

$$E_0 = m_0 c^2$$

$$= 9 \times 10^{-31} \times 9 \times 10^{16}$$

$$= 81 \times 10^{-15} \text{ J} \quad (B)$$

$$E_0 = m_0 c^2$$

$$= 1.67 \times 10^{-27} \times 9 \times 10^{16}$$

$$= 15.03 \times 10^{-11} \text{ J}$$

C (8) A (7) D (6)

C (11) A (10) C (9)

A (14) C (13) C (12)

A (15)

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{399^2}{400^2} c^2}} \quad (16)$$

$$\gamma = \frac{1}{\sqrt{\frac{1}{400}}} = 20 \quad (C)$$

B (18) C (17)

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هذا البنك المؤتمت لبحث
يكانيك السوائل المتحركة
سنة الطالب المتوسطة

D (3) A (2) C (1)

A (6) C (5) D (4)

A (9) D (8) D (7)

C (12) B (11) C (10)

D (15) C (14) A (13)

سنة الطالب المتوسطة

$$\Delta m = \frac{E_k}{c^2} = \frac{162 \times 10^{-16}}{9 \times 10^{16}} \quad (2)$$

$$\Delta m = 18 \times 10^{-32} \text{ kg}$$

$$18 \times 10^{-32} \text{ kg} \text{ مقدار تزيار عبقار } m_e = 9 \times 10^{-31} \text{ kg} \text{ كل}$$

$$\Delta m' \quad \text{كل } 100 \text{ kg}$$

$$\Delta m' = \frac{18 \times 10^{-32} \times 100}{9 \times 10^{-31}} = 20\% \quad (C)$$

$$4 \text{ kg} \text{ مقدار تزيار عبقار } 100 \text{ kg} \text{ كل} \quad (3)$$

$$\Delta m \text{ مقدار تزيار عبقار } m_e = 9 \times 10^{-31} \text{ kg} \text{ كل}$$

$$\Delta m = \frac{4 \times 9 \times 10^{-31} \times 100}{100} = 36 \times 10^{-33} \text{ kg}$$

$$E_k = \Delta m \cdot c^2 = 36 \times 10^{-33} \times 9 \times 10^{16}$$

$$= 3.24 \times 10^{-15} \text{ J} \quad (C)$$

2/

$$P = mv = \gamma m_0 v \quad (1)$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{\frac{3}{4}c^2}{c^2}}} = \frac{1}{\sqrt{\frac{1}{4}}} = 2$$

مفوضه ب (1)

$$P = 2 \times 1.67 \times 10^{-27} \times \frac{\sqrt{3}}{2} \times 3 \times 10^8 = 5.01 \sqrt{3} \times 10^{-19} \text{ kg m s}^{-1} \quad (B)$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{\frac{8}{9}c^2}{c^2}}} \quad (6)$$

$$\gamma = \frac{1}{\sqrt{\frac{1}{9}}} = 3$$

$$\Rightarrow m = \gamma m_0 = 3 \times 1.67 \times 10^{-27} = 5.01 \times 10^{-27} \text{ kg} \quad (D)$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{\frac{899}{900}c^2}{c^2}}} \quad (7)$$

$$\gamma = \frac{1}{\sqrt{\frac{1}{900}}} = 30 \quad (D)$$

$$v = \frac{d}{t_0} = \frac{z}{\frac{4}{\sqrt{3}}} = \frac{\sqrt{3}}{2} c \text{ m s}^{-1} \quad (8)$$

$$v = \frac{d}{t_0} \Rightarrow t_0 = \frac{d}{v} = \frac{4}{0.2c} \quad (9)$$

$$t_0 = \frac{40}{2c} = 20 \text{ سنة} \quad (A)$$

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قسم الطالب الجيد

$$L = \frac{L_0}{\gamma} \Rightarrow 2d = \frac{5d}{\gamma} \Rightarrow \gamma = \frac{5}{2} \quad (1)$$

$$\frac{5}{2} = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \Rightarrow \frac{25}{4} = \frac{1}{1 - \frac{v^2}{c^2}}$$

$$1 - \frac{v^2}{c^2} = \frac{4}{25} \Rightarrow \frac{v^2}{c^2} = 1 - \frac{4}{25} = \frac{21}{25}$$

$$v^2 = \frac{21c^2}{25} \Rightarrow v = \frac{c\sqrt{21}}{5} \quad (B)$$

$$P = mv = \gamma m_0 v \quad (1) \quad (2)$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{\frac{3}{4}c^2}{c^2}}} = \frac{1}{\sqrt{\frac{1}{4}}} = 2$$

مفوضه ب (1)

$$P = 2 \times 9 \times 10^{-31} \times \frac{\sqrt{3}}{2} \times 3 \times 10^8 = 27 \sqrt{3} \times 10^{-23} \text{ kg m s}^{-1} \quad (1)$$

B (3)

$$E_k = (\gamma - 1)m_0 c^2 \quad (1) \quad (4)$$

$$v = 1.5 \sqrt{3} \times 10^8 = \frac{\sqrt{3}}{2} c \text{ m s}^{-1}$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{\frac{3}{4}c^2}{c^2}}} = \frac{1}{\sqrt{\frac{1}{4}}} = 2$$

