Answer Key

PHYSICS	CHEMISTRY	BOTANY	ZOOLOGY
1. (b)	46. (c)	91. (c)	136. (d)
2. (d)	47. (d)	92. (a)	137. (b)
3. (b)	48. (d)	93. (d)	138. (a)
4. (c)	49. (a)	94. (a)	139. (b)
5. (a)	50. (b)	95. (c)	140. (a)
6. (d)	51. (c)	96. (d)	141. (a)
7. (b)	52. (c)	97. (a)	142. (d)
8. (d)	53. (a)	98. (d)	143. (c)
9. (d)	54. (a)	99. (b)	144. (d)
10. (b)	55. (b)	100. (c)	145. (c)
11. (b)	56. (b)	101. (b)	146. (c)
12. (c)	57. (a)	102. (d)	147. (b)
13. (a)	58. (c)	103. (d)	148. (b)
14. (a)	59. (c)	104. (c)	149. (c)
15. (c)	60. (d)	105. (c)	150. (b)
16. (c)	61. (c)	106. (d)	151. (c)
17. (b)	62. (d)	107. (b)	152. (a)
18. (a)	63. (a)	108. (a)	153. (b)
19. (d)	64. (c)	109. (a)	154. (d)
20. (d)	65. (c)	110. (a)	155. (c)
21. (b)	66. (b)	111. (a)	156. (d)
22. (a)	67. (b)	112. (d)	157. (a)
23. (a)	68. (c)	113. (a)	158. (d)
24. (a)	69. (b)	114. (c)	159. (c)
25. (c)	70. (d)	115. (b)	160. (d)
26. (d)	71. (b)	116. (d)	161. (d)
27. (c)	72. (d)	117. (b)	162. (a)
28. (d)	73. (a)	118. (b)	163. (d)
29. (a)	74. (a)	119. (a)	164. (d)
30. (a)	75. (a)	120. (a)	165. (d)
31. (d)	76. (b)	121. (c)	166. (b)
32. (d)	77. (a)	122. (b)	167. (d)
33. (a)	78. (a)	123. (d)	168. (c)
34. (b)	79. (c)	124. (d)	169. (d)
35. (b)	80. (a)	125. (b)	170. (d)
36. (a)	81. (d)	126. (c)	171. (d)
37. (d)	82. (c)	127. (c)	172. (c)
38. (b)	83. (c)	128. (b)	173. (c)
39. (a)	84. (c)	129. (a)	174. (d)
40. (a)	85. (c)	130. (b)	175. (a)
41. (a)	86 (b)	131. (b)	176. (a)
42. (d)	87. (a)	132. (b)	177. (c)
43. (b)	88. (d)	133. (a)	178. (b)
44. (d)	89. (a)	134. (c)	179. (c)
45. (d)	90. (c)	135. (a)	180. (c)

Hint & Solutions

PHYSICS

1. Work done by centripetal force is always zero, because force and instantaneous displacement are always perpendicular.

$W = \vec{F}.\vec{s} = Fs\cos\theta = Fs\cos(90°) = 0$

2. Stopping distance $S \propto u^2$. If the speed is doubled then the stopping distance will be four times.

3. Work done does not depend on time.

4. $W = \vec{F}.\vec{s} = (5\hat{i} + 3\hat{j}).(2\hat{i} - \hat{j}) = 10 - 3 = 7\ J$

5. $\text{Power} = \dfrac{\text{workdone}}{\text{time}} = \dfrac{\text{pressure} \times \text{change in volume}}{\text{time}} = \dfrac{20000 \times 1 \times 10^{-6}}{1} = 2 \times 10^{-2} = 0.02\,W$

7. Work done $= mgh = 10 \times 9.8 \times 1 = 98\,J$

8. Net force on body $= \sqrt{4^2 + 3^2} = 5N$

$\therefore a = F / m = 5/10 = 1/2\,m/s^2$

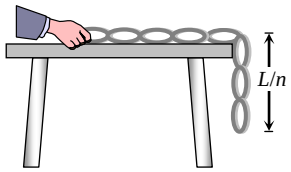
Kinetic energy = $\dfrac{1}{2}mv^2 = \dfrac{1}{2}m(at)^2 = 125\,Joule$

9. *Watt* and *Horsepower* are the unit of power

10. Work = Force × Displacement

If force and displacement both are doubled then work would be four times.

