ΛΥΣΕΙΣ ΔΙΑΓΩΝΙΣΜΑΤΟΣ Α' ΛΥΚΕΙΟΥ 3/1/2022

ΘΕΜΑ Α

Α1) β Α2) δ Α3) γ Α4) β Α5) Λ, Σ, Λ, Σ, Σ

ΘΕΜΑ Β

Β1) $x = \frac{1}{2} a t^2$

Για $t_1 = 1s$: $x_1 = \frac{1}{2} a t_1^2 = \frac{1}{2} \cdot 4 \cdot 1^2 \Rightarrow x_1 = 2m$

Για $t_2 = 2s$: $x_2 = \frac{1}{2} a t_2^2 = \frac{1}{2} \cdot 4 \cdot 2^2 \Rightarrow x_2 = 8m$

$\Delta x_{2ο} = x_2 - x_1 = 6m$, Σωστό το (β)

Β2) α) Κινητό Α: $a_A = \frac{\Delta u}{\Delta t} = \frac{6-2}{2-0} m/s^2 \Rightarrow a_A = 2 m/s^2$ Άρα το (α): ΣΩΣΤΟ

Κινητό Β: $a_B = \frac{\Delta u}{\Delta t} = \frac{6-0}{2-0} m/s^2 \Rightarrow a_B = 3 m/s^2$

β) Για $t = 3s$: $u_A = u_0 + a_A \Delta t = 2 + 2 \cdot 3 \Rightarrow u_A = 8 m/s$

$u_B = a_B \cdot \Delta t = 3 \cdot 3 \Rightarrow u_B = 9 m/s$ Άρα το (β): ΛΑΘΟΣ

γ) Για $t = 4s$: $x_A = u_0 \Delta t + \frac{1}{2} a_A \Delta t^2 = 2 \cdot 4 + \frac{1}{2} \cdot 2 \cdot 4^2 \Rightarrow x_A = 24m$

$x_B = \frac{1}{2} a_B \Delta t^2 = \frac{1}{2} \cdot 3 \cdot 4^2 \Rightarrow x_B = 24m$

Οπότε $x_A = x_B$, άρα το β1: ΛΑΘΟΣ

Β3) Ι) $s_{ολ} = \text{Εμπαδόν} = \frac{(2,7 + 0,7) \cdot 20}{2} m \Rightarrow s_{ολ} = 34m < d = 35m$

Άρα αποφεύγεται.

Σωστό το (α)

Ι1) $s_1 = u_0 \Delta t_1 = 20 \cdot 0,7 m \Rightarrow s_1 = 14m$

$s_2 = d' - s_1 = 30m - 14m \Rightarrow s_2 = 16m$

Θα πρέπει $s_2 = s_{stop} = \frac{u_0^2}{2a'} \Rightarrow 16 = \frac{20^2}{2a'} \Rightarrow 32a' = 400 \Rightarrow a' = \frac{400}{32} = 12,5 m/s^2$

Σωστό το (β)

Β4) $s_1 = s_2 = \frac{d}{2} = 50m$

$s_1 = \frac{1}{2} a \Delta t_1^2 \Rightarrow 50 = \frac{1}{2} \cdot a \cdot 10^2 \Rightarrow \boxed{a = 1 m/s^2} = a_1 = a_2$

$s_1' = d - s_1 = 100m - 50m \Rightarrow s_1' = 50m$ και $u_1 = u_2 = a \Delta t_1 = 10 m/s$

$s_1' = u_1 \Delta t_1' \Rightarrow 50 = 10 \cdot \Delta t_1' \Rightarrow \Delta t_1' = 5s$

Άρα $\Delta t = \Delta t_1 + \Delta t_1' = 10s + 5s \Rightarrow \Delta t = 15s$ Σωστό το (β)

ΘΕΜΑ Γ

1η κίνηση (0-10s): $U_1 = a_1 \Delta t_1 = 2 \cdot 10 \Rightarrow U_1 = 20 m/s$

$\Delta x_1 = \frac{1}{2} a_1 \Delta t_1^2 = \frac{1}{2} \cdot 2 \cdot 10^2 \Rightarrow \Delta x_1 = 100m$, $S_1 = 100m$

2η κίνηση (10s-16s): $U_2 = U_1 = 20 m/s$ = σταθ.

