PEMBAHASAN OLIMPIADE FISIKA

TINGKAT SMA/MA

A. Pilihan Ganda

1. Kunci B

   A x B = $|A|\ |B|$ Sin Θ = 12

   A . B = $|A|\ |B|$ Cos Θ = 16 :

   Tan Θ = 3/4

   Θ = 37^0

2. Kunci C

   A . B = 16

   $|A|\ |B|$ Cos Θ = 16

   $|A|\ |B|$ 0,8 = 16

   $|A|\ |B| = \frac{16}{0,8} = 20$

   $|A| = 4 \qquad |B| = 5$

3. Kunci E

   V_A = 15 m/s V_B = 10 m/s S = 200 m

   $V_{tot} = V_A + V_B$ = 25 m/s (karena berlawanan arah)

   S_{tot} = 200 m

   $t_A = t_B = t_{tot} = S / V_{tot} = 200 / 25 = 8$ sekon.

   $S_A = V_A . t_A = 15 . 8 = 120$ m.

4. Kunci B

   $V_{tot} = V_A - V_B$ = 5 m/s (karena searah)

   S = 200 m

   $t_A = S / V_{tot} = 200 / 5 = 40$ sekon

   $\Delta S = V_{tot} . t_A = 200$ m

   $S_A = S + \Delta S = 400$ m

5. Kunci D

   $V_{tot} = V_A - V_B$ = 5 m/s (karena searah)

   ΔS = 400 m – 200 m

   $t_{tot} = \Delta S / V_{tot} = 200 / 5 = 40$ sekon

6. Kunci A

   Saat peluru naik :

   $t_{naik} = \frac{V0 . Sin\ \theta}{g1}$

   $h_{max} = \frac{Vo^2 Sin^2\theta}{2\ g1}$

   Saat peluru turun :

   $t_{turun} = \sqrt{\frac{2\ hmax}{g2}} = \sqrt{\frac{2\ Vo^2\ Sin^2\theta}{2\ g1\ g2}}$

   $t_{turun} = V_0 \text{ Sin } \theta \sqrt{\frac{1}{g1\ g2}}$

   $t_{total} = t_{naik} + t_{turun}$

   $t_{tot} = \frac{V0\ Sin\ \theta}{g1} + V_0 \text{Sin } \theta \sqrt{\frac{1}{g1\ g2}}$

   $= \frac{V0\ Sin\ \theta}{g1} \left(1 + \sqrt{\frac{1}{g2}}\right)$

7. Kunci A

   $F = G\ M_1 M_2 / R^2$

   Dari rumus gravitasi Newton tersebut terlihat bahwa semakin besar jarak, maka semakin kecil gaya. Demikian juga dengan radiasi.

8. Kunci E

   $I \approx 1/R^2$

   Misal : $X_1 = 10{,}30 \rightarrow R_1^2 = 100^2$

   $X_2 = 120^2$

   $\frac{x}{10,3} = \frac{100^2}{120^2} \rightarrow x = \frac{10.000\ (0,3)}{14.400}$

   $X = 7{,}5\ \mu N/m^2$

9. Kunci D

   $I = \frac{E}{A\ .\ t}$; $P = \frac{I}{c}$

   $\frac{E}{c\ .\ t\ .\ A} = P$

   $\frac{E}{t} = 10{,}3 \times 10^{-6} \times 4\pi (100 \times 10^6)^2 \times 3 \times 10^8$

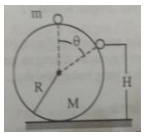
   $\frac{E}{t} = P = 3{,}9 \times 10^{26}$ watt

10. Kunci B

    $I \approx \frac{1}{R^2}$

    Dari rumus terlihat bahwa intensitas/gaya radiasi berbanding terbalik dengan kuadrat jarak.

11.Kunci B



$F_{sp} = W \cos \theta$

$\frac{m}{R}v^2 = mg \cos \theta$

$V = \sqrt{g.R.Cos\ \theta}$ . .....(i).....

$E_{P1} = E_{P2} + E_{K2}$

$m.g.2R = m.g(2R-h) + \frac{1}{2}mv^2$

$v = \sqrt{2.g.h}$ .....(ii).....

Subs (i) ke (ii) :

$\cos \theta = \frac{2h}{R}$ .....(iii).....

Dari gambar, $\cos \theta = \frac{R-h}{R}$ ...(iv)...

