Θέμα Α

Α1 –β , Α2 – γ , Α3 – γ , Α4 – δ , Α5 – 1) Σ 2) Σ 3) Σ 4) Λ 5) Σ

Θέμα Β

Β1.

α) Σωστό

$$\alpha_A = \frac{\Delta\upsilon}{\Delta t} \Rightarrow \alpha_A = \frac{6-2}{2-0} \Rightarrow \boxed{\alpha_A = 2\,m/s^2}$$

$$\alpha_B = \frac{\Delta\upsilon}{\Delta t} \Rightarrow \alpha_B = \frac{6-0}{2-0} \Rightarrow \boxed{\alpha_B = 3\,m/s^2}$$

β) Λάθος

$$\upsilon_A = \upsilon_0 + \alpha_A \cdot t \Rightarrow \upsilon_A = 2 + 2\cdot 3 \Rightarrow \boxed{\upsilon_A = 8\,m/s}$$

$$\upsilon_B = \alpha_B \cdot t \Rightarrow \upsilon_B = 3\cdot 3 \Rightarrow \boxed{\upsilon_B = 9\,m/s}$$

γ) Λάθος

$$x_A = \upsilon_0 \cdot t + \frac{1}{2}\cdot \alpha_A \cdot t^2 \Rightarrow x_A = 2\cdot 4 + \frac{1}{2}\cdot 2\cdot 4^2 \Rightarrow x_A = 8 + 16 \Rightarrow \boxed{x_A = 24\,m}$$

$$x_B = \frac{1}{2}\cdot \alpha_B \cdot t^2 \Rightarrow x_B = \frac{1}{2}\cdot 3\cdot 4^2 \Rightarrow \boxed{x_B = 24\,m}$$

$$Άρα: \boxed{\Delta x = x_B - x_A = 0}$$

Β2. Σωστή απάντηση είναι η (γ).

Χρησιμοποιώντας τους τύπους χωρίς χρόνο, έχουμε:

$$d_1 = \frac{\upsilon_1^2}{2|\alpha|} (1)$$

$$d_2 = \frac{\upsilon_2^2}{2|\alpha|} \Rightarrow d_2 = \frac{(2\cdot\upsilon_1)^2}{2|\alpha|} \Rightarrow d_2 = \frac{4\cdot\upsilon_1^2}{2|\alpha|} (2)$$

Με διαίρεση κατά μέλη των δύο σχέσεων, έχουμε:

$$\frac{(2)}{(1)} \Rightarrow \frac{d_2}{d_1} = \frac{\frac{4\cdot\upsilon_1^2}{2|\alpha|}}{\frac{\upsilon_1^2}{2|\alpha|}} \Rightarrow \frac{d_2}{d_1} = \frac{4\cdot\upsilon_1^2\cdot 2|\alpha|}{\upsilon_1^2\cdot 2|\alpha|} \Rightarrow \frac{d_2}{d_1} = 4 \Rightarrow \boxed{d_2 = 4d_1}$$

Β3. Σωστή απάντηση είναι η (β).

Αρχικά, όταν στο σώμα ασκείται μόνο η δύναμη F_1 ισχύει:

$$\vec{F}_{ολ} = m\cdot\vec{a} \Rightarrow a = \frac{F_1}{m} (1)$$

Όταν στη συνέχεια το σώμα δέχεται δύο αντίρροπες δυνάμεις, θα ισχύει:

$$\vec{F}_{ολ} = m\cdot\vec{a} \Rightarrow a' = \frac{F_2 - F_1}{m} \Rightarrow a' = \frac{4F_1 - F_1}{m} \Rightarrow a' = \frac{3F_1}{m} (2)$$

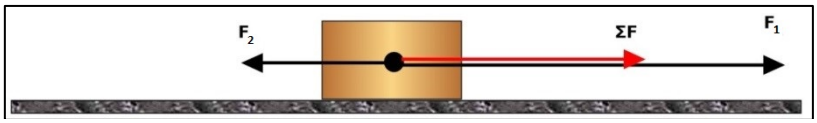
Με διαίρεση κατά μέλη των δύο σχέσεων έχουμε:

$$\frac{(2)}{(1)} \Rightarrow \frac{\alpha'}{\alpha} = \frac{\frac{3F_1}{m}}{\frac{F_1}{m}} \Rightarrow \frac{\alpha'}{\alpha} = 3 \Rightarrow \boxed{\alpha' = 3\alpha}$$