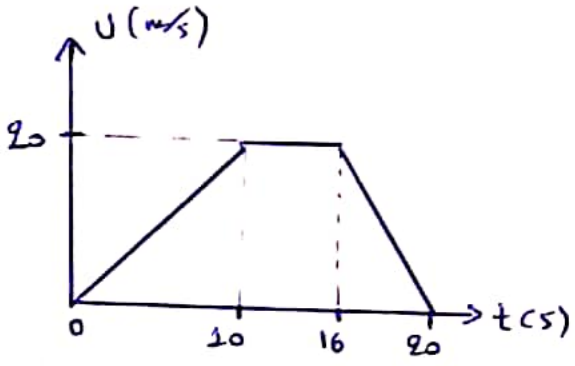
$\Delta x_2 = U_2 \Delta t_2 = 20 \cdot 6 \Rightarrow \Delta x_2 = 120m$, $S_2 = 120m$

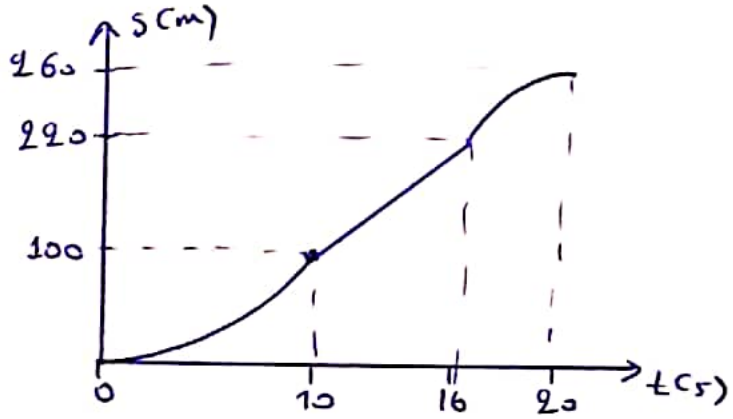
3η κίνηση (16s-20s): $\Delta x_3 = \frac{U_0^2}{2|a_3|} = \frac{20^2}{2 \cdot 5} \Rightarrow \Delta x_3 = 40m$, $S_3 = 40m$

Γ1) $S_{ολ} = S_1 + S_2 + S_3 = 100m + 120m + 40m \Rightarrow S_{ολ} = 260m$

$U_μ = \frac{S_{ολ}}{t_{ολ}} = \frac{260}{20} m/s \Rightarrow U_μ = 13 m/s$

Γ2)





Γ3) Για $t_0 = 0$: $x_0 = +5m$

Για $t_1 = 10s$: $x_1 = \Delta x_1 + x_0 = 100m + 5m \Rightarrow x_1 = 105m$

Για $t_2 = 16s$: $x_2 = \Delta x_2 + x_1 = 120m + 105m \Rightarrow x_2 = 225m$

Από 16 ως 19s έχει μετατοπιστεί: $\Delta x = U_0 \Delta t - \frac{1}{2}|a_3|\Delta t^2 \Rightarrow$

$\Rightarrow \Delta x = 20 \cdot (19-16) - \frac{1}{2} \cdot 5 (19-16)^2 = 20 \cdot 3 - \frac{1}{2} \cdot 5 \cdot 3^2 \Rightarrow \Delta x = 37,5m$

Άρα για $t = 19s$ η θέση του κινητού είναι: $x = \Delta x + x_2 \Rightarrow$

$\Rightarrow x = 37,5m + 225m \Rightarrow x = 262,5m$

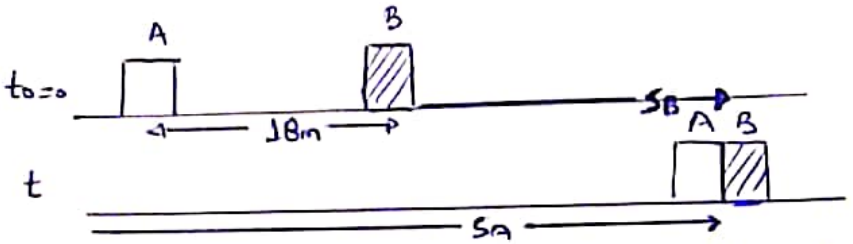
Γ4) Για $t_1 = 15s$: $U_1 = 20 m/s$

Για $t_2 = 19s$: $U_2 = U_0 - |a_3| \cdot \Delta t = 20 - 5 (19-16) = 20 - 5 \cdot 2 \Rightarrow$