Subs (iii) ke (iv) :

$\cos \theta = \frac{2}{3}$

12.Kunci C

$V = \sqrt{g.R.Cos\theta} = \sqrt{\frac{2}{3}.g.R}$

13.Kunci C

$a_{tangensial} = g.\ Sin\theta \rightarrow Sin\ \theta = \frac{\sqrt{5}}{3}$

$= \frac{\sqrt{5}}{3}\ g$

$a_{sentripetal} = \frac{v^2}{R} = \frac{2}{3}\ g$

$a_{total} = \sqrt{\left(\frac{2}{3}g\right)^2 + \left(\frac{\sqrt{5}}{3}\right)^2} = g$

14.Kunci A

Saat partikel meninggalkan bola :

$V_{0y} = V_0.Sin\theta = \sqrt{\frac{2gR}{3}}.\ \frac{\sqrt{5}}{3} = \frac{1}{3}\sqrt{\frac{10gR}{3}}$

$Y = H - (V_{0y}\ .\ t - \frac{1}{2}.g.t^2) \rightarrow$ saat di lantai,

$Y = 0$

$0 = \frac{5}{3}R - \left(\frac{1}{3}\sqrt{\frac{10gR}{3}}\ .t\ + \frac{1}{2}.g.t^2\right)$

$0 = \frac{1}{2}.g.t^2 + \frac{1}{3}\sqrt{\frac{10gR}{3}} - \frac{5}{3}R$

Dengan menggunakan rumus ABC, :

$t = \frac{1}{3}\sqrt{\frac{10R}{g}}\left(-1 + \sqrt{\frac{10R}{3g}}\right)$

15.Bonus

$V_y = V_0.\ Sin\ \theta + g\ .\ t$

$= \frac{10}{3}\sqrt{\frac{gR}{3}}$

$V_x = V_0\ .\ Cos\ \theta = \frac{2}{3}\sqrt{\frac{2gR}{3}}$

$V_{total} = \sqrt{Vx^2 + Vy^2}$

$= 2\sqrt{g.R}$

16.Kunci D

Hk.Kekekalan Energi Mekanik :

$\frac{1}{2}\ .\ m.\ V_1^2 + \frac{1}{2}\ .\ K.\ X_1^2 = \frac{1}{2}\ .\ m.\ V_2^2 + \frac{1}{2}\ .\ K.\ X_2^2$

$K\ (X_1^2 - X_2^2) = m\ (v_2^2 - v_1^2)$

$\omega = ((V_2^2 - V_1^2)\ /\ (X_1^2 - X_2^2))^{1/2}$

17.Kunci A

$\frac{1}{2}\ .\ m.\ V_1^2 + \frac{1}{2}\ .\ K.\ X_1^2 = \frac{1}{2}\ .\ K.\ A^2$

$A^2 = \frac{m}{K}\ .\ V_1^2 + X_1^2$

$A^2 = \left(\frac{X1^2 - X2^2}{V2^2 - V1^2}\right) V_1^2 + X_1^2$

$A = \sqrt{\left(\frac{X1^2V2^2 - X2^2V1^2}{V2^2 - V1^2}\right)}$

18.Kunci E

$V = \sqrt{2.g.h} = \sqrt{2.10.50} = 10\sqrt{10}$ m/s

Angka yang paling dekat dengan $10\sqrt{10}$ adalah 25 m/s

19.Kunci A

$m.g.(50 + x) = \frac{1}{2}.K.X^2$

$50.10.(50 + x) = \frac{1}{2}.50.\ X^2$

$X = 43$ m

$L = 50 + 43 = 93$ m

$H = 200 - 93 = 107$ m

20.Kunci C

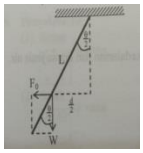
$m.g.(50 + x) = \frac{1}{2}.K.X^2$

$50.10.(50 + x) = \frac{1}{2}.50.\ X^2$

$X = 43$ m

$L = 50 + 43 = 93$ m

21.Kunci A



$\text{Tan}\frac{\theta}{2} = F_C / W$

$= \frac{K}{mg}\frac{Q^2}{d^2}$

Maka diperoleh :

$Q = \sqrt{\frac{d^2.m.g.Tan\frac{\theta}{2}}{K}}$

22.Kunci B

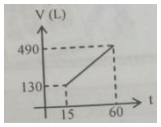
Laju bunyi di udara (ada pemantulan bunyi)

