find time of car with velocity

72 km/h, cover distance 360 km

$$\text{Velocity} = v = 72 \text{ km/h}$$

$$\text{Distance} = S = 360 \text{ m}$$

$$\text{Time} = t = ?$$

$$\text{Speed} \rightarrow v = S/t$$

$$t = S/v = 360/72 = 5 \text{ h}$$

☒ 2.3 find acceleration of a car

moves from rest to velocity 90

km/h taking time 50 seconds

$$\text{Initial velocity} = v_i = 0$$

$$\text{Final velocity} = v_f = 90 \text{ km/h}$$

$$v_f = \frac{90 \times 1000 \text{ m}}{3600 \text{ s}} = 25 \text{ m/s}$$

$$\text{Time} = t = 50 \text{ s}$$

$$\text{Acceleration} = a = ?$$

$$a = (v_f - v_i)/t$$

$$a = (25 - 0)/50$$

$$a = 0.5 \text{ m/s}^2$$

☒ 2.4 find velocity of a car starts

moving with velocity 5 m/s for 5 s

$$v_f = 12.5 \text{ m/s}$$

2.5 find distance of a bike moving with velocity 18 km/h for time 10 seconds with acceleration 2 m/s²

$$\text{Initial velocity} = v_i = 18 \text{ km/h}$$

$$v_i = \frac{18 \times 1000 \text{ m}}{3600 \text{ s}} = 5 \text{ m/s}$$

$$\text{Acceleration} = a = 2 \text{ m/s}^2$$

$$\text{Time} = t = 10 \text{ s}$$

$$\text{Distance} = S = ?$$

$$S = v_i t + \frac{1}{2} a t^2$$

$$S = (5)(10) + \frac{1}{2} (2)(10)^2$$

$$S = 50 + \frac{1}{2} (2)(100) = 150 \text{ m}$$

2.6 find acceleration of a car moving with velocity 54 km/h that cover 25 m after applying brake.

$$\text{Initial velocity} = v_i = 54 \text{ km/h}$$

$$v_i = \frac{54 \times 1000 \text{ m}}{3600 \text{ s}} = 15 \text{ m/s}$$

$$\text{Final velocity} = v_f = 0$$

$$\text{Distance} = S = 25 \text{ m}$$

$$\text{Acceleration} = a = ?$$

$$2aS = v_f^2 - v_i^2$$

$$2 \times a \times 25 = (0)^2 - (15)^2$$

$$50a = -225$$

$$a = -225/50 = -4.5 \text{ m/s}^2$$

2.7 a ball is fall from 45 m. find its time of fall and hitting velocity

$$\text{Initial velocity} = v_i = 0$$

$$\text{Acceleration} = g = 10 \text{ ms}^{-2}$$

$$\text{Distance} = S = 45 \text{ m}$$

$$\text{Final velocity} = v_f = ?$$

$$\text{Time} = t = ?$$

$$2aS = v_f^2 - v_i^2$$

$$2 \times 10 \times 45 = v_f^2 - (0)^2$$

$$900 = v_f^2$$

$$\sqrt{v_f^2} = \sqrt{900}$$

$$v_f = 30 \text{ m/s}$$

$$v_f = v_i + at$$

$$30 = 0 + (10) \times t$$

$$t = 30/10 = 3 \text{ s}$$

2.8 find average velocity of a car moves 10 km with velocity 20 m/s and 0.8 km with velocity 4 m/s

$$1^{\text{st}} \text{ velocity} = v_1 = 20 \text{ m/s}$$

$$2^{\text{nd}} \text{ velocity} = v_2 = 4 \text{ m/s}$$

$$1^{\text{st}} \text{ distance} = S_1 = 10 \text{ km} =$$

$$10 \times 1000 \text{ m} = 10000 \text{ m}$$

$$2^{\text{nd}} \text{ distance} = S_2 = 0.8 \text{ km} =$$

$$0.8 \times 1000 \text{ m} = 800 \text{ m}$$

$$\text{Average velocity} = v_{\text{ave}} = ?$$

$$\text{Time for } 1^{\text{st}} \text{ motion} = t_1 =$$

$$S_1/v_1 = 10000/20 = 500 \text{ s}$$

$$\text{Time for } 2^{\text{nd}} \text{ motion} = t_2 =$$

$$S_2/v_2 = 800/4 = 200 \text{ s}$$

$$\text{Total time} = t_1 + t_2 = 700 \text{ s}$$

$$\text{Total distance} = S_1 + S_2 =$$

$$10000 + 800 = 10800 \text{ m}$$

$$v_{\text{ave}} = \frac{\text{total distance}}{\text{total time}}$$

$$= 10800/700 = 15.4 \text{ m/s}$$

2.9 find height and hitting velocity of a ball that falls in 5 seconds

$$\text{Initial velocity} = v_i = 0$$

$$\text{Acceleration} = g = 10 \text{ ms}^{-2}$$

$$\text{Time} = t = 5 \text{ s}$$

$$\text{Final velocity} = v_f = ?$$

$$\text{Height} = h = ?$$

$$S = v_i t + \frac{1}{2} a t^2$$

$$h = (0)(5) + \frac{1}{2} (10)(5)^2$$

$$h = 0 + \frac{1}{2} (10)(25) = 125 \text{ m}$$

$$v_f = v_i + at$$

$$v_f = 0 + (10) \times 5 = 50 \text{ m/s}$$

2.10 find velocity with which a ball go upward in 3 seconds and find the height if it is hits from 1 m height

$$\text{Acceleration} = g = -10 \text{ ms}^{-2}$$

$$\text{Time} = t = 3 \text{ s}$$

$$\text{Final velocity} = v_f = 0$$

$$\text{Already up} = h_1 = 1 \text{ m}$$

$$\text{Height} = h_2 = ?$$

$$\text{Initial velocity} = v_i = ?$$

$$v_f = v_i + at$$

$$0 = v_i + (-10)(3)$$

$$v_i = 30 \text{ m/s}$$

$$S = v_i t + \frac{1}{2} a t^2$$

$$h = (30)(3) + \frac{1}{2} (-10)(3)^2$$

$$h = 90 - \frac{1}{2} (10)(9) = 45 \text{ m}$$

$$\text{Total height} = 1 + 45 = 46 \text{ m}$$

Chapter # ③

ⓧ find velocity with a man of 60 kg with velocity 4 m/s push back to another man of 80 kg

$$1^{\text{st}} \text{ man mass} = m_1 = 60 \text{ kg}$$

$$1^{\text{st}} \text{ man velocity} = v_1 = 4 \text{ m/s}$$

$$2^{\text{nd}} \text{ man mass} = m_2 = 80 \text{ kg}$$

$$2^{\text{nd}} \text{ man velocity} = v_2 = ?$$

$$0 = m_1 v_1 + m_2 v_2$$

$$0 = (60)(4) + (80)(v_2)$$

$$v_2 = -240/80 = -3 \text{ m/s}$$

ⓧ find force on 5 kg mass moving with velocity 10 m/s and reverse in 5 s with velocity 2 m/s

$$\text{Mass} = m = 5 \text{ kg}$$

$$\text{Initial velocity} = v_i = 10 \text{ m/s}$$

$$\text{Final velocity} = v_f = -2 \text{ m/s}$$

$$\text{Time} = t = 5 \text{ s}$$

$$F = \Delta P/t = m(v_f - v_i)/t$$

$$F = 5(-2 - 10)/5 = -12 \text{ N}$$

ⓧ find force on block of 10 kg moving with acceleration 2 m/s²

$$\text{Mass} = m = 10 \text{ kg}$$

$$\text{Acceleration} = a = 2 \text{ m/s}^2$$

$$\text{Force} = F = ?$$

$$F = ma = 10 \times 2 = 20 \text{ N}$$

ⓧ find acceleration of car of 3000 kg moves with 7500 N force. Find time if speed is increased from 36 km/h to 72 km/h