11. Fraction of length of the chain hanging from the table



$= \dfrac{1}{n} = \dfrac{60cm}{200cm} = \dfrac{3}{10} \Rightarrow n = \dfrac{10}{3}$

Work done in pulling the chain on the table

$W = \dfrac{mgL}{2n^2} = \dfrac{4 \times 10 \times 2}{2 \times (10/3)^2} = 3.6J$

12. When a force of constant magnitude which is perpendicular to the velocity of particle acts on a particle, work done is zero and hence change in kinetic energy is zero.

13. K.E. acquired by the body = work done on the body

$K.E. = \dfrac{1}{2}mv^2 = Fs$ *i.e.* it does not depend upon the mass of the body although velocity depends upon the mass

$v^2 \propto \dfrac{1}{m}$ [If F and s are constant]

14. As surface is smooth so work done against friction is zero. Also the displacement and force of gravity are perpendicular so work done against gravity is zero.

15. Opposing force in vertical pulling = mg

But opposing force on an inclined plane is $mg\sin\theta$, which is less than mg.

16. When the ball is released from the top of tower then ratio of distances covered by the ball in first, second and third second

$h_I : h_{II} : h_{III} = 1:3:5:$ [because $h_n \propto (2n-1)$]

$\therefore$ Ratio of work done $mgh_I : mgh_{II} : mgh_{III}$ = 1:3:5

17. $W\int_0^{x_1} F.dx = \int_0^{x_1} Cx\,dx = C\left[\dfrac{x^2}{2}\right]_0^{x_1} = \dfrac{1}{2}Cx_1^2$

18. $\dfrac{1}{2}kS^2 = 10\ J$ (given in the problem)

$\dfrac{1}{2}k\left[(2S)^2 - (S)^2\right] = 3 \times \dfrac{1}{2}kS^2 = 3 \times 10 = 30\ J$

19. $W = \int_0^5 F dx = \int_0^5 (7 - 2x + 3x^2)\, dx = [7x - x^2 + x^3]^5 = 35 - 25 + 125 = 135\ J$

20. $S = \frac{t^3}{3} \therefore\ dS = t^2 dt$

$a = \frac{d^2S}{dt^2} = \frac{d^2}{dt^2}\left[\frac{t^3}{3}\right] = 2t\ m/s^2$

Now work done by the force $W = \int_0^2 F.dS = \int_0^2 ma.dS$

$\int_0^2 3 \times 2t \times t^2 dt = \int_0^2 6t^3 dt = \frac{3}{2}\left[t^4\right]_0^2 = 24\ J$

21. $\frac{1}{2}mv^2 = \frac{1}{2}kx^2 \Rightarrow x = v\sqrt{\frac{m}{k}} = 10\sqrt{\frac{0.1}{1000}} = 0.1m$

22. $W = \int F\, dx$

$W = \frac{mkx^2}{2}$

23. If x is the extension produced in spring.

$F = kx \Rightarrow x = \frac{F}{k} = \frac{mg}{k} = \frac{20 \times 9.8}{4000} = 4.9\,cm$

24. $U = \frac{F^2}{2k} = \frac{T^2}{2k}$

25. $P = \sqrt{2mE} \therefore P \propto \sqrt{m}$ (if $E = \text{const.}$) $\therefore \frac{P_1}{P_2} = \sqrt{\frac{m_1}{m_2}}$

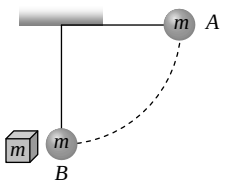
26. $E = \frac{P^2}{2m} \therefore E \propto P^2$

i.e. if P is increased n times then E will increase n^2 times.

