

KINEMATIKA PARTIKEL

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Partikel...?

Partikel dalam bagian ini:

- ✓ Bukan dari ukuran benda
- ✓ Dianggap bergerak sebagai satu kesatuan utuh
- ✓ Putaran terhadap titik pusat massa diabaikan





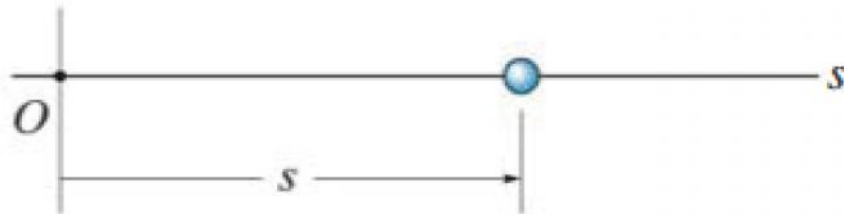
DISKUSI

1. Posisi dan perpindahan pada rectilinear motion
2. Kecepatan dan percepatan pada rectilinear motion
3. Gerak lurus dengan kecepatan konstan
4. Gerak lurus dengan percepatan konstan
5. Gerak absolut dan gerak relatif
6. Kecepatan dan percepatan sudut
7. Hubungan kecepatan linear dan kecepatan sudut

Jelaskan dan deskripsikan sesuai hasil diskusi dalam 3-5 kalimat saja (waktu 15 menit)

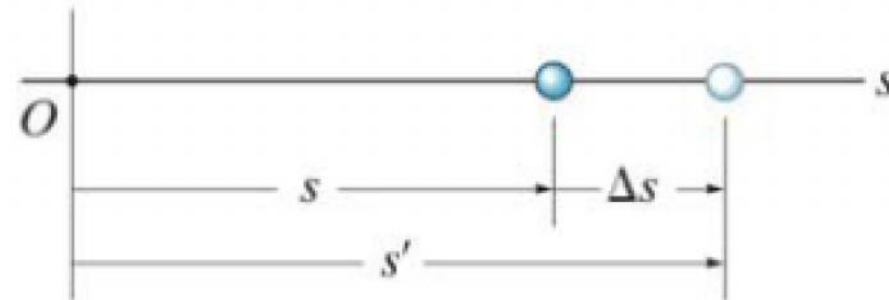


POSISI DAN PERPINDAHAN



Position

(a)

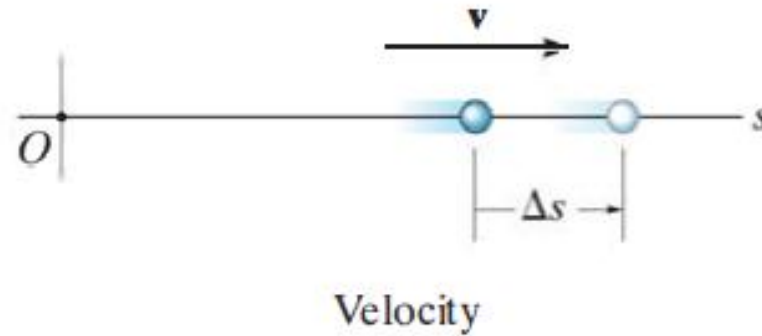


Displacement

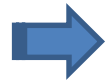
(b)



KECEPATAN DAN PERCEPATAN



$$v_{\text{avg}} = \frac{\Delta s}{\Delta t}$$



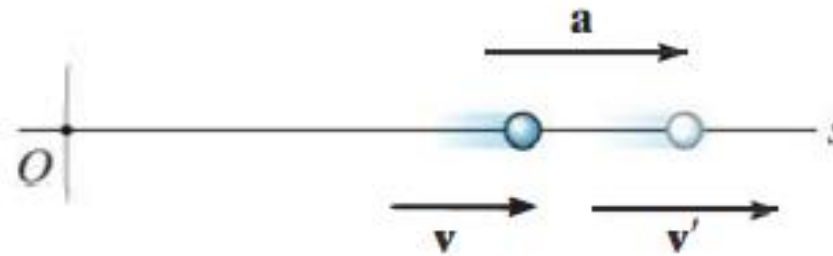
$$v = \lim_{\Delta t \rightarrow 0} (\Delta s / \Delta t),$$