$$\text{Mass} = m = 3000 \text{ kg}$$

$$\text{Force} = F = 7500 \text{ N}$$

$$\text{Initial velocity} = v_i = 36 \text{ kmh}^{-1}$$

$$v_i = \frac{36 \times 1000 \text{ m}}{3600 \text{ s}} = 10 \text{ m/s}$$

$$\text{Final velocity} = v_f = 72 \text{ kmh}^{-1}$$

$$v_f = \frac{72 \times 1000 \text{ m}}{3600 \text{ s}} = 20 \text{ m/s}$$

$$\text{Time} = t = ?$$

$$\text{Acceleration} = a = ?$$

$$a = F/m \quad (F = ma)$$

$$a = 7500/3000 = 2.5 \text{ m/s}^2$$

$$v_f = v_i + at$$

$$20 = 10 + (2.5) \times t$$

$$t = 10/2.5 = 4 \text{ s}$$

ⓧ find momentum of a bullet of mass 15 g with velocity 150 m/s

$$\text{Mass} = m = 15 \text{ g} = 15 \text{ kg/k} =$$

$$15 \text{ kg}/1000 = 0.015 \text{ kg}$$

$$\text{Velocity} = v = 150 \text{ m/s}$$

$$\text{Momentum} = P = ?$$

$$P = mv = 0.015 \times 150$$

$$P = 2.25 \text{ kgm/s}$$

ⓧ find force of bat on a ball of velocity -28 m/s which change to 52 m/s during hitting time 4×10^{-3} s

$$\text{Mass} = m = 160 \text{ g} = 160 \text{ kg/k} =$$

$$160 \text{ kg}/1000 = 0.16 \text{ kg}$$

$$\text{Initial velocity} = v_i = -28 \text{ ms}^{-1}$$

$$\text{Final velocity} = v_f = 52 \text{ m/s}$$

$$\text{Time} = t = 4 \times 10^{-3} \text{ s}$$

$$F = m(v_f - v_i)/t$$

$$F = 0.16[52 - (-28)]/4 \times 10^{-3}$$

$$F = 0.16(52 + 28)/0.004$$

$$F = (0.16 \times 80)/0.004$$

$$F = 3200 \text{ N}$$

ⓧ find recoil velocity of gun

$$\text{Mass of bullet} = m_1$$

$$\text{Velocity of bullet} = v_1$$

$$\text{Mass of gun} = M_2$$

$$\text{Velocity of gun} = V_2 = ?$$

According to conservation

$$\text{of momentum} \rightarrow P_i = P_f$$

$$\text{velocities before fire} = 0$$

$$0 = m_1 v_1 + M_2 V_2$$

$$V_2 = -m_1 v_1 / M_2$$

ⓧ find velocity of two balls stick together after hitting as a ball of mass 3 kg with velocity 5 m/s hits another ball of 2 kg at rest

$$\text{Mass of } 1^{\text{st}} \text{ ball} = m_1 = 3 \text{ kg}$$

$$\text{Mass of } 2^{\text{nd}} \text{ ball} = m_2 = 2 \text{ kg}$$

Velocity of 1st ball before

$$\text{hitting} = u_1 = 5 \text{ m/s}$$

Velocity of 2nd ball before

$$\text{hitting} = u_2 = 0$$

Velocity of both balls after

$$\text{hitting} = v = ?$$

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

$$(3 \times 5) + (2 \times 0) = 3v + 2v$$

$$15 + 0 = (3 + 2)v$$

$$v = 15/5 = 3 \text{ m/s}$$

3.1 find acceleration and then velocity after 5 s of a block of 10 kg pushed by 5N force

$$\text{Mass} = m = 10 \text{ kg}$$

$$\text{Force} = F = 5 \text{ N}$$

$$\text{Initial velocity} = v_i = 0$$

$$\text{Time} = t = 5 \text{ s}$$

$$\text{Acceleration} = a = ?$$

$$\text{Final velocity} = v_f = ?$$

$$a = F/m \quad (F = ma)$$

$$a = 5/10 = 0.5 \text{ m/s}^2$$

$$v_f = v_i + at$$

$$v_f = 0 + (0.5)(5) = 2.5 \text{ m/s}$$

3.2 find weight of a man of 80 kg on earth and moon

$$\text{Mass} = m = 80 \text{ kg}$$

$$\text{For earth} = g = 10 \text{ m/s}^2$$

$$\text{For moon} = g = 1.6 \text{ m/s}^2$$

$$\text{Weight on earth} = W_e = ?$$

$$\text{Weight on moon} = W_m = ?$$

$$W_e = mg = (80)(10) = 800 \text{ N}$$

$$W_m = mg = (80)(1.6) = 128 \text{ N}$$

3.3 find force to increase velocity of car of 800 kg from 10 m/s to 30 m/s in 10 seconds

$$\text{Mass} = m = 800 \text{ kg}$$

$$\text{Initial velocity} = v_i = 10 \text{ m/s}$$

$$\text{Final velocity} = v_f = 30 \text{ m/s}$$

$$\text{Time} = t = 10 \text{ s}$$

$$F = m(v_f - v_i)/t$$

$$F = 800(30 - 10)/10$$

$$F = 800(20)/10 = 1600 \text{ N}$$

3.4 find recoil velocity of gun of 10 kg which fire a bullet of 5 g with speed 300 m/s

$$\text{Bullet mass} = m_1 = 5 \text{ g} = 5$$

$$\text{kg/k} = 5 \text{ kg}/10^3 = 0.005 \text{ kg}$$

$$\text{Bullet speed} = v_1 = 300 \text{ ms}^{-1}$$

$$\text{Mass of gun} = M_2 = 10 \text{ kg}$$

$$\text{Velocity of gun} = V_2 = ?$$

$$V_2 = -m_1 v_1 / M_2$$

$$V_2 = -(0.005)(300)/10$$

$$V_2 = -0.15 \text{ m/s}$$

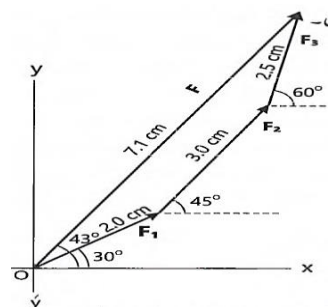
3.5 find recoil velocity and distance covered in 30 minutes if a