27. P.E. of bob at point $A = mgl$

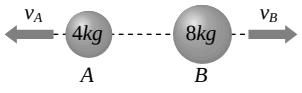
This amount of energy will be converted into kinetic energy

$\therefore$ K.E. of bob at point $B = mgl$



and as the collision between bob and block (of same mass) is elastic so after collision bob will come to rest and total Kinetic energy will be transferred to block. So kinetic energy of block = mgl

28. As the initial momentum of bomb was zero, therefore after explosion two parts should possess numerically equal momentum



i.e. $m_A v_A = m_B v_B \Rightarrow 4 \times v_A = 8 \times 6 \Rightarrow v_A = 12\ m/s$

$\therefore$ Kinetic energy of other mass A, $= \frac{1}{2}m_A v_A^2 = \frac{1}{2} \times 4 \times (12)^2 = 288\ J.$

29. Power of gun $= \dfrac{\text{Total K.E. of fired bullet}}{\text{time}} = \dfrac{n \times \frac{1}{2}mv^2}{t} = \dfrac{360}{60} \times \dfrac{1}{2} \times 2 \times 10^{-2} \times (100)^2 = 600W$

30. Let initial kinetic energy, $E_1 = E$

Final kinetic energy, $E_2 = E + 300\%$ of $E = 4E$

As $P \propto \sqrt{E} \Rightarrow \dfrac{P_2}{P_1} = \sqrt{\dfrac{E_2}{E_1}} = \sqrt{\dfrac{4E}{E}} = 2 \Rightarrow P_2 = 2P_1$

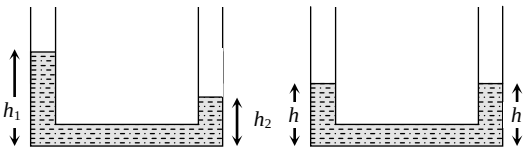
$\Rightarrow \quad P_2 = P_1 + 100\%$ of P_1

i.e. Momentum will increase by 100%.

31. Condition for vertical looping

$\dfrac{1}{2}m(5gR) = mgh$

32. If h is the common height when they are connected, by conservation of mass



$\rho A_1 h_1 + \rho A_2 h_2 = \rho h(A_1 + A_2)$

$h = (h_1 + h_2)/2$ [as $A_1 = A_2 = A$ given]

As (h_1/2) and (h_2/2) are heights of initial centre of gravity of liquid in two vessels., the initial potential energy of the system

$$U_i = (h_1 A\rho)g\frac{h_1}{2} + (h_2 A\rho)\frac{h_2}{2} = \rho gA\frac{(h_1^2 + h_2^2)}{2} \qquad \text{...(i)}$$

When vessels are connected the height of centre of gravity of liquid in each vessel will be h/2,

i.e. $(\dfrac{(h_1 + h_2)}{4}$ [as $h = (h_1 + h_2)/2]$

Final potential energy of the system

$$U_F = \left[\frac{(h_1 + h_2)}{2} A\rho\right] g\left(\frac{h_1 + h_2}{4}\right)$$

$$= A\rho g\left[\frac{(h_1 + h_2)^2}{4}\right] \qquad \ldots\text{(ii)}$$

Work done by gravity

$$W = U_i - U_f = \frac{1}{4}\rho gA[2(h_1^2 + h_2^2) - (h_1 + h_2)^2] = \frac{1}{4}\rho gA(h_1 \sim h_2)^2$$

33. $E = \dfrac{P^2}{2m}$. If m is constant then $E \propto P^2$

$$\Rightarrow \frac{E_2}{E_1} = \left(\frac{P_2}{P_1}\right)^2 = \left(\frac{1.2P}{P}\right)^2 = 1.44$$

$\Rightarrow E_2 = 1.44E_1 = E_1 + 0.44E_1$

$E_2 = E_1 + 44\%$ of E_1

i.e. the kinetic energy will increase by 44%

34. Because 50% loss in kinetic energy will affect its potential energy and due to this ball will attain only half of the initial height.

