SOLUTIONS

PHASE TEST-1

MGZ-1904,1905

AIIMS PATTERN

Test Date: 05-11-2017

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PHYSICS

1. (2)

Nm $\rightarrow$ Unit of torque

mN $\rightarrow$ Milli newton $\Rightarrow 10^3$N

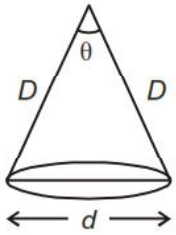
nm $\rightarrow$ Nano metre

Ns $\rightarrow$ Unit of momentum

2. (3)

$$\theta = \frac{\text{Arc length}}{\text{Radius}}$$

$$\theta = \frac{d}{D}$$



$$\Rightarrow \boxed{d = D\theta}$$

3. (1)

Time span of human life $= 10^9$ s

Age of universe $= 10^{17}$ s

So, $\frac{\text{Age of universe}}{\text{Time of human}} = \frac{10^{17}}{10^9} = 10^8$

If, $\frac{\text{Age of universe}}{100} = 10^8$

$$\Rightarrow \boxed{\text{Age of universe} = 10^{10}\text{ s}}$$

4. (4)

3×10^{-3}

3.0×10^{-3}

3.0×10^{-3}

3.00×10^{-3}

So, fourth measurement is most precise.

5. (2)

$r = (2.6 \pm 0.1)$cm

$$V = \frac{4}{3}\pi r^2$$

$$\frac{\Delta V}{V} \times 100\% = \frac{3\Delta r}{r} \times 100\%$$

$$\boxed{\frac{\Delta V}{V} \times 100\% = \frac{3 \times 0.1}{2.6} \times 100\%}$$

6. **(4)**

41.68 cm

The rightmost digit is most insignificant and leftmost is most significant.

So, 8 $\rightarrow$ most insignificant

4 $\rightarrow$ most significant

7. **(1)**

$F \propto V^a \rho^b g^c$

$F = [L^3]^a [ML^{-3}]^b [LT^{-2}]^c$

$[MLT^{-2}] = F = [M^b L^{3a-3b+c} T^{-2c}]$

On comparing

$\boxed{b = 1}$, $\quad -2c = -2 \quad \Rightarrow \quad \boxed{c = 1}$

$3a - 3b + c = 1$

$\Rightarrow 3a - 3 + 1 = 1$

$\Rightarrow \; 3a - 2 = 1$

$\Rightarrow 3a = 3 \Rightarrow \boxed{a = 1}$

So, on putting all these values, $\boxed{F = V\rho g}$

8. **(2)**

The dimensional formula of energy $E = [ML^2T^{-2}]$

So, dimensions of i) Mass $\rightarrow$ 1 ii) Length $\rightarrow$ 2 iii) Time $\rightarrow -2$

9. **(3)**

$$\text{Energy density} = \frac{E}{V} = \frac{1}{2}\varepsilon_0 E^2 \Rightarrow \frac{ML^2T^{-2}}{L^3} \Rightarrow \boxed{[ML^{-1}T^{-2}] = \frac{1}{2}\varepsilon_0 E^2}$$

10. **(3)**

$\frac{d^2y}{dx^2}$ will have dimensions of $\frac{y}{x^2}$

$y \rightarrow$ pressure, $x \rightarrow$ velocity gradient

$$x \rightarrow \frac{V}{L} \Rightarrow \frac{LT^{-1}}{L} \Rightarrow T^{-1} \qquad \frac{y}{x^2} = \frac{ML^{-1}T^{-2}}{T^{-2}} \Rightarrow [ML^{-1}]$$

11. **(3)**

$$F = \frac{\alpha - t^2}{\beta v^2}$$

Dimensionally, $\alpha = [T^2]$

$$[MLT^{-2}] = \frac{[T^2]}{\beta[L^2T^{-2}]}$$

$$\beta = \frac{T^2}{[MLT^{-2}.L^2T^{-2}]}$$

$$\Rightarrow \beta = [M^{-1}L^{-3}T^6]$$

Dimensions of $\frac{\alpha}{\beta} = \frac{T^2}{M^{-1}L^{-3}T^6} = [ML^3T^{-4}]$

12. (2)

$g = LT^{-2}$ $\qquad \frac{\Delta g}{g} = \frac{\Delta L}{L} = \frac{2\Delta T}{T}$

$$\Rightarrow \boxed{\frac{\Delta g}{g} = e_1 + 2e_2}$$

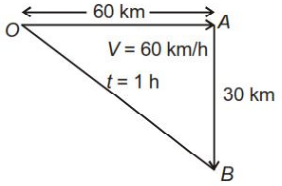
13. (1)

$$KE = \frac{1}{2}MV^2 \Rightarrow \frac{\Delta K}{K} \times 100\% = \frac{\Delta M}{M} \times 100\% + \frac{2\Delta V}{V} \times 100\%$$

$$\Rightarrow \boxed{\frac{\Delta K}{K} \times 100\% = 8\%}$$

14. (3)