$$v = \frac{ds}{dt}$$



KECEPATAN DAN PERCEPATAN



Acceleration

$$a_{\text{avg}} = \frac{\Delta v}{\Delta t} \quad \rightarrow \quad a = \lim_{\Delta t \rightarrow 0} (\Delta v / \Delta t), \quad \rightarrow \quad \boxed{a = \frac{dv}{dt}}$$

$$\boxed{a ds = v dv} \quad \leftarrow \quad a = \frac{d^2s}{dt^2} \quad \leftarrow$$

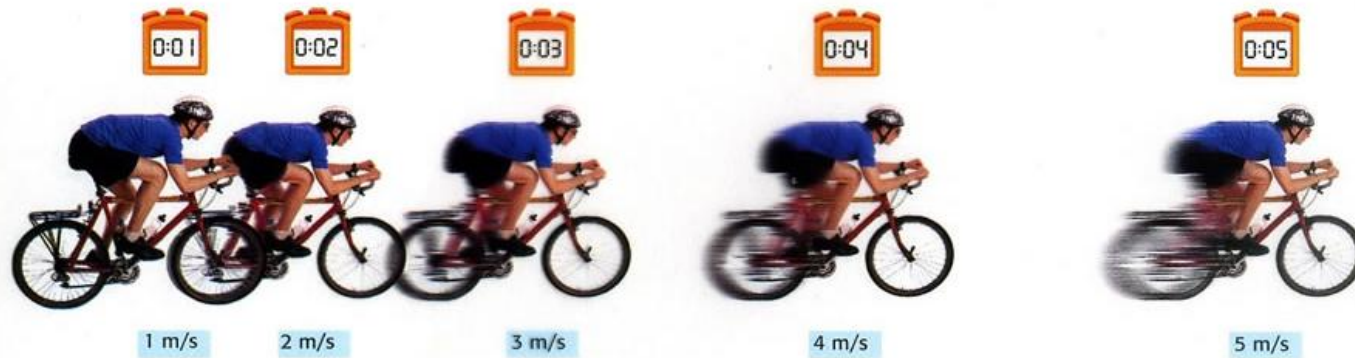




Speed...?



Velocity...?



Acceleration...?



KECEPATAN KONSTAN

Tidak mengalami percepatan ($a = 0$)

$$v = \frac{dx}{dt} = \text{konstan}$$

$$\int_{x_0}^x dx = v \int_0^t dt \rightarrow x - x_0 = vt \quad x = x_0 + vt$$

Persamaan di atas digunakan jika diketahui kecepatan partikel adalah konstan.



PERCEPATAN KONSTAN

Velocity as a Function of Time. Integrate $a_c = dv/dt$, assuming that initially $v = v_0$ when $t = 0$.

$$\int_{v_0}^v dv = \int_0^t a_c dt$$

(\pm)

$$v = v_0 + a_c t$$

Constant Acceleration

(12-4)

Position as a Function of Time. Integrate $v = ds/dt = v_0 + a_c t$, assuming that initially $s = s_0$ when $t = 0$.

$$\int_{s_0}^s ds = \int_0^t (v_0 + a_c t) dt$$

(\pm)

$$s = s_0 + v_0 t + \frac{1}{2} a_c t^2$$

Constant Acceleration

(12-5)



PERCEPATAN KONSTAN

Velocity as a Function of Position. Either solve for t in Eq. 12-4 and substitute into Eq. 12-5, or integrate $v dv = a_c ds$, assuming that initially $v = v_0$ at $s = s_0$.