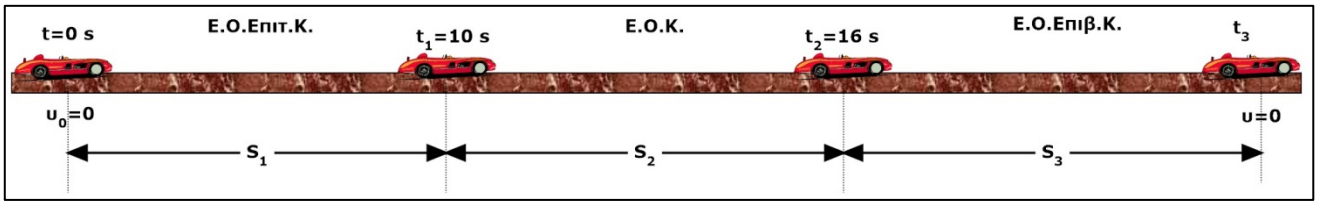
Β4. Σωστή απάντηση είναι η (iii).
Αφού οι δυνάμεις είναι αντίρροπες, ισχύει:

$$F_1 - F_2 = F_{ολ} \xrightarrow{F_1=3F_2} 3F_2 - F_2 = 12 \Rightarrow 2F_2 = 12 \Rightarrow \boxed{F_2 = 6\ N}$$

$$F_1 = 3F_2 \Rightarrow \boxed{F_1 = 18\ N}$$



Θέμα Γ

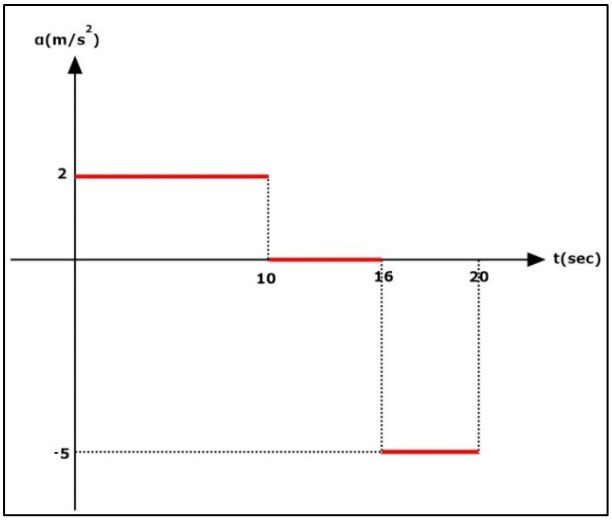


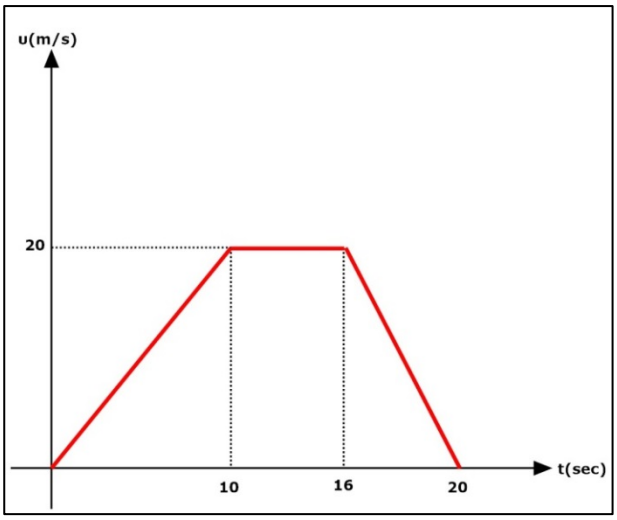
$a_1 = 2\ m/s^2$, $\Delta t_1 = 10\,\sec$	$a_2 = 0\ m/s^2$, $\Delta t_2 = 6\,\sec$	$\Delta t_2 = 4\,\sec$
$\upsilon_1 = \alpha_1 \cdot \Delta t_1 \Rightarrow \upsilon_1 = 2 \cdot 10$ $\Rightarrow \upsilon_1 = 20\ m/s$	$\upsilon_2 = \upsilon_1 = 20\ m/s$	$\upsilon = \upsilon_0 - \lvert\alpha_3\rvert \cdot \Delta t_3 \Rightarrow 0 = 20 - \lvert\alpha_3\rvert \cdot 4$ $\Rightarrow \lvert\alpha_3\rvert = \frac{20}{4} \Rightarrow \lvert\alpha_3\rvert = 5\ m/s^2$
$S_1 = \frac{1}{2} \cdot a_1 \cdot \Delta t_1^2$ $\Rightarrow S_1 = \frac{1}{2} \cdot 2 \cdot 10^2$ $\Rightarrow S_1 = 100\ m$	$S_2 = \upsilon_2 \cdot \Delta t_2$ $\Rightarrow S_2 = 20 \cdot 6$ $\Rightarrow S_2 = 120\ m$	$S_3 = \frac{\upsilon_0^2}{2 \cdot \lvert\alpha_3\rvert} \Rightarrow S_3 = \frac{20^2}{2 \cdot 5} \Rightarrow S_3 = 40\ m$