$V = \frac{2\,S}{t\ pantul} = \frac{2\ x\ 20\ m}{120\ x\ 10^{-3}\ s} = 333{,}3$ m/s

Jarak tembak kamera ke serangga :

$S = V \cdot \frac{1}{2}t_{pantul} = \frac{2\ .20\ m}{120\ ms}$ x 12 ms = 2 m

23.Kunci C



$\left(\frac{Y-Y1}{Y2-Y1}\right) = \left(\frac{X-X1}{X2-X1}\right)$

$\left(\frac{V-130}{490-130}\right) = \left(\frac{X-15}{60-15}\right)$

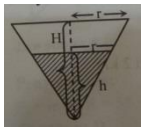
$\left(\frac{V-130}{360}\right) = \left(\frac{t-15}{45}\right)$

V = 8t + 10

24.Kunci B

$Q = \frac{\Delta V}{\Delta t} = \frac{490-130}{60-15} = 8$ L/menit

25.Kunci C



$r = \frac{R}{H} . h = \frac{1}{1} . h = h$

$V = \pi . r^2 . H / 3$

$490 = \frac{\pi}{3}r^3 \rightarrow r = \sqrt[3]{\frac{1470}{\pi}}$

$A = \pi r^2 = \pi \sqrt[3]{\frac{1470}{\pi}}$

$= \sqrt[3]{\frac{(1470)^2.\pi}{1}}$

B. Essay

1. $E = K.\frac{Q}{R^2} \rightarrow E = K\,\rho.\left(\frac{\frac{4}{3}\pi R^3}{R^2}\right) \rightarrow \rho =$ rapat muatan

   $E = K.\rho.\frac{4}{3}\pi.R$

   $3{,}2 .10^6 = 9.10^9.1{,}2.10^{10} .1{,}6. 10^{-19}. \frac{4}{3}$ .3,14.R

   R = 4,4 km

2. $E_M = \frac{1}{2}KA^2$

   $\frac{1}{2}mv^2 + \frac{1}{2}KY^2 = \frac{1}{2}KA^2$

   $m\ v^2 + m\ \omega^2 x_0^2 = m\ \omega^2 A^2$

   $v_0^2 + x_0^2\ \omega^2 = \omega^2 A^2$

   $A = \sqrt{Xo^2 + \left(\frac{Vo^2}{\omega^2}\right)}$

   $E = \frac{1}{2}K\sqrt{Xo^2 + \left(\frac{Vo^2}{\omega^2}\right)}$

3. Percepatan gravitasi dapat dirumuskan :

   $g = \frac{G\,M}{r^2}$

   maka perbandingan gravitasi pada ketinggian h diatas permukaan bumi/laut adalah :

   $\frac{g''}{g} = \left(\frac{r^2}{r''^2}\right) = \frac{Rb^2}{(Rb+h)^2}$

   Periode bandul : $T = 2\pi\sqrt{\frac{l}{g}}$

   Maka : $\frac{T''}{To} = \sqrt{\frac{l''}{l}.\frac{g}{g''}} = \sqrt{\frac{l}{lo}\frac{(Rb+h)^2}{Rb^2}}$

   $T'' = T_0\frac{(Rb+h)}{Rb}\sqrt{\frac{l}{lo}}$

4. $P_2 : T_2 = P_0 : T_0$

   $P_2 : \frac{3}{4}T_0 = P_0 : T_0$

   $P_2 = \frac{3}{4}P_0$

   Untuk usaha : $W = P\,.\,\Delta V$ ($\Delta V = 0$, karena wadah tertutup)

   $W = 0$

   Untuk Perubahan Energi Dalam : $\Delta U =$

   $Q = \frac{3}{2}n\,.\,R\,.\,T_0$

Untuk Energi yang dilepas : Q = W + ΔU

Q = $\Delta U = \frac{3}{2}$ n . R . T

5. $F_{LORENTZ} = F_{SENTRIPETAL}$

B . q . $V_0 = \frac{m}{R}. V_0^2$

B . q = m . ω

B . q = m . $\frac{2\pi}{T}$

T = $\frac{2\pi m}{Bq}$

t = 2T

h = μ_0 . t

= μ_0 . 2 . $\frac{2\pi m}{Bq}$

h = μ_0 . $\frac{4\pi m}{Bq}$