man in space of 75 kg hits a ball of 300 g with speed 3.5 m/s
 Time = $t = 30 \text{ min} = 1800 \text{ s}$
 Ball mass = $m_1 = 300 \text{ g}$
 $m_1 = 300 \text{ kg/k} = 0.3 \text{ kg}$
 Ball speed = $v_1 = 3.5 \text{ ms}^{-1}$
 Mass of man = $M_2 = 75 \text{ kg}$
 Velocity of man = $V_2 = ?$
 $V_2 = -m_1 v_1 / M_2$
 $V_2 = (0.3)(3.5) / 75$
 $V_2 = -0.014 \text{ m/s}$
 $V_2 = -1.4 \times 10^{-2} \text{ m/s}$
 $S = vt$
 $S = 0.014 \times 1800 = 25.2 \text{ m}$
3.6 find velocity of two boxes stick together after hitting as a box of mass $6.5 \times 10^3 \text{ kg}$ with 0.8 m/s velocity hit by another box of $9.2 \times 10^3 \text{ kg}$ with velocity 1.2 m/s
 Mass of 1st box = $m_1 = 6.5 \times 10^3 \text{ kg} = 6500 \text{ kg}$
 Mass of 2nd box = $m_2 = 9.2 \times 10^3 \text{ kg} = 9200 \text{ kg}$
 Velocity of 1st box before hitting = $u_1 = 0.8 \text{ m/s}$
 Velocity of 2nd box before hitting = $u_2 = 1.2 \text{ m/s}$
 Velocity of both boxes after hitting = $v = ?$
 $m_1 u_1 + m_2 u_2 = m_1 v + m_2 v$
 $v = \frac{(6500 \times 0.8) + (9200 \times 1.2)}{6500 + 9200}$
 $v = 16240 / 15700 = 1.03 \text{ m/s}$
3.7 find distance covered by 55 kg man on a bike of 5 kg from rest to till 8 seconds with 90 N force and then moves more 8 seconds
 Mass = $m = 5 + 55 = 60 \text{ kg}$
 Initial velocity = $v_i = 0$
 Force = $F = 90 \text{ N}$
 1st time = $t_1 = 8 \text{ s}$
 2nd time = $t_2 = 8 \text{ s}$
 Distance = $S = ?$
 $a = F/m = 90/60 = 1.5 \text{ m/s}^2$
 $v_f = v_i + at$
 $v_f = 0 + (1.5)(8) = 12 \text{ m/s}$
 $S = v_i t + \frac{1}{2} at^2$ (for 1st time)
 $S_1 = (0)(8) + \frac{1}{2} (1.5)(8)^2$
 $S_1 = 0 + \frac{1}{2} (1.5)(64) = 48 \text{ m}$
 $S_2 = v_f t$ (for 2nd time)
 $S_2 = 12 \times 8 = 96 \text{ m}$
 Distance = $S = S_1 + S_2$
 $S = 48 + 96 = 144 \text{ m}$
3.8 find impulse of a ball of 0.4 kg fall from 1.8 m and then jump 0.8 m
 Mass = $m = 0.4 \text{ kg}$

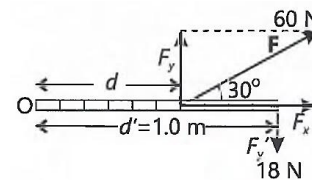
1st height = $h_1 = 1.8 \text{ m}$
 2nd height = $h_2 = 0.8 \text{ m}$
 Acceleration = $g = 10 \text{ m/s}^2$
 Impulse = $\Delta P = ?$
 Falling velocity at instant of hitting from height h_1
 $2as = v_f^2 - v_i^2$
 $2 \times 10 \times 1.8 = (v_f)^2 - (0)^2$
 $\sqrt{v_f^2} = \sqrt{36}$
 $v_f = 6 \text{ m/s}$
 Jumping velocity from ground to height h_2
 $2as = v_f^2 - v_i^2$
 $2 \times (-10) \times 0.8 = (0)^2 - (v_i)^2$
 $\sqrt{v_i^2} = \sqrt{16}$
 $v_i = 4 \text{ m/s}$
 For two opposite vectors
 $\Delta v = v_f - v_i$
 $\Delta v = (6) - (-4) = 10 \text{ m/s}$
 $\Delta P = m \Delta v = 0.4 \times 10 = 4 \text{ Ns}$
 Direction is upward
3.9 find velocity of 0.4 kg ball after hitting with a ball of 0.2 kg with velocity 6 m/s as before hitting 0.2 kg ball has velocity 20 m/s and 0.4 kg ball has 5 m/s
 1st mass = $m_1 = 0.2 \text{ kg}$
 2nd mass = $m_2 = 0.4 \text{ kg}$
 Velocities before hitting
 1st velocity = $u_1 = 20 \text{ m/s}$
 2nd velocity = $u_2 = -5 \text{ m/s}$
 Velocities after hitting
 1st velocity = $v_1 = 6 \text{ m/s}$
 2nd velocity = $v_2 = ?$
 $m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$
 $m_1 u_1 + m_2 u_2 - m_1 v_1 = m_2 v_2$
 $v_2 = \frac{m_1 u_1 + m_2 u_2 - m_1 v_1}{m_2}$
 $v_2 = \frac{(0.2)(20) + (0.4)(-5) - (0.2)(6)}{0.4}$
 $v_2 = (4 + 2 - 1.2) / 0.4$
 $v_2 = 0.8 / 0.4 = 2 \text{ m/s}$

Chapter # 4

i find magnitude of resultant force by using head to tail rule
 1st force = $F_1 = 200 \text{ N}$
 2nd force = $F_2 = 300 \text{ N}$
 3rd force = $F_3 = 250 \text{ N}$



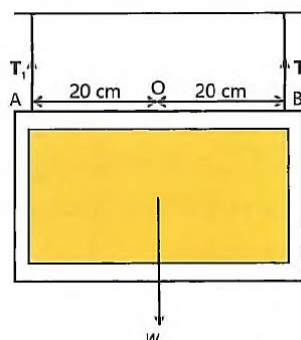
$F = 710 \text{ N}$ at $\theta = 43^\circ$
ii find torque of 25 cm wrench with applied force of 400 N
 Force = $F = 400 \text{ N}$
 Moment arm = $L = 25 \text{ cm} = 25 \times 10^{-2} \text{ m} = 0.25 \text{ m}$
 Torque = $\tau = F \times L$
 $\tau = 400 \times 0.25 = 100 \text{ Nm}$
iii find x any y component of a 160 N force with angle 60 degree
 Force = $F = 160 \text{ N}$
 Angle = $\theta = 60^\circ$
 Horizontal comp = $F_x = ?$
 Vertical comp = $F_y = ?$
 $F_x = F \cos \theta = 160 \cos(60)$
 $F_x = 160 \times 0.50 = 80 \text{ N}$
 $F_y = F \sin \theta = 160 \sin(60)$
 $F_y = 160 \times 0.86 = 138.6 \text{ N}$
iv find distance of a force of 60 N with angle 30° acted on 1 m rod in opposite direction of 18 N force such that this rod will not rotate



1st force = $-F_y = 18 \text{ N}$
 2nd force = $+F = 60 \text{ N}$
 Distance = $d = ?$
 $+F_x = +F \cos \theta = 60 \cos 30^\circ = 60 \times 0.86 = 51.9 \text{ N}$
 $+F_y = +F \sin \theta = 60 \sin 30^\circ = 60 \times 0.50 = 30 \text{ N}$
 As $-F_y$ and $+F_y$ are opposite components of force so

$\tau_{\text{clockwise}} = \tau_{\text{anti clockwise}}$
 $+F_y \times d = -F_y \times d$
 $18 \times 1 = 30 \times d$
 $d = 18/30 = 0.6 \text{ m}$

v find tension in two strings from those a picture of 5 N (40 cm) is hanged from corners

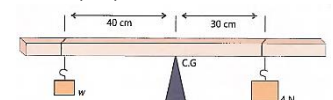


Weight = $W = 5 \text{ N}$
 Length = $AB = 40 \text{ cm} = 40 \times 10^{-2} \text{ m} = 40/100 \text{ m} = 0.4 \text{ m}$