$\Rightarrow U_2 = 10 m/s$

Άρα $\frac{U_1}{U_2} = \frac{20 m/s}{10 m/s} = \frac{2}{1}$

ΘΕΜΑ Δ



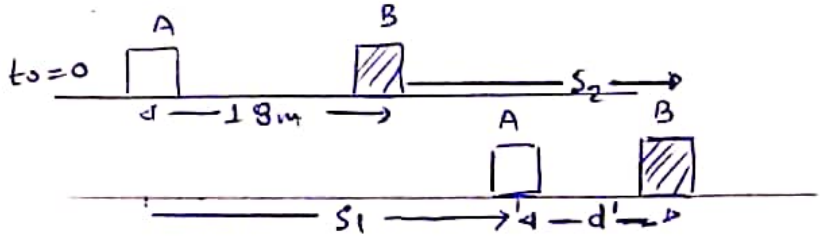
Δ1) $S_A = d + S_B \Rightarrow \frac{1}{2} a_A t^2 = d + \frac{1}{2} a_B t^2 \Rightarrow \frac{1}{2} \cdot 3 t^2 = 18 + \frac{1}{2} \cdot 2 t^2 \Rightarrow$

$\Rightarrow 3t^2 - 2t^2 = 36 \Rightarrow t^2 = 36 \Rightarrow t = \sqrt{36} \Rightarrow$ $\boxed{t = 6s}$

Δ2) $U_A = a_A \cdot t = 3 \cdot 6 \Rightarrow U_A = 18 m/s$, $S_A = \frac{1}{2} a_A t^2 = \frac{1}{2} \cdot 3 \cdot 6^2 \Rightarrow$ $\boxed{S_A = 54m}$

$U_B = a_B \cdot t = 2 \cdot 6 \Rightarrow U_B = 12 m/s$, $S_B = \frac{1}{2} a_B t^2 = \frac{1}{2} \cdot 2 \cdot 6^2 \Rightarrow$ $\boxed{S_B = 36m}$

Δ3)



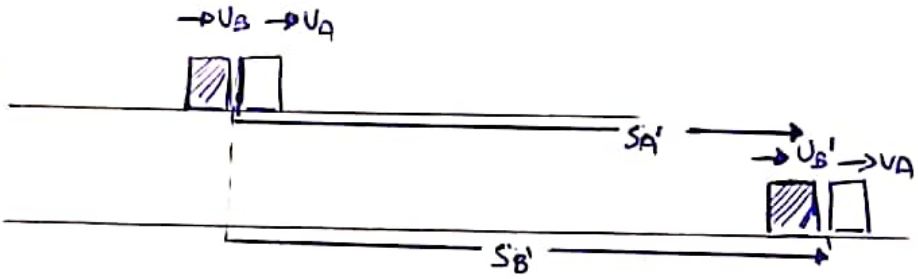
$t_1 = 3s < t = 6s$, χρονική στιγμή πριν την συνάντηση τους

Ισχύει: $S_2 + 18 = S_1 + d' \Rightarrow \frac{1}{2} a_B t_1^2 + 18 = \frac{1}{2} a_A t_1^2 + d' \Rightarrow$

$\Rightarrow \frac{1}{2} \cdot 2 \cdot 3^2 + 18 = \frac{1}{2} \cdot 3 \cdot 3^2 + d' \Rightarrow 27m = 13{,}5m + d' \Rightarrow$

$\boxed{d' = 13{,}5m}$

Δ4) $t = 6s$



$S_{A'} = U_A \cdot \Delta t$ και $S_{B'} = U_B \cdot \Delta t + \frac{1}{2} a_B \Delta t^2$

Όταν ξαναβρίσκονται την χρονική στιγμή t_2 θα ισχύει:

$S_{A'} = S_{B'} \Rightarrow U_A \Delta t = U_B \Delta t + \frac{1}{2} a_B \Delta t^2 \Rightarrow 18 \Delta t = 12 \Delta t + \frac{1}{2} \cdot 2 \Delta t^2 \Rightarrow$

$\Rightarrow 6 \Delta t - \Delta t^2 = 0 \Rightarrow \Delta t (6 - \Delta t) = 0 \Rightarrow \Delta t = 0$ ή $\boxed{\Delta t = 6s}$

και $\Delta t = t_2 - t \Rightarrow t_2 = \Delta t + t = 6s + 6s \Rightarrow t_2 = 12s$

$U_B' = U_B + a_B \Delta t = 12 + 2 \cdot 6 \Rightarrow$ $\boxed{U_B' = 24 m/s}$