مفوضه ب (1)

$$E_k = (2 - 1) \times 1.67 \times 10^{-27} \times 9 \times 10^{16} = 15.03 \times 10^{-11} \text{ J} \quad (B)$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{\frac{1}{4}c^2}{c^2}}} = \frac{1}{\sqrt{\frac{3}{4}}} \quad (3)$$

$$\gamma = \frac{2}{\sqrt{3}} \Rightarrow L = \frac{L_0}{\gamma} = \frac{10}{\frac{2}{\sqrt{3}}} = 5\sqrt{3} \text{ m}$$

$$L \approx 8.3 \text{ m} \quad (D)$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{\frac{8}{9}c^2}{c^2}}} = \frac{1}{\sqrt{\frac{1}{9}}} \quad (4)$$

$$\gamma = 3 \quad \text{عدد الكثرات}$$

$$P = m v = \gamma m_0 v \times n$$

$$54\sqrt{2} \times 10^{-21} = 3 \times 9 \times 10^{-31} \times \frac{2\sqrt{2}}{3} \times 3 \times 10^8 \times n$$

$$n = \frac{54\sqrt{2} \times 10^{-21}}{3 \times 9 \times 10^{-31} \times \frac{2\sqrt{2}}{3} \times 3 \times 10^8} = 100 \quad (B)$$

A (5)

$$t = \gamma t_0 \quad (1)$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{\frac{8}{9}c^2}{c^2}}} = \frac{1}{\sqrt{\frac{1}{9}}} = 3$$

نقوضه ب (1):

$$t = 3 \times \frac{8}{3} = 8 \text{ سنة} \quad (C)$$

$$d = \frac{d_0}{\gamma} \Rightarrow d_0 = \gamma d \quad (1)$$

$$v = \frac{d}{t_0} = \frac{4}{\frac{8}{\sqrt{3}}} = \frac{\sqrt{3}}{2} \text{ سنة ضوئية}$$

$$v = \frac{\sqrt{3}}{2} c \text{ سنة}$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{\frac{3}{4}c^2}{c^2}}} = \frac{1}{\sqrt{\frac{1}{4}}} = 2$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{0.99c^2}{c^2}}} \quad (10)$$

$$\gamma = \frac{1}{\sqrt{\frac{1}{100}}} = 10$$

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$$L = \frac{L_0}{\gamma} = \frac{200}{10} = 20 \text{ m} \quad A$$

متم الطالب لطقوت

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{\frac{19}{20}c^2}{c^2}}} = \frac{1}{\sqrt{\frac{1}{20}}} \quad (1)$$

$$\gamma = 2\sqrt{5} \Rightarrow L = \frac{L_0}{\gamma} = \frac{10}{2\sqrt{5}} = \frac{5}{\sqrt{5}}$$

$$L = \sqrt{5} \approx 2.23 \text{ m} \quad \text{السار عبر الحجرة} \quad (D)$$

$$L < 19 \quad \text{ننتار بسرعة التي تمك}$$

$$\Rightarrow \frac{L_0}{\gamma} < 19 \Rightarrow \frac{20}{19} < \gamma \Rightarrow \gamma > \frac{4}{3}$$

$$\frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} > \frac{4}{3} \Rightarrow \frac{1}{1 - \frac{v^2}{c^2}} > \frac{16}{9} \Rightarrow$$

$$1 - \frac{v^2}{c^2} < \frac{9}{16} \Rightarrow \frac{v^2}{c^2} < \frac{7}{16} \Rightarrow$$

$$\frac{v^2}{c^2} > \frac{9}{16} \Rightarrow v^2 > \frac{9c^2}{16} \Rightarrow$$

$$v > \frac{\sqrt{9}}{4} c \Rightarrow v > 0.25\sqrt{9} c$$

هذه تسمى سرعة الحد الأدنى

$$0.3\sqrt{9} c \quad (B)$$

4/

$$1 - \frac{v^2}{c^2} = \frac{1}{16} \Rightarrow \frac{v^2}{c^2} = 1 - \frac{1}{16} = \frac{15}{16}$$

$$v^2 = \frac{15}{16} c^2 \Rightarrow v = 0.25 \sqrt{15} c \quad \text{م}^{-1} \quad (10)$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{8}{9} c^2}} = \frac{1}{\sqrt{\frac{1}{9}}} \quad (12)$$

$$\gamma = 3$$

$$b = \frac{b_0}{\gamma} \Rightarrow b = \frac{3a}{3} \Rightarrow b = a$$

بأ - بعرض = بطول فيصبح الشكل مربع (C)

$$E_k = E - E_0 = 2E_0 - E_0 = E_0 \quad (13)$$

$$E_k = E_0 = m_0 c^2 \quad (B)$$

$$= 1.67 \times 9 \times 10^6 = 15.03 \times 10^{-11} \text{ ج}$$

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$$m c^2 = 2 m_0 c^2 \Rightarrow m = 2 m_0$$