Displacement of car $= \sqrt{60^2 + 30^2} = 30\sqrt{5}$ km



[Distance OA = Speed × Time
$\Rightarrow$ 60 × 1 h = 60 km]

15. (4)

$\sqrt{x} = t + 7$ $\qquad \Rightarrow x = (t+7)^2$

$= t^2 + 49 + 14t$ (squaring)

$\frac{dx}{dt} = 2t + 14$ $\boxed{v = 2t + 14} \Rightarrow \boxed{v \propto t}$

Acceleration :

$a = \frac{dv}{dt}$ $\qquad \boxed{a = 2ms^{-2}} \rightarrow$ constant

16. (3)

17. (2)

$x = A\sin\omega t$

$\frac{dx}{dt} = A\omega\cos\omega t$ $\qquad \Rightarrow \frac{d^2x}{dt^2} = -A\omega^2\sin\omega t$

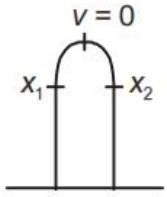
$\Rightarrow \boxed{a = -\omega^2 x}$ $\quad (\because A\sin\omega t = x)$

18. (1)

As the motion under gravity is symmetric, so distance travelled in last second of ascent is equal to first second of descent.

t = 1 s (1st second)

$$-x_2 = ut - \frac{1}{2}g \times 1^2$$



$$x_2 = \frac{1}{2}9.8 \times 1^2 \left(\because u = 0\right)$$

$$\Rightarrow \boxed{x_2 = 4.9m}$$

This distance is constant for every body thrown with any speed.

19. (4)

$$\text{Average acceleration} = \frac{\text{Change in velocity}}{\text{Time}} \Rightarrow \boxed{a_{av} = \frac{\int_{t_1}^{t_2} a\,dt}{t_2 - t_1}}$$

20. (2)

$$s = \frac{1}{2}g \times 1^2 \Rightarrow \boxed{s = \frac{g}{2}}$$

21. (4)

This graph is possible.

22. (2)

The speed of an object is directly proportional to time $\boxed{v \propto t}$

23. (3)

From 0 to 6 s $\rightarrow$ Displacement = 0

so, average velocity = 0

at t = 3 s, the displacement = 0, so v = 0

24. (2)

$$v = \frac{\text{Distance}}{\text{Time}} = \frac{40}{8} = 5 ms^{-1}$$

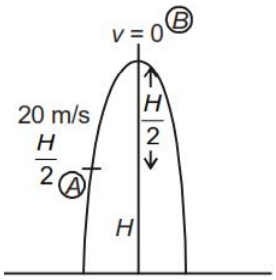
25. (3)

$$a = kx \text{ and } \frac{vdv}{dx} = a \Rightarrow \int_u^v vdv = \int_0^x adx = \int_0^x kxdx$$

$$\Rightarrow \frac{v^2}{2}\Big|_u^v = \frac{kx^2}{2}\Big|_0^2 \Rightarrow v^2 - u^2 = kx^2 \Rightarrow \boxed{v^2 = u^2 + kx^2}$$

26. (4)

$$v_B^2 - v_A^2 = -2g\left(\frac{H}{2}\right)$$



$$\Rightarrow 0 - 400 = -2 \times 10 \times \frac{H}{2}$$

$$\Rightarrow \boxed{40\ m = H}$$

27. (4)

None of the graph is physically possible.

28. (2)

Let the total height of tower = H

Total time of journey = t

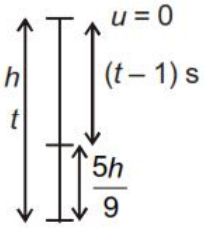
Time taken to cover the $\frac{5h}{9}$ is = last second

so, $s_t - s_{t-1} = \frac{5h}{9}$

$$\Rightarrow \frac{1}{2}gt^2 - \frac{1}{2}g(t-1)^2 = \frac{5}{9} \times \frac{1}{2}gt^2 \qquad \left[\because h = \frac{1}{2}gt^2\right]$$

$$\Rightarrow \frac{1}{2}g(t^2 - t^2 - 1 + 2t) = \frac{1}{2}gt^2 \times \frac{5}{9}$$

$$\Rightarrow (2t-1) = \frac{5}{9}t^2$$



$$\Rightarrow 18t - 9 = 5t^2$$

$$\Rightarrow 5t^2 - 18t + 9 = 0$$

$$\Rightarrow 5t^2 - 15t - 3t + 9 = 0$$

$\Rightarrow 5t(t-3)-3(t-3)=0$

$\Rightarrow (5t-3)(t-3)=0$

$t=\frac{3}{5}, \boxed{r=3s}$ $\left(t=\frac{3}{5},\right.$, doesn't satisfy the given criterion, so we neglect it)

29. (3)

Given vectors can be rewritten as $\vec{A}=2\hat{i}+3\hat{j}+8\hat{k}$ and $\vec{B}=-4\hat{i}+4\hat{j}+\alpha\hat{k}$

Dot product of these vectors should be equal to zero because they are perpendicular.