Half-length = $OB = OA = 20 \text{ cm} = 20 \times 10^{-2} \text{ m} = 0.2 \text{ m}$
 Tension = $T = ?$
 $\Sigma F_x = 0, \Sigma F_y = 0$
 $T_1 + T_2 = W$
 $\Sigma \tau = 0, \tau_{\text{cw}} = \tau_{\text{acw}}$
 If we take B as axis of rotation
 $T_1 \times AB = W \times OB$
 $T_1 \times 0.4 = 5 \times 0.2$
 $T_1 = 1.0/0.4 = 2.5 \text{ N}$
 as $T_1 + T_2 = W$
 $2.5 + T_2 = 5$
 $T_2 = 5 - 2.5 = 2.5 \text{ N}$
vi find centripetal force acting on ball of 150 g hanged with 1.2 m string rotating with speed 8 m/s
 Mass = $m = 150 \text{ g} = 150 \text{ kg/k} = 150 \text{ kg}/1000 = 0.15 \text{ kg}$
 Speed = $v = 8 \text{ m/s}$
 Radius = $r = 1.2 \text{ m}$
 Centripetal force = $F_c = ?$
 $F_c = mv^2/r = (0.15)(8)^2/1.2$
 $F_c = (0.15)(64)/1.2 = 8 \text{ N}$

4.1 find x any y component of a 200 N force with angle 30 degree
 Force = $F = 200 \text{ N}$
 Angle = $\theta = 30^\circ$
 Horizontal comp = $F_x = ?$
 Vertical comp = $F_y = ?$
 $F_x = F \cos \theta = 200 \cos(30)$
 $F_x = 200 \times 0.86 = 173.2 \text{ N}$
 $F_y = F \sin \theta = 200 \sin(30)$
 $F_y = 200 \times 0.50 = 100 \text{ N}$
4.2 find torque of 1.2 m long door with applied force of 300 N
 Force = $F = 300 \text{ N}$
 Moment arm = $L = 1.2 \text{ m}$
 Torque = $\tau = F \times L$
 $\tau = 300 \times 1.2 = 360 \text{ Nm}$

4.3 find weight W with 40 cm far from COG and a weight of 4 N with 30 cm far from COG balance it



Known Weight = $W_2 = 4 \text{ N}$
 Arm with $W_2 = 30 \text{ cm} = 30 \times 10^{-2} \text{ m} = 30/100 \text{ m} = 0.3 \text{ m}$
 Unknown Weight = $W_1 = ?$
 Arm with $W_1 = 40 \text{ cm} = 40 \times 10^{-2} \text{ m} = 40/100 \text{ m} = 0.4 \text{ m}$

$\tau_{\text{clockwise}} = \tau_{\text{anti-clockwise}}$
 $4 \times 0.3 = W_1 \times 0.4$
 $W_1 = (4 \times 0.3) / 0.4 = 3 \text{ N}$
4.4 find moments of a sea and saw on that one baby of 30 kg is sitting

2 m from origin and other baby of 40 kg is sit 1.5 m from origin on it
1st weight = $W_1 = m_1g$
 $W_1 = 30 \times 10 = 300 \text{ N}$

1st moment arm = $L_1 = 2 \text{ m}$
2nd weight = $W_2 = m_2g$
 $W_2 = 40 \times 10 = 400 \text{ N}$
2nd moment arm = $L_2 = 1.5 \text{ m}$

Moments of torque = ?

$$\tau_1 = W_1 \times L_1 = 300 \times 2$$

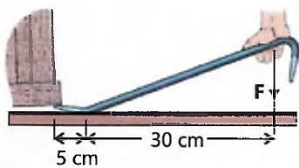
$$\tau_1 = 600 \text{ Nm}$$

$$\tau_2 = W_2 \times L_2 = 400 \times 1.5$$

$$\tau_2 = 600 \text{ Nm}$$

Sea & saw is in equilibrium

4.5 find the weight up lift by a crowbar of 250 N with 30 cm bar length and 5 cm head of bar



1st weight = $W_1 = 250 \text{ N}$

1st moment arm = $L_1 = 30 \text{ cm}$

$$= 30 \times 10^{-2} \text{ m} = 0.3 \text{ m}$$

2nd moment arm = $L_2 = 5 \text{ cm}$

$$= 5 \times 10^{-2} \text{ m} = 0.05 \text{ m}$$

2nd weight = $W_2 = ?$

$\tau_{\text{clockwise}} = \tau_{\text{anti clockwise}}$

$$W_2 \times 0.05 = 250 \times 0.3$$

$$W_2 = 75/0.05 = 1500 \text{ N}$$

4.6 find force of wrench of 30 cm long that existing torque 150 Nm

$$\text{Torque} = \tau = 150 \text{ Nm}$$

$$\text{Moment arm} = L = 30 \text{ cm} =$$

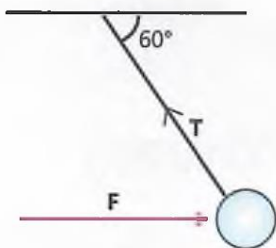
$$30 \times 10^{-2} \text{ m} = 30/100 = 0.3 \text{ m}$$

$$\text{Force} = F = ?$$

$$F = \tau/L \quad (\tau = FL)$$

$$F = 150/0.3 = 500 \text{ N}$$

4.7 find force and tension in a hanging ball of 5N at 60° with roof



Weight = $W = 5 \text{ N}$

$$\text{Angle} = \theta = 60^\circ$$

$$\text{Force} = F = ?$$

$$\text{Tension} = T = ?$$

$$W = T \sin \theta$$

$$5 = T \sin 60$$

$$5 = T \times 0.86$$

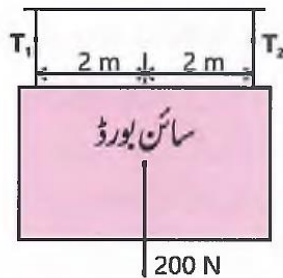
$$T = 5/0.86 = 5.8 \text{ N}$$

$$F = T \cos \theta$$

$$F = 5.8 \times \cos 60$$

$$F = 5.8 \times 0.50 = 2.9 \text{ N}$$

4.8 find tension in two strings from those board of 200 N (4 m) is hanging from corners



Weight = $W = 200 \text{ N}$

$$\text{Tension} = T = T_1 = T_2 = ?$$

$$T_1 + T_2 = W$$

$$T + T = 200$$

$$2T = 200$$

$$T = 200/2 = 100 \text{ N}$$

4.9 find moment arm of a baby of 40 kg sitting on a sea and saw such that one baby of 30 kg is sitting 1.6 m from origin than this baby.