35. Change in gravitational potential energy= Elastic potential energy stored in compressed spring

$$\Rightarrow mg(h+x)=\frac{1}{2}kx^2$$

37. $P=\vec{F}.\vec{v}=ma\times at=ma^2t$ [as $u=0$]

$$=m\left(\frac{v_1}{t_1}\right)^2 t=\frac{mv_1^2t}{t_1^2} \qquad \left[\text{As } a=v_1/t_1\right]$$

38. If a motor of 12 *HP* works for 10 days at the rate of 8 *hr/day* then energy consumption = power × time

$$=12\times 746\frac{J}{\sec}\times(80\times 60\times 60)\sec$$

$$=12\times 746\times 80\times 60\times 60\ J = 2.5\times 10^9\ J$$

Rate of energy = $50\frac{paisa}{kWh}$

i.e. $3.6\times 10^6\ J$ energy cost 0.5 *Rs*

So 2.5×10^9 *J* energy cost = $\frac{2.5\times 10^9}{2\times 3.6\times 10^6}=358\ Rs$

39. $P=Fv=F\times\frac{s}{t}=40\times\frac{30}{60}=20W$

40. $P=\frac{\vec{F}.\vec{s}}{t}=\frac{(2\hat{i}+3\hat{j}+4\hat{k}).(3\hat{i}+4\hat{j}+5\hat{k})}{4}=\frac{38}{4}=9.5\,W$

41. The work done, $W=\vec{F}.\vec{s}=Fs\cos\theta$, when a person walk on a horizontal road with load on his head then $\theta=90°$.

Hence $W=Fs\cos 90°=0$

Thus no work is done by the person.

42. When a body slides down on inclined plane, work done by friction is negative because it opposes the motion ($\theta=180°$ between force and displacement)

If $\theta<90°$ then W =positive because $W=F.s.\cos\theta$

43. $P=\vec{F}.\vec{v}$ and unit of power is *Watt*.

44. Rate of change of momentum is proportional to external forces acting on the system. The total momentum of whole system remain constant when no external force is acted upon it.

Internal forces can change the kinetic energy of the system.

45. Work done and power developed is zero in uniform circular motion only.

CHEMISTRY

46. (c)

$$V_2=\frac{T_2}{T_1}.V_1=\frac{270^oK}{300^oK}\times 300ml=270ml$$

47. (d)

$\frac{P_1}{P_2}=\frac{1}{2},\therefore \frac{V_1}{V_2}=\frac{P_2}{P_1}=\frac{2}{1}$

$\frac{2L}{V_2}=\frac{2}{1}$; $V_2=1L$

48. (d)

49. (a)

no. of moles of $O_2=\frac{4}{32}=0.125$

no. of moles of $H_2=\frac{2}{2}=1$

total no. of moles = $1+0.125=1.125$

$P=\frac{nRT}{V}=\frac{1.125\times 0.082\times 273}{1}=25.184 atm.$

50. (b)

$\frac{r_{He}}{r_{CH_4}}=\sqrt{\frac{M_{CH_4}}{M_{He}}}=\sqrt{\frac{16}{4}}=2$

51. (c)

$P_{H_2}=\frac{\frac{20}{2}}{\frac{80}{32}+\frac{20}{2}}\times 1$

52. (c)

$751\ mm\,Hg = P_{O_2}+aqueous\ tension$

53. (a)

54. (a)

$r_{SO_2}:r_{O_2}:r_{CH_4}=\frac{1}{\sqrt{M_{SO_2}}}:\frac{1}{\sqrt{O_2}}:\frac{1}{\sqrt{CH_4}}$

$=\frac{1}{\sqrt{64:32:16}}=\frac{1}{\sqrt{4:2:1}}$

$\frac{1}{2}:\frac{1}{\sqrt{2}}:\frac{1}{1}$; $\frac{2}{2}:\frac{2}{\sqrt{2}}:\frac{2}{1}$; $1:\sqrt{2}:2$

55. (b)

If $Z<1$ then molar volume is less than 22.4 L

56. (b)

57. (a)

$V_{av}:V_{rms}:V_{\text{most probable}} = V:U:\alpha$

$\sqrt{\frac{8RT}{\pi M}}:\sqrt{\frac{3RT}{M}}:\sqrt{\frac{2RT}{M}}$

$\alpha:V:U=\sqrt{2}:\sqrt{\frac{8}{\pi}}:\sqrt{3}$ $=1:1.128:1.224$

58. (c)

Gas deviate from ideal gas behaviour to real gas (according to Vander Waal's at low temperature and high pressure)

59. (c)
At same temperature and pressure, equal volumes have equal number of molecules. If 1*lit*. of oxygen consists *N* molecules then at same temperature and pressure 1 *lit* of SO_2 will consists *N* molecules. So 2 lit. of SO_2 will contain $2N$ molecules.