$$m = 2 \times 1.67 \times 10^{-27} = 3.34 \times 10^{-27} \text{ kg} \quad (A)$$

$$E = E_k + E_0 = 2E_0 + E_0 = 3E_0 \quad (15)$$

$$m c^2 = 3 m_0 c^2 \Rightarrow m = 3 m_0$$

$$\Rightarrow \gamma = 3 \Rightarrow \frac{3}{1} = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \Rightarrow$$

$$9 = \frac{1}{1 - \frac{v^2}{c^2}} \Rightarrow 1 - \frac{v^2}{c^2} = \frac{1}{9} \Rightarrow$$

$$v^2 = \frac{8}{9} c^2 \Rightarrow v = \frac{2\sqrt{2}}{3} c \quad (10)$$

نفوضه ب (1):

$$d_0 = \gamma d = 2 \times 4 = 8 \text{ سنة ضوئية} \quad (B)$$

$$t = \gamma t_0 \quad (11)$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{15}{16} c^2}} = \frac{1}{\sqrt{\frac{1}{16}}} = 4$$

نفوضه ب (1):

$$t = 4 \times 3 = 12 \text{ سنة} \quad (B)$$

$$t = \gamma t_0 \quad (11)$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{3}{4} c^2}} = \frac{1}{\sqrt{\frac{1}{4}}} = 2$$

نفوضه ب (1):

$$t = 2 \times 3 = 6 \text{ سنة} \quad (B)$$

$$t = \gamma t_0 \Rightarrow 9 = \gamma (3) \Rightarrow \gamma = 3 \quad (10)$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \Rightarrow 3 = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \quad \text{مربع}$$

$$9 = \frac{1}{1 - \frac{v^2}{c^2}} \Rightarrow 1 - \frac{v^2}{c^2} = \frac{1}{9} \Rightarrow$$

$$\frac{v^2}{c^2} = 1 - \frac{1}{9} = \frac{8}{9} \Rightarrow v^2 = \frac{8}{9} c^2$$

$$v = \frac{2\sqrt{2}}{3} c \quad (A)$$

$$t = \gamma t_0 \Rightarrow 16 = \gamma (4) \Rightarrow \gamma = 4 \quad (11)$$

$$4 = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \Rightarrow 16 = \frac{1}{1 - \frac{v^2}{c^2}} \Rightarrow$$

(15)

$$E_k = (\gamma - 1) m_0 c^2 \quad (1)$$

$$E = 3 E_0 \Rightarrow \gamma = 3 \Rightarrow$$

$$E_k = (3 - 1) \times 1.67 \times 10^{-27} \times 9 \times 10^{16} \\ = 30.06 \times 10^{-11} \text{ J} \quad (17)$$

$$P = m v = \gamma m_0 v \quad (20)$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{8}{9} \frac{c^2}{c^2}}} = \frac{1}{\sqrt{\frac{1}{9}}}$$

$$\gamma = 3 \Rightarrow$$

$$P = 3 \times 9 \times 10^{-31} \times \frac{2\sqrt{2}}{3} \times 3 \times 10^8 \\ = 54\sqrt{2} \times 10^{-23} \text{ kg m s}^{-1} \quad (18)$$

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(16)

$$L = \frac{L_0}{\gamma} \Rightarrow 2a = \frac{4a}{\gamma} \Rightarrow \gamma = 2$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \Rightarrow 2 = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \Rightarrow$$

$$4 = \frac{1}{1 - \frac{v^2}{c^2}} \Rightarrow 1 - \frac{v^2}{c^2} = \frac{1}{4} \Rightarrow$$

$$\frac{v^2}{c^2} = 1 - \frac{1}{4} = \frac{3}{4} \Rightarrow v^2 = \frac{3}{4} c^2$$

$$v = \frac{\sqrt{3}}{2} c \quad (19)$$

$$E = E_k + E_0 = 3 E_0 + E_0$$

$$E = 4 E_0 \Rightarrow m c^2 = 4 m_0 c^2$$

$$m = 4 m_0 = 4 \times 1.67 \times 10^{-27} \\ = 6.68 \times 10^{-27} \text{ kg} \quad (20)$$

$$P = m v = \gamma m_0 v \quad (1)$$

$$E = 3 E_0 \Rightarrow m c^2 = 3 m_0 c^2 \Rightarrow m = 3 m_0$$

$$\Rightarrow \gamma = 3 \Rightarrow 3 = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \Rightarrow$$

$$9 = \frac{1}{1 - \frac{v^2}{c^2}} \Rightarrow 1 - \frac{v^2}{c^2} = \frac{1}{9} \Rightarrow$$

$$\frac{v^2}{c^2} = 1 - \frac{1}{9} = \frac{8}{9} \Rightarrow v^2 = \frac{8}{9} c^2 \Rightarrow$$

$$v = \frac{2\sqrt{2}}{3} c \quad \text{نقوضه بـ (1)}$$

$$P = 3 \times 1.67 \times 10^{-27} \times \frac{2\sqrt{2}}{3} \times 3 \times 10^8 \\ = 10.02\sqrt{2} \times 10^{-19} \text{ kg m s}^{-1} \quad (2)$$