1st weight = $W_1 = m_1g$

$$W_1 = 30 \times 10 = 300 \text{ N}$$

1st moment arm = $L_1 = 1.6 \text{ m}$

2nd weight = $W_2 = m_2g$

$$W_2 = 40 \times 10 = 400 \text{ N}$$

2nd moment arm = $L_2 = ?$

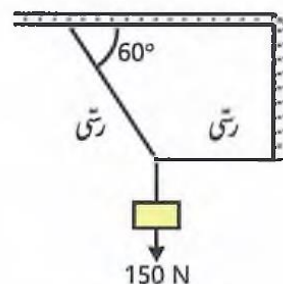
Sea & saw is in equilibrium

$$\tau_1 = \tau_2$$

$$300 \times 1.6 = 400 \times L_2$$

$$L_2 = 480/400 = 1.2 \text{ m}$$

4.10 find tension in two strings with 150 N weight at angle 60°



Weight = $W = 150 \text{ N}$

$$\text{Tension} = T = ?$$

$$W = T_1 \sin \theta$$

$$150 = T_1 \times \sin 60$$

$$150 = T_1 \times 0.86$$

$$T_1 = 150/0.86 = 173.2 \text{ N}$$

$$T_2 = T_1 \cos \theta$$

$$T_2 = 173.2 \times \cos 60$$

$$T_2 = 173.2 \times 0.50 = 86.6 \text{ N}$$

Chapter # 5

i find powers of force that do 5 J work in 10 seconds and 3 J in 5 s

$$\text{Work} = W = 5 \text{ J}, 3 \text{ J}$$

$$\text{Time} = t = 10 \text{ s}, 5 \text{ s}$$

$$\text{Power} = P = ?$$

$$P = W/t = 5/10 = 0.5 \text{ W}$$

$$P = W/t = 3/5 = 0.3 \text{ W}$$

ii how much water a pump of 2 kW pick to height of 5 m in 1 minute

$$\text{Power} = P = 2000 \text{ W}$$

$$\text{Time} = t = 60 \text{ s}$$

$$\text{Height} = h = 5 \text{ m}$$

$$m = Pt/gh \quad (P = PE/t)$$

$$m = (2000 \times 60)/(10 \times 5)$$

$$m = 120000/50 = 2400 \text{ L}$$

x KE of 0.05 kg ball with 300 m/s

$$\text{Mass} = m = 0.05 \text{ kg}$$

$$\text{Speed} = v = 300 \text{ m/s}$$

$$\text{KE} = \frac{1}{2} mv^2 = \frac{1}{2} \times 0.05 \times$$

$$(300)^2 = 2250 \text{ J}$$

ii KE at double velocity

$$\text{KE} = \frac{1}{2} mv^2 = \frac{1}{2} m (2v)^2$$

$$= \frac{1}{2} m (4v^2) = 4(\frac{1}{2} mv^2)$$

ii KE at double momentum

$$\text{KE} = P^2/2m = (2P)^2/2m$$

$$\text{KE} = 4P^2/2m = 4(P^2/2m)$$

ii find force if 200 J work is done on body to push till 5 m

$$\text{Work} = W = 200 \text{ J}$$

$$\text{Distance} = S = 5 \text{ m}$$

$$\text{Force} = F = ?$$

$$F = W/S \quad (W = FS)$$

$$F = 200/5 = 40 \text{ N}$$

ii find work if a force of 65 N act at angle of 30° for 20 m

$$\text{Force} = F = 65 \text{ N}$$

$$\text{Distance} = S = 20 \text{ m}$$

$$\text{Angle} = \theta = 30^\circ$$

$$\text{Work} = W = ?$$

$$W = F S \cos \theta$$

$$W = 65 \times 20 \times \cos 60$$

$$W = 1300 \times 0.86 = 1125.8 \text{ J}$$

iii find kinetic energy of 3000 kg car moves with velocity 54 km/h

$$\text{Mass} = m = 3000 \text{ kg}$$

$$\text{Velocity} = v = 54 \text{ km/h} =$$

$$54 \times 10^3 \text{ m}/3600 \text{ s} = 15 \text{ m/s}$$

$$\text{Kinetic energy} = \text{KE} = ?$$

$$\text{KE} = \frac{1}{2} mv^2$$

$$\text{KE} = \frac{1}{2} \times 3000 \times (15)^2$$

$$\text{KE} = 1500 \times 225$$

$$\text{KE} = 337500 = 337.5 \times 10^3 \text{ J}$$

iv find potential energy of a ball of 180 g lift upward to 12 m

$$\text{Mass} = m = 180 \text{ g} = 180 \text{ kg}/1000$$

$$= 180 \text{ kg}/1000 = 0.18 \text{ kg}$$

$$\text{Height} = h = 12 \text{ m}$$

$$\text{Potential energy} = \text{PE} = ?$$

$$\text{PE} = mgh = 0.18 \times 10 \times 12$$

$$\text{PE} = 21.6 \text{ J}$$

ii find power of a car engine of 1000 kg with acceleration of 4 m/s² moves till 50 m in 5 seconds

$$\text{Mass} = m = 1000 \text{ kg}$$

$$\text{Acceleration} = a = 4 \text{ m/s}^2$$

$$\text{Distance} = S = 50 \text{ m}$$

$$\text{Time} = t = 5 \text{ s}$$

$$\text{Power} = P = ?$$

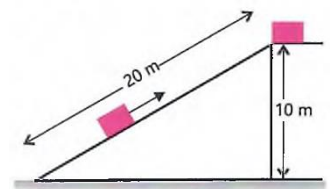
$$P = W/t = FS/t = maS/t$$

$$P = (1000 \times 4 \times 50)/5$$

$$P = 200000/5 = 40000 \text{ W}$$

$$P = 4 \times 10^4 \text{ W} = 4 \text{ kW}$$

ii find efficiency of a block of 120 N weight push by 100 N force up to height 10 m on a 20 m slope



$$\text{Weight} = W = 120 \text{ N}$$

$$\text{Force} = F = 100 \text{ N}$$

$$\text{Distance} = S = 20 \text{ m}$$

$$\text{Height} = h = 10 \text{ m}$$

$$\text{Efficiency} = E = ?$$

$$\text{Work done on block} = W =$$

$$FS = 100 \times 20 = 2000 \text{ J}$$

$$\text{Energy gain on height} = \text{PE} =$$

$$Wh = 120 \times 10 = 1200 \text{ J}$$

$$E = \frac{\text{output energy}}{\text{input energy}} \times 100$$

$$E = (1200 \times 100)/2000$$

$$E = 60\%$$

5.1 find work done by a force of 20 N at angle 60° moves 3 m

$$\text{Force} = F = 20 \text{ N}$$

$$\text{Angle} = \theta = 60^\circ$$

$$\text{Distance} = S = 3 \text{ m}$$

$$\text{Work} = W = ?$$

$$W = F S \cos \theta$$

$$W = 20 \times 3 \times \cos 60$$

$$W = 60 \times 0.50 = 30 \text{ J}$$

5.2 find angle of force of 8 N act for distance 5 m due to 20 J work

$$\text{Work} = W = 20 \text{ J}$$

$$\text{Force} = F = 8 \text{ N}$$

$$\text{Distance} = S = 5 \text{ m}$$

$$\text{Angle} = \theta = ?$$

$$W = F S \cos \theta$$

$$20 = 8 \times 5 \cos \theta$$

$$20/40 = \cos\theta$$

$$0.5/\cos = \theta$$

$$\theta = \cos^{-1}(0.5) = 60^\circ$$

5.3 find power of engine that lift 100 kg water at 80 m in 25 seconds

$$\text{Mass} = m = 100 \text{ kg}$$

$$\text{Height} = h = 80 \text{ m}$$

$$\text{Time} = t = 25 \text{ s}$$

$$\text{Power} = P = ?$$

$$P = W/t = mgh/t$$

$$P = (100 \times 10 \times 80)/25$$

$$P = 3200 \text{ W}$$

5.4 find kinetic energy of body 20 kg at rest if 40 N force act in 5 s

$$\text{Mass} = m = 20 \text{ kg}$$

$$\text{Velocity} = v_i = 0$$

$$\text{Force} = F = 40 \text{ N}$$

$$\text{Time} = t = 5 \text{ s}$$

$$\text{Kinetic energy} = KE = ?$$

$$a = F/m = 40/20 = 2 \text{ m/s}^2$$

$$v_f = v_i + at = 0 + 2 \times 5 = 10 \text{ m/s}$$

$$KE = \frac{1}{2} mv^2 = \frac{1}{2} \times 20 \times (10)^2$$

$$KE = 10 \times 100 = 1000 \text{ J}$$

5.5 find potential energy of 160 g ball at 20 m height

$$\text{Mass} = m = 160 \text{ g} = 160 \text{ kg/k} = 160 \text{ kg}/1000 = 0.16 \text{ kg}$$