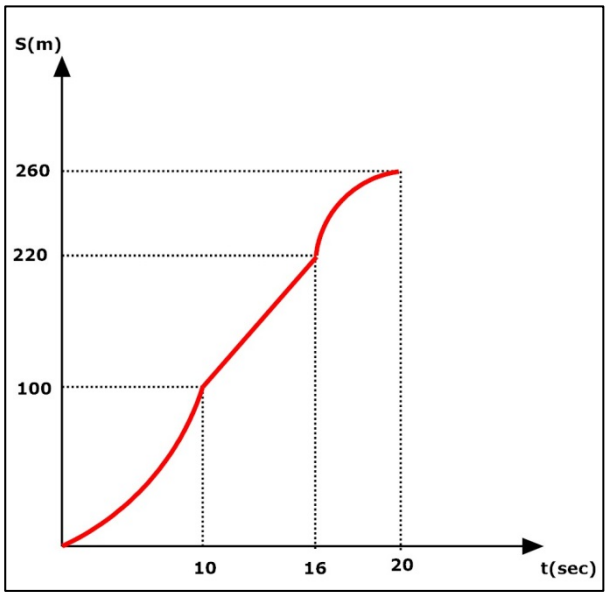
Γ1. $\upsilon = \upsilon_0 - \lvert\alpha_3\rvert \cdot \Delta t_3 \Rightarrow 0 = 20 - \lvert\alpha_3\rvert \cdot 4 \Rightarrow \lvert\alpha_3\rvert = \frac{20}{4} \Rightarrow \lvert\alpha_3\rvert = 5\ m/s^2$

Γ2. $S_{ολ.} = S_1 + S_2 + S_3 \Rightarrow S_{ολ.} = 100 + 120 + 40 \Rightarrow \boxed{S_{ολ.} = 260\ m}$

Γ3.







Γ4. Υπολογίζουμε τη μετατόπιση του σώματος από 0-4 sec και από 0-5 sec.

$$\Delta x_1 = \frac{1}{2}\cdot a_1 \cdot \Delta t^2 \Rightarrow \Delta x_1 = \frac{1}{2}\cdot 2 \cdot 4^2 \Rightarrow \Delta x_1 = 60 - 22,5 \Rightarrow \Delta x_1 = 16\,m$$

$$\Delta x_2 = \frac{1}{2}\cdot a_1 \cdot \Delta t^2 \Rightarrow \Delta x_2 = \frac{1}{2}\cdot 2 \cdot 5^2 \Rightarrow \Delta x_2 = 25\,m$$

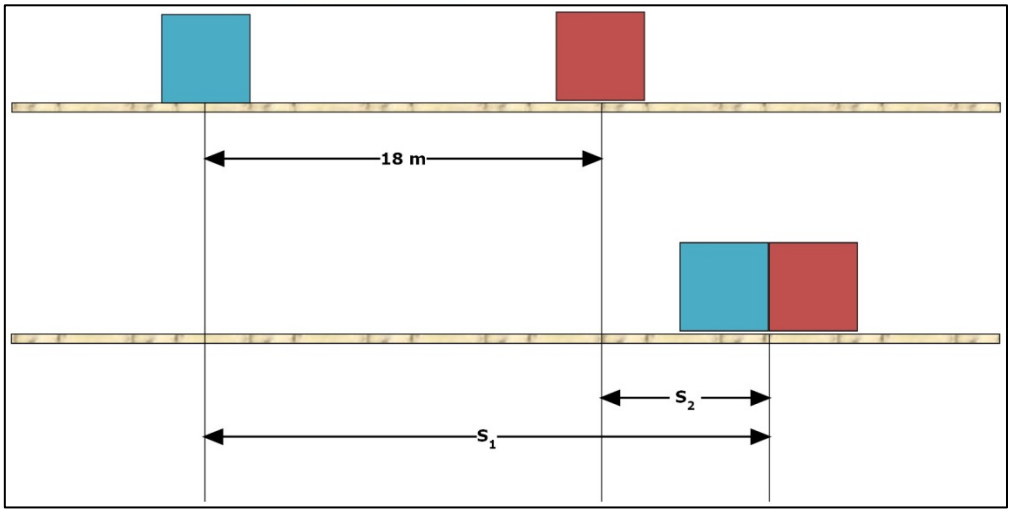
$$\Delta x = \Delta x_2 - \Delta x_1 \Rightarrow \Delta x = 25 - 16 \Rightarrow \boxed{\Delta x = 9\,m}$$