$\therefore\ \vec{A}.\vec{B}=-8+12+8\alpha=0\ \Rightarrow 8\alpha=-4\Rightarrow \alpha=-1/2$

30. (3)

We know that $\vec{A}\times\vec{B}=-(\vec{B}\times\vec{A})$ because the angle between these two is always 90°.

But if the angle between $\vec{A}$ and $\vec{B}$ is 0 or π. Then $\vec{A}\times\vec{B}=\vec{B}\times\vec{A}=0$.

31. (1)

$W=\vec{F}.\vec{s}=(5\hat{i}+6\hat{j}+4\hat{k})(6\hat{i}-5\hat{k})=30-20=10$

32. (4)

$$\cos\theta=\frac{\vec{A}\vec{B}}{AB}=\frac{42+24-12}{\sqrt{36+36+9}\sqrt{49+16+16}}=\frac{56}{9\sqrt{71}}$$

$\cos\theta=\frac{56}{9\sqrt{71}}\ \therefore \sin\theta=\frac{\sqrt{5}}{3}$ or $\theta=\sin^{-1}\left(\frac{\sqrt{5}}{3}\right)$

33. (2)

$|\vec{A}\times\vec{B}|=\vec{A}.\vec{B}\Rightarrow AB\sin\theta=AB\cos\theta\Rightarrow\tan\theta=1$

$\therefore\ \theta=45°$

34. (1)

35. (4)

$|\vec{A}\times\vec{B}|=\sqrt{3}(\vec{A}.\vec{B})$

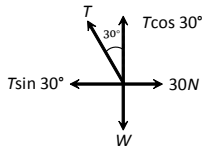
$AB\sin\theta=\sqrt{3}AB\cos\theta\Rightarrow\ \tan\theta=\sqrt{3}\ \therefore\ \theta=60°$

Now, $|\vec{R}|=|\vec{A}+\vec{B}|=\sqrt{A^2+B^2+2AB\cos\theta}$

$$=\sqrt{A^2+B^2+2AB\left(\frac{1}{2}\right)}=(A^2+B^2+AB)^{1/2}$$

36. (2)

37. (2)



From the figure $T\sin 30^\circ = 30$ …(i)

$$T\cos 30^\circ = W \quad \ldots(ii)$$

By solving equation (i) and (ii) we get

$W = 30\sqrt{3}N$ and $T = 60N$

38. (3)

$\sin^2\alpha + \sin^2\beta + \sin\gamma$

$= 1 - \cos^2\alpha + 1 - \cos^2\beta + 1 - \cos^2\gamma$

$= 3 - (\cos^2\alpha + \cos^2\beta + \cos^2\gamma) = 3 - 1 = 2$

39. (2)

40. (4)

$$\Delta v = 2v\sin\left(\frac{90^\circ}{2}\right) = 2v\sin 45^\circ = 2v \times \frac{1}{\sqrt{2}} = \sqrt{2}v \qquad = \sqrt{2} \times r\omega = \sqrt{2} \times 1 \times \frac{2\pi}{60} = \frac{\sqrt{2}\pi}{30}\ \text{cm/s}$$

CHEMISTRY

61. (1)

$Cu^+ - 1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}$

62. (3)

$n = 5\ l = 0 \rightarrow 5s$

$n = 4\ l = 1 \rightarrow 4P$

$n = 3\ l = 2 \rightarrow 3d \rightarrow$ lower energy.

63. (4)

$E_1 = -13.6ev$

$E_2 = -3.4ev$

$\Delta E = E_2 - E_1 = 13.6 - 3.4 = 10.2ev$

64. (2)

65. (3)

For He^+

$$E = -13.6\frac{Z^2}{n^2} = -\frac{13.6 \times Z^2}{1^2} = -54.4ev$$

66. **(1)**

$$\frac{1}{\lambda} = R\left(\frac{1}{1^2} - \frac{1}{\infty^2}\right)$$

$$\frac{1}{\lambda} = 1.097 \times 10^7$$

$$\frac{1}{\lambda} = \frac{1}{1.097} \times 10^{-7}\,m$$

$$= \frac{100}{1.097} \times 10^{-9}\,m$$

= 91 nm

67. **(2)**

68. **(1)**

$Fe^{+2} - 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6$

69. **(3)**

Mn^{+2} has maximum unpaired electron (5) so its magnetic moment is highest.