$$\text{Height} = h = 20 \text{ m}$$

$$\text{Potential energy} = PE = ?$$

$$PE = mgh = 0.16 \times 10 \times 20$$

$$PE = 32 \text{ J}$$

5.6 find height up to a ball of 140 g lift with velocity 35 m/s

$$\text{Mass} = m = 140 \text{ g} = 140 \text{ kg/k} = 140 \text{ kg}/1000 = 0.14 \text{ kg}$$

$$\text{Initial velocity} = v_i = 35 \text{ m/s}$$

$$\text{Final velocity} = v_f = 0$$

$$\text{Acceleration} = g = -10 \text{ ms}^{-2}$$

$$\text{Height} = h = ?$$

$$2aS = v_f^2 - v_i^2$$

$$2 \times (-10) \times h = (0)^2 - (35)^2$$

$$-20h = -1225$$

$$h = 1225/20 = 61.25 \text{ m}$$

5.7 find max velocity of a girl swing with height 1.2 m to 2 m

$$\text{Low height} = h_1 = 1.2 \text{ m}$$

$$\text{High height} = h_2 = 2 \text{ m}$$

$$\text{Distance cover in swing} = h$$

$$h_2 - h_1 = 2 - 1.2 = 0.8 \text{ m}$$

$$\text{Mini velocity} = v_f = 0$$

$$\text{Max velocity} = v_i = ?$$

$$2aS = v_f^2 - v_i^2$$

$$2(-10)(0.8) = (0)^2 - (v_i)^2$$

$$-16 = -v_i^2$$

$$\sqrt{v_i^2} = \sqrt{16}$$

$$v_i = 4 \text{ m/s}$$

max velocity will be at h_1

5.8 find work on a machine push 20 m by 50 N force at angle of 45°

$$\text{Force} = F = 50 \text{ N}$$

$$\text{Angle} = \theta = 45^\circ$$

$$\text{Distance} = S = 20 \text{ m}$$

$$\text{Work} = W = ?$$

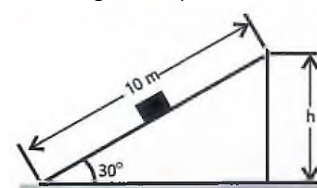
$$W = FS \cos\theta$$

$$W = 50 \times 20 \times \cos 45^\circ$$

$$W = 1000 \times 0.707$$

$$W = 707 \text{ J}$$

5.9 find work done on a block of 5 kg moves 10 m on a slope of angle 30° and again find work if block is lift to height of slope



$$\text{Mass} = m = 5 \text{ kg}$$

$$\text{Angle} = \theta = 30^\circ$$

$$\text{Distance} = S = 10 \text{ m}$$

$$\text{Work} = W = ?$$

$$(a) W = FS = mgs \sin\theta \times S$$

$$W = 5 \times 10 \times \sin 30^\circ \times 10$$

$$W = 500 \times 0.50 = 250 \text{ J}$$

$$(b) \sin\theta = \sin 30^\circ = h/10$$

$$h = 10 \sin 30^\circ = 10 \times 0.5 = 5 \text{ m}$$

$$W = PE = mgh$$

$$W = 5 \times 10 \times 5 = 250 \text{ J}$$

5.10 find efficiency if a 10 kg box push by 80 N force on 15 m slope which has 5 m height

$$\text{Mass} = m = 10 \text{ kg}$$

$$\text{Distance} = S = 15 \text{ m}$$

$$\text{Force} = F = 80 \text{ N}$$

$$\text{Height} = h = 5 \text{ m}$$

$$\text{Efficiency} = E = ?$$

$$E_i = W = FS$$

$$E_i = 80 \times 15 = 1200 \text{ J}$$

$$E_o = PE = mgh$$

$$E_o = 10 \times 10 \times 5 = 500 \text{ J}$$

$$E = \frac{\text{output energy}}{\text{input energy}} \times 100$$

$$E = (500 \times 100)/1200$$

$$E = 41.7\%$$

5.11 find power if a force of 600 N pushes a box to 5 m in 15 second

$$\text{Force} = F = 600 \text{ N}$$

$$\text{Distance} = S = 5 \text{ m}$$

$$\text{Time} = t = 15 \text{ s}$$

$$\text{Power} = P = ?$$

$$P = W/t = FS/t$$

$$P = (600 \times 5)/15 = 200 \text{ W}$$

5.12 find power of a boy of 40 kg who can walk 10 m in 8 seconds

$$\text{Mass} = m = 40 \text{ kg}$$

$$\text{Height} = h = 10 \text{ m}$$

$$\text{Time} = t = 8 \text{ s}$$

$$\text{Power} = P = ?$$

$$P = W/t = mgh/t$$

$$P = (40 \times 10 \times 10)/8 = 500 \text{ W}$$

5.13 find work if a force F act for distance L and then it becomes 2F, so distance also becomes 2L

$$(a) \text{Force} = F = F$$

$$\text{Distance} = S = L$$

$$\text{Work} = W = FS = F \times L$$

$$(b) \text{Force} = F = 2F$$

$$\text{Distance} = S = 2L$$

$$\text{Work} = W = FS$$

$$W = 2F \times 2L = 4FL$$

$$\text{Total work} = FL + 4FL = 5FL$$

Chapter # 6

1 find force on area with of 40 cm and 50 cm dimensions push by a atmospheric pressure 100 kPa

$$\text{Pressure} = P = 100000 \text{ Pa}$$

$$\text{Area} = A = 40 \text{ cm} \times 50 \text{ cm}$$

$$= 2000 \text{ cm}^2 = 2 \times 10^3 \text{ cm}^2$$

$$= 2 \times 10^3 (10^{-2})^2 \text{ m}^2$$

$$= 2 \times 10^3 \times 10^{-4} \text{ m}^2$$

$$= 2 \times 10^{-1} \text{ m}^2 = 0.2 \text{ m}^2$$

$$F = PA \quad (P = F/A)$$

$$F = 100000 \times 0.2$$

$$F = 20000 \text{ N} = 20 \text{ kN}$$

2 wire length wrt diameter

$$\text{Load} = F = W$$

$$\text{Original length} = L$$

$$\text{Original area} = A = \pi r^2 =$$

$$\pi(d/2)^2 = \pi d^2/4$$

$$\Delta L = FL/AY \quad (Y = FL/A\Delta L)$$

$$\Delta L = \frac{FL}{Y\pi d^2/4} = 4FL/Y\pi d^2$$

$$\Delta L \propto 1/d^2$$

For half diameter, length becomes 4 times

$$\Delta L \propto 1/(d/2)^2 \propto 4(1/d^2)$$

3 wire length wrt diameter

$$\text{as } \Delta L \propto 1/d^2$$

so wire with least diameter will elongate more than

others ($d = 0.5 \text{ mm}$, $L = 4 \text{ m}$)

4 pressure on plates of 2 and 3 m²

$$P = \rho gh, \text{ so pressure is not}$$

affected by area (1:1)