Γ5. Την t=3 sec: $\upsilon_3 = \alpha_1 \cdot \Delta t_1 \Rightarrow \upsilon_3 = 2\cdot(3-0) \Rightarrow \boxed{\upsilon_3 = 6\,m/s}$

Την t=19 sec: $\upsilon_{19} = \upsilon_0 - |\alpha_3| \cdot \Delta t_3 \Rightarrow \upsilon_{19} = 20 - 5\cdot(19-16) \Rightarrow \upsilon_{19} = 20 - 15 \Rightarrow \boxed{\upsilon_{19} = 5\,m/s}$

Θέμα Δ

Δ1.



$$S_1 - S_2 = 18 \Rightarrow \frac{1}{2}\alpha_1 t^2 - \frac{1}{2}\alpha_2 t^2 = 18 \Rightarrow \frac{1}{2}3t^2 - \frac{1}{2}2t^2 = 18 \Rightarrow \frac{1}{2}t^2 = 18 \Rightarrow t^2 = 36 \Rightarrow \boxed{t = 6\,\text{sec}}$$

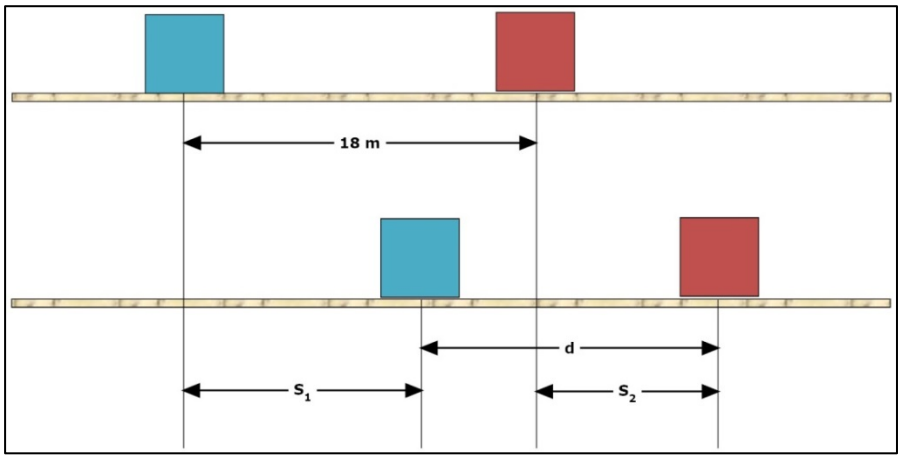
Δ2. $\upsilon_1 = \alpha_1 \cdot t \Rightarrow \upsilon_1 = 3\cdot 6 \Rightarrow \boxed{\upsilon_1 = 18\,m/s}$

$\upsilon_2 = \alpha_2 \cdot t \Rightarrow \upsilon_2 = 2\cdot 6 \Rightarrow \boxed{\upsilon_2 = 12\,m/s}$

$$S_1 = \frac{1}{2}\alpha_1 t^2 \Rightarrow S_1 = \frac{1}{2}\cdot 3\cdot 6^2 \Rightarrow S_1 = 54\,m$$

$$S_2 = \frac{1}{2}\alpha_2 t^2 \Rightarrow S_2 = \frac{1}{2}\cdot 2\cdot 6^2 \Rightarrow S_2 = 36\,m$$

Δ3.



$$S_1 = \frac{1}{2}\alpha_1 t^2 \Rightarrow S_1 = \frac{1}{2}\cdot 3\cdot 3^2 \Rightarrow S_1 = 13,5\,m$$

$$S_2 = \frac{1}{2}\alpha_2 t^2 \Rightarrow S_2 = \frac{1}{2}\cdot 2\cdot 3^2 \Rightarrow S_2 = 9\,m$$

$$d + S_1 = 18 + S_2 \Rightarrow d = 18 - S_1 + S_2 \Rightarrow d = 18 - 13,5 + 9 \Rightarrow d = 18 - 4,5 \Rightarrow \boxed{d = 13,5\,m}$$

Δ4. Το σώμα Β εκτελεί Ε.Ο.Κ. στη συνέχεια. Μετατοπίζεται 24 m σε χρονικό διάστημα:

$$\upsilon_B = \frac{\Delta x}{\Delta t} \Rightarrow \Delta t = \frac{24}{12} \Rightarrow \Delta t = 2\,\text{sec}$$

Η ταχύτητα του σώματος Α είναι:

$$\upsilon_A = \upsilon_1 + a_1\cdot\Delta t \Rightarrow \upsilon_A = 18 + 3\cdot 2 \Rightarrow \boxed{\upsilon_A = 24\,m/s}$$

Δ5.