$$\int_{v_0}^v v dv = \int_{s_0}^s a_c ds$$

(\pm)

$$v^2 = v_0^2 + 2a_c(s - s_0)$$

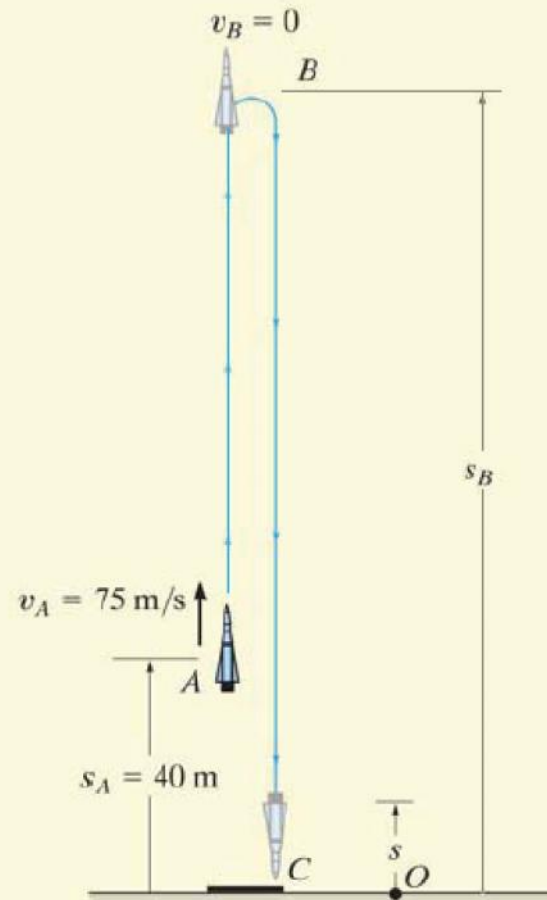
Constant Acceleration

(12-6)



Contoh soal

During a test a rocket travels upward at 75 m/s, and when it is 40 m from the ground its engine fails. Determine the maximum height s_B reached by the rocket and its speed just before it hits the ground. While in motion the rocket is subjected to a constant downward acceleration of 9.81 m/s^2 due to gravity. Neglect the effect of air



$$v_B^2 = v_A^2 + 2a_c(s_B - s_A)$$

$$0 = (75 \text{ m/s})^2 + 2(-9.81 \text{ m/s}^2)(s_B - 40 \text{ m})$$

$$s_B = 327 \text{ m}$$

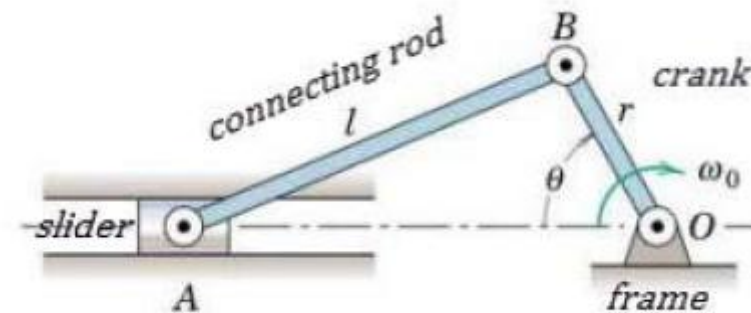
$$v_C^2 = v_B^2 + 2a_c(s_C - s_B)$$

$$= 0 + 2(-9.81 \text{ m/s}^2)(0 - 327 \text{ m})$$

$$v_C = -80.1 \text{ m/s} = 80.1 \text{ m/s} \downarrow$$



Latihan soal-1



Untuk sebuah *slider crank mechanism* persamaan berikut ini adalah *percepatan* *slidernya*.

$$a = 2r\omega^2 (\cos 2\omega r + 1/n \cos 4\omega r)$$

Dimana :

r = panjang crank

n = perbandingan panjang *connecting rod* dengan *crank*

ω = kecepatan sudut crank

Pertanyaan :

- Tentukan *persamaan kecepatan slider* dan *perpindahannya* berdasarkan harga batas $v_0 = 0$ dan $x_0 = 0$
- Tentukan *waktu, kecepatan* dan *percepatan slider* bila *perpindahan slider* = 5 cm dan harga-harga : $r = 10$ cm, $\omega = 10$ rad/detik, $n = 5$.