5 find density of a 94 g block with dimensions 2cm, 2 cm, 3 cm

$$\text{Mass} = m = 94 \text{ g} = 94 \text{ kg/k} =$$

$$94 \text{ kg}/1000 = 0.094 \text{ kg}$$

$$\text{Volume} = L \times W \times B$$

$$V = 3 \text{ cm} \times 2 \text{ cm} \times 2 \text{ cm}$$

$$V = \frac{3 \text{ m}}{100} \times \frac{2 \text{ m}}{100} \times \frac{2 \text{ m}}{100}$$

$$V = 0.03 \text{ m} \times 0.02 \text{ m} \times 0.02 \text{ m}$$

$$V = 0.000012 \text{ m}^3$$

$$\text{Density} = d = ?$$

$$d = m/V = 0.094/0.000012$$

$$d = 7833 \text{ kg/m}^3$$

6 find pressure of 76 cm Hg column while density of Hg is $13.6 \times 10^3 \text{ kg/m}^3$

$$\text{Height} = h = 76 \text{ cm}$$

$$h = 76 \times 10^{-2} \text{ m}$$

$$\text{Density} = \rho = 13.6 \times 10^3 \text{ kg/m}^3$$

$$\text{Pressure} = P = ?$$

$$P = \rho gh = 13.6 \times 10^3 \times 10 \times$$

$$76 \times 10^{-2} = 10336 \times 10^{-2}$$

$$P = 103360 = 1.034 \times 10^5 \text{ Pa}$$

7 find pressure on ground floor due to a water tank with 2 m depth placed at height of 20 m

$$\text{Height} = 20 + 2 = 22 \text{ m}$$

$$\text{Density} = \rho = 1000 \text{ kg/m}^3$$

$$\text{Pressure} = P = ?$$

$$P = \rho gh = 1000 \times 10 \times 22$$

$$P = 220000 = 2.2 \times 10^5 \text{ Pa}$$

8 find pressure on large piston of diameter 25 cm due to small piston of diameter 5 cm push by 160 N force and find lifted weight

$$\text{Applied force} = f_1 = 160 \text{ N}$$

$$\text{Small diameter} = d = 5 \text{ cm} =$$

$$5 \times 10^{-2} \text{ m} = 5/100 = 0.05 \text{ m}$$

$$\text{Large diameter} = D = 25 \text{ cm} =$$

$$25 \times 10^{-2} \text{ m} = 0.25 \text{ m}$$

$$\text{Pressure} = P = ?$$

$$\text{Weight lift} = W = ?$$

$$\text{Small area} = a_1 = \pi r_1^2$$

$$a_1 = \pi(d/2)^2 = 3.14(0.05/2)^2$$

$$a_1 = 0.0019625 \text{ m}^2$$

$$\text{Large area} = A_2 = \pi R_2^2$$

$$A_2 = \pi(D/2)^2 = 3.14(0.25/2)^2$$

$$A_2 = 0.0490625 \text{ m}^2$$

$$F_2 = f_1 \left(\frac{A_2}{a_1} \right) \quad \left(\frac{F_2}{A_2} = \frac{F_1}{a_1} \right)$$

$$W = 160 \times \left(\frac{0.0490625}{0.0019625} \right)$$

$$W = 4000 \text{ N} = 4 \text{ kN}$$

$$P = f_1/a_1 = 160/0.0019625$$

$$P = 81528.66 \text{ Pa}$$

9 find spring constant if 40 N weight elongate spring to 20 mm and find weight if a body produce elongation of 16 mm

$$(a) \text{Elongation} = x = 20 \text{ mm} = 20 \times 10^{-3} \text{ m} = 0.02 \text{ m}$$

$$\text{Force} = F = 40 \text{ N}$$

$$\text{Spring constant} = k = ?$$

$k = F/x$ ($F = kx$)
 $k = 40/0.02 = 2000 \text{ N/m}$
 $k = 2 \text{ kN}$
 (b) Elongation = $x = 16 \text{ mm} = 16 \times 10^{-3} \text{ m} = 0.016 \text{ m}$
 Force = $F = 40 \text{ N}$
 Weight = $W = F = ?$
 $F = kx = 2000 \times 0.016$
 $W = 32 \text{ N}$
6.2 find density of 5 L milk having mass 4.5 kg
 Mass = $m = 4.5 \text{ kg}$
 Volume = $V = 5 \text{ L}$
 $V = 5 \times 0.001 = 0.005 \text{ m}^3$
 Density = $d = ?$
 $d = m/V = 4.5/0.005$
 $d = 900 \text{ kg/m}^3$
6.3 find density of 60 g box when dip water goes 40 cm^3 to 44 cm^3
 Mass = $m = 60 \text{ g} = 60 \text{ kg/k} = 60 \text{ kg}/1000 = 0.06 \text{ kg}$
 Volume = $V = V_2 - V_1$
 $V = 44 - 40 = 4 \text{ cm}^3$
 $V = 4 \text{ cm}^3 = 4 \times (10^{-2})^3 \text{ m}^3$
 $V = 4 \times 10^{-6} \text{ m}^3$
 Density = $d = ?$
 $d = m/V = 0.06/4 \times 10^{-6}$
 $d = 0.015 \times 10^6 = 15000$
 $d = 15 \times 10^3 \text{ kg/m}^3$
6.4 find mass of box having 60 cm^3 volume & density $8 \times 10^3 \text{ kg/m}^3$
 Density = $d = 8 \times 10^3 \text{ kg/m}^3$
 Volume = $V = 60 \text{ cm}^3$
 $V = 60 \text{ cm}^3 = 60 \times (10^{-2})^3 \text{ m}^3$
 $V = 60 \times 10^{-6} \text{ m}^3$
 $m = dV$ ($d = m/V$)
 $m = 8 \times 10^3 \times 60 \times 10^{-6}$
 $m = 480 \times 10^{-3} = 0.48 \text{ kg}$
6.5 find mini and max pressure that can be exert on 5 kg box of dimensions 5 cm, 10 cm, 20 cm
 Mass = $m = 5 \text{ kg}$
 Mini area = $A = 5 \times 10 = 50 \text{ cm}^2 = 50 \text{ cm}^2 = 50 \times (10^{-2})^2 \text{ m}^2 = 50 \times 10^{-4} \text{ m}^2$
 Max area = $A = 10 \times 20 = 200 \text{ cm}^2 = 200 \text{ cm}^2 = 200 \times (10^{-2})^2 \text{ m}^2 = 200 \times 10^{-4} \text{ m}^2$
 Force = $F = mg$
 $F = 5 \times 10 = 50 \text{ N}$
 Pressure = $P = ?$
 (a) mini area $\rightarrow P$ max
 $P = F/A = 50/50 \times 10^{-4}$
 $P = 1/10^{-4} = 10000 \text{ Pa}$
 (b) max area $\rightarrow P$ mini