70. **(2)**

$n = 3, l = 2\ m = +2 \rightarrow 3d$

$m = -2\ -1\ 0\ +1\ +2$

71. **(4)**

72. **(2)**

orbital angular momentum = $\sqrt{l(l+1)}\,\frac{h}{2\pi}$

= $\sqrt{l(1+1)}\,\frac{h}{2\pi}$

= $\sqrt{2}\,\frac{h}{2\pi} = \frac{h}{\sqrt{2}\pi}$

73. **(3)**

74. **(1)**

75. **(4)**

$$4PH_3 \xrightarrow{\Delta} P_4 + 6H_2$$

4 ml PH_3 gives 6 ml H_2

$\therefore$ 100 ml $PH_3 = \frac{6}{4} \times 100 = 150\,ml\,H_2.$

so volume increases by 50 ml.

76. (3)

77. (2)

$$\text{Average at. mass} = \frac{\begin{array}{l}\%\text{ of 1st isotope} \times \text{At.mass} + \% \\ \text{of 2nd isotope} \times \text{At. mass} + \% \\ \text{of 3rd isotope} \times \text{At. mass.}\end{array}}{100}$$

78. (3)

79. (1)

80. (1)

Let molar mass be x

$$x \times \frac{4.6}{100} = 56$$

$$\therefore \quad x = \frac{5600}{4.6} = 1200\,u.$$

81.	**(4)**	**82.**	**(1)**	**83.**	**(1)**	**84.**	**(3)**	**85.**	**(2)**	**86.**	**(2)**	**87.**	**(2)**
88.	**(3)**	**89.**	**(2)**	**90.**	**(1)**	**91.**	**(1)**	**92.**	**(1)**	**93.**	**(3)**	**94.**	**(1)**
95.	**(3)**	**96.**	**(4)**	**97.**	**(1)**	**98.**	**(2)**	**99.**	**(3)**	**100**	**(1)**	**101.**	**(1)**
102.	**(3)**	**103.**	**(1)**	**104.**	**(1)**	**105.**	**(2)**	**106.**	**(1)**	**107.**	**(1)**	**108.**	**(2)**
109.	**(2)**	**110.**	**(2)**	**111.**	**(1)**	**112.**	**(4)**	**113.**	**(3)**	**114.**	**(3)**	**115.**	**(1)**
116.	**(1)**	**117.**	**(1)**	**118.**	**(1)**	**119.**	**(1)**	**120.**	**(2)**				

BIOLOGY

121.	**(1)**	**122.**	**(3)**	**123.**	**(3)**	**124.**	**(4)**	**125.**	**(3)**	**126.**	**(3)**	**127.**	**(3)**
128.	**(4)**	**129.**	**(4)**	**130.**	**(4)**	**131.**	**(2)**	**132.**	**(3)**	**133.**	**(3)**	**134.**	**(1)**
135.	**(4)**	**136.**	**(2)**	**137.**	**(2)**	**138.**	**(1)**	**139.**	**(1)**	**140.**	**(1)**	**141.**	**(4)**
142.	**(3)**	**143.**	**(1)**	**144.**	**(1)**	**145.**	**(2)**	**146.**	**(1)**	**147.**	**(3)**	**148.**	**(3)**
149.	**(4)**	**150.**	**(1)**	**151.**	**(2)**	**152.**	**(4)**	**153.**	**(3)**	**154.**	**(2)**	**155.**	**(3)**
156.	**(1)**	**157.**	**(4)**	**158.**	**(4)**	**159.**	**(3)**	**160.**	**(4)**	**161.**	**(1)**	**162.**	**(2)**
163.	**(2)**	**164.**	**(2)**	**165.**	**(3)**	**166.**	**(1)**	**177.**	**(1)**	**168.**	**(2)**	**169.**	**(2)**
170.	**(3)**	**171.**	**(4)**	**172.**	**(1)**	**173.**	**(3)**	**174.**	**(2)**	**175.**	**(1)**	**176.**	**(1)**
177.	**(1)**	**178.**	**(2)**	**179.**	**(1)**	**180.**	**(1)**						

GENERAL KNOWLEDGE

181.	**(4)**	**182.**	**(4)**	**183.**	**(3)**	**184.**	**(3)**	**185.**	**(3)**	**186.**	**(2)**	**187.**	**(2)**
188.	**(3)**	**189.**	**(2)**	**190.**	**(2)**	**191.**	**(1)**	**192.**	**(4)**	**193.**	**(1)**	**194.**	**(3)**
195.	**(4)**	**196.**	**(1)**	**197.**	**(3)**	**198.**	**(2)**	**199.**	**(3)**	**200.**	**(3)**		