$P = F/A = 50/200 \times 10^{-4}$
 $P = 50/2 \times 10^{-2} = 2500 \text{ Pa}$
6.6 find height of water column in barometer, water is filled instead of Hg
 Density of mercury = $\rho_1 = 13.6 \times 10^3 \text{ kg/m}^3$
 Hg height = $h_1 = 0.76 \text{ cm}$
 Density of water = $\rho_2 = 1000 \text{ kg/m}^3$
 Water height = $h_2 = ?$
 $h_2 = \frac{\rho_1 g h_1}{\rho_2 g}$ ($\rho_2 g h_2 = \rho_1 g h_1$)
 $h_2 = \frac{13.6 \times 10^3 \times 10 \times 0.76}{1000 \times 10}$
 $h_2 = 13.6 \times 0.76 = 10.3 \text{ m}$
6.7 find pressure and force on large piston of area 20 cm^2 due to small piston of area 5 cm^2 push by 500 N force
 Applied force = $f_1 = 500 \text{ N}$
 Small area = $a_1 = 5 \text{ cm}^2 = 5 \text{ cm}^2 = 5 \times (10^{-2})^2 \text{ m}^2 = 5 \times 10^{-4} \text{ m}^2$
 Large area = $a_2 = 20 \text{ cm}^2 = 20 \text{ cm}^2 = 20 \times (10^{-2})^2 \text{ m}^2 = 20 \times 10^{-4} \text{ m}^2$
 Pressure = $P = ?$
 Force = $F_2 = ?$
 $F_2 = f_1 \left(\frac{A_2}{A_1} \right)$ ($\frac{F_2}{A_2} = \frac{F_1}{A_1}$)
 $F_2 = 500 \times \left(\frac{20 \times 10^{-4}}{5 \times 10^{-4}} \right)$
 $F_2 = 500 \times 4 = 2000 \text{ N}$
 $P = f_1/a_1 = 500/5 \times 10^{-4}$
 $P = 100 \times 10^{-4} = 1 \times 10^6 \text{ Pa}$
6.8 find pressure at 10 m depth in water of density 1030 kg/m^3
 Depth = $h = 10 \text{ m}$
 Density = $\rho = 1030 \text{ kg/m}^3$
 Pressure = $P = ?$
 $P = \rho gh = 1030 \times 10 \times 10$
 $P = 103000 = 1.03 \times 10^5 \text{ Pa}$
6.9 find applied force on small piston of 10 cm^2 area to push large piston of area 100 cm^2 to lift 4 kN
 Weight = $F_2 = 4000 \text{ N}$
 Small area = $a_1 = 10 \text{ cm}^2 = 10 \text{ cm}^2 = 10 \times (10^{-2})^2 \text{ m}^2 = 10 \times 10^{-4} \text{ m}^2 = 10^{-3} \text{ m}^2$
 Large area = $A_2 = 100 \text{ cm}^2 = 100 \text{ cm}^2 = 100 \times (10^{-2})^2 \text{ m}^2 = 100 \times 10^{-4} \text{ m}^2 = 10^{-2} \text{ m}^2$
 Applied force = $f_1 = ?$
 $F_2/A_2 = f_1/a_1$
 $4000/10^{-2} = f_1/10^{-3}$
 $4 \times 10^3 \times 10^2 = 10^3 \times f_1$
 $f_1 = 400 \text{ N}$
6.10 find pressure on sea level

Height = $h = 0.76 \text{ m}$
 Density = $\rho = 13600 \text{ kg/m}^3$
 Pressure = $P = ?$
 $P = 13600 \times 10 \times 0.76$
 $P = 103360 = 1.03 \times 10^5 \text{ Pa}$

P (kPa)	h (m)
99.5	150
95.7	500
92.4	800
88.9	1140
87.2	1300
85.3	1500

From graph we get height 1.02 km, pressure is 90 kPa
6.11 find weight lifted by jack of area 50 cm^2 push by 10 Pa
 Pressure = $P = 10 \text{ N/cm}^2 = 10 \text{ N/cm}^2 = 10 \text{ Nm}^{-2}/(10^{-2})^2 = 10/10^{-4} \text{ Pa} = 10^5 \text{ Pa}$
 Area = $A = 50 \text{ cm}^2 = 50 \text{ cm}^2 = 5 \times (10^{-2})^2 \text{ m}^2 = 50 \times 10^{-4} \text{ m}^2 = 5 \times 10^{-3} \text{ m}^2$
 $F = PA$ ($P = F/A$)
 $W = 10^5 \times 5 \times 10^{-3}$
 $W = 5 \times 10^2 = 500 \text{ N}$
6.12 find pressure and force on large piston of area 20 cm^2 due to small piston of area 5 cm^2 push by 500 N force
 Applied force = $f_1 = 500 \text{ N}$
 Small area = $a_1 = 5 \text{ cm}^2 = 5 \text{ cm}^2 = 5 \times (10^{-2})^2 \text{ m}^2 = 5 \times 10^{-4} \text{ m}^2$
 Large area = $a_2 = 20 \text{ cm}^2 = 20 \text{ cm}^2 = 20 \times (10^{-2})^2 \text{ m}^2 = 20 \times 10^{-4} \text{ m}^2$
 Pressure = $P = ?$
 Force = $F_2 = ?$
 $F_2 = f_1 \left(\frac{A_2}{A_1} \right)$ ($\frac{F_2}{A_2} = \frac{F_1}{A_1}$)
 $F_2 = 500 \times \left(\frac{20 \times 10^{-4}}{5 \times 10^{-4}} \right)$
 $F_2 = 500 \times 4 = 2000 \text{ N}$
 $P = f_1/a_1 = 500/5 \times 10^{-4}$
 $P = 100 \times 10^{-4} = 1 \times 10^6 \text{ Pa}$

Chapter # 7

7.1 convert temperature
 Given temp = $C = 30^\circ \text{C}$
 $F = 1.8C + 32$
 $F = (1.8 \times 30) + 32 = 86^\circ \text{F}$
 $K = 273 + C$
 $K = 273 + 30 = 303 \text{ K}$
7.2 convert temperature
 Given temp = $F = 98.6^\circ \text{F}$
 $F = 1.8C + 32$
 $98.6 = 1.8 \times C + 32$

$98.6 - 32 = 1.8 \times C$
 $C = 66.6/1.8 = 37^\circ \text{C}$
 $K = 273 + C$
 $K = 273 + 37 = 310 \text{ K}$
7.3 find value that which Celsius and Fahrenheit scales are equal
 Let $F = C$
 $F = 1.8C + 32$
 $F = 1.8 \times F + 32$
 $F - 1.8F = 32$
 $(1 - 1.8)F = 32$
 $-0.8F = 32$
 $F = -32/0.8 = -40$
7.4 convert temperature
 Given temp = $F = 5^\circ \text{F}$
 $F = 1.8C + 32$
 $5 = 1.8 \times C + 32$
 $5 - 32 = 1.8 \times C$
 $C = -27/1.8 = -15^\circ \text{C}$
 $K = 273 + C$
 $K = 273 - 15 = 258 \text{ K}$
7.5 find temp of 67.2 mm Hg column while distance b/w ice and steam point is 192 mm
 Ice point = 0°C
 Steam point = 100°C
 Hg column = 67.2 mm
 Total column = 192 mm
 192 mm col has temp = 100
 1 mm col has temp = $\frac{100}{192}^\circ \text{C}$
 67.2 mm col has temp = $\frac{100}{192} \times 67.2 = 35^\circ \text{C}$
7.6 find temp of 4.5 cm Hg column while distance b/w lower and upper fix point is 20 cm
 Ice point = 32°C
 Steam point = 212°C
 Hg column = 4.5 cm
 Total column = 20 cm
 20 cm col has temp = 180°F
 1 cm col has temp = $\frac{180}{20}^\circ \text{F}$
 4.5 cm col has temp = $\frac{180}{20} \times 4.5 = 40.5^\circ \text{F}$
 Temp = $32 + 40.5 = 72.5^\circ \text{F}$

this document is only to help
 my own class weak students,
 not to publish.
 Courtesy: PTB physics 9th