60. (d)
For *Z* gas of given gases, critical temperature is highest
$$T_c = \frac{8a}{27Rb} \Rightarrow T_c = \frac{8\times 12}{27\times .0821\times .027} = 1603.98K$$

61. (c)

62. (d)

63. (a)
$$\left(P + \frac{n^2a}{V^2}\right)(V - nb) = nRT$$
$$\left(P + \frac{2.253}{0.25\times 0.25}\right)(0.25 - 0.0428) = 0.0821\times 300$$
or $(P + 36.048)(0.2072) = 24.63$
$\Rightarrow P + 36.048 = 118.87 \Rightarrow P = 82.82$ atm.

64. (c)

65. (c)

66. (b)
At high temperature and low pressure, Vander Waal's equation is reduced to ideal gas equation.
$PV = nRT$
$PV = RT$ (For 1 mole of gas)

67. (b)

68. (c)
$P_{gas} + 15.6 = 43.7 + 70.7$
P_{gas} = 98.8 cm Hg.
= 1.3 atm. (1 atm = 76 cm Hg)

69. (b)
At Boyle temperature real gas is changed into ideal gas

70. (d)

71. (b)

72. (d)

73. (a)
Average kinetic energy $\propto$ (*T* Kelvin)
$$\text{(Factor)}\ \frac{K.E_2}{K.E_1} = \frac{T_2}{T_1} = \frac{40 + 273}{20 + 273} = \frac{313}{293}$$

74. (a)

75. (a)

From density = $\frac{PM}{RT}$

$= \frac{2\times M}{RT} = \frac{5\times 28}{RT}$

$\Rightarrow$ M = 70 gram

76. (b)

77. (a)
Ammonia will liquefy first because its critical temperature will be reached first. Liquifaction of other gases will require more cooling.

78. (a)
$\rho = \frac{PM}{RT} \Rightarrow P = \frac{\rho RT}{M} \Rightarrow P_x = \frac{\rho_x RT}{M_x}; P_y = \frac{\rho_y RT}{M_y}$

Given, $\rho_y = 3\rho_x$

$M_y = 2M_x$

$\Rightarrow \quad \frac{P_x}{P_y} = 6$

79. (c)
$U_{rms} = \sqrt{\frac{3RT}{M}}; U_{rms} \propto \sqrt{\frac{T}{M}} \Rightarrow \frac{U_{rms}(H_2 \text{ at } 50\ K)}{(O_2 \text{ at } 800\ K)} = \sqrt{\frac{50}{2}\times\frac{32}{800}} = 1$

80. (a)
$\left(P + n^2a/V^2\right)(V - nb) = nRT$

At high pressures, 'b' cannot be ignored because volume of gas is very low. At high temperature 'a' can be ignored as the pressure of the gas is high.

$\therefore$ P (V – b) = RT $\Rightarrow$ PV – Pb = RT $\Rightarrow$ PV = RT + Pb $\Rightarrow$ $\frac{PV}{RT} = Z = 1 + \frac{Pb}{RT}$

81. (d)
$NH_3 + HCl \rightarrow NH_4Cl$

82. (c)

83. (c)

84. (c)

85. (c)
$V_{rms} = \sqrt{\frac{3RT}{M}}$

For H_2 gas $V_{rms} = \sqrt{\frac{3RT(H_2)}{2\times10^{-3}}}$

For N_2 gas $V_{rms} = \sqrt{\frac{3RT(N_2)}{28\times10^{-3}}}$

$\sqrt{\frac{3RT(H_2)}{2\times10^{-3}}} = \sqrt{7}\times\sqrt{\frac{3RT(N_2)}{28\times10^{-3}}}$

$\frac{TH_2}{2} = 7\frac{TN_2}{28}$

$TN_2 = 2\times TH_2$

86 (b)
$R = \frac{PV}{T}$ for 1 mole

$PV = \frac{N}{m^2} m^3 = N \times m$

Which is Joule unit of work.

87. (a)

88. (d)

At high pressure, $\frac{an^2}{v^2}$ will be negligible in comparison to the pressure P, therefore Assertion is incorrect but Reason is correct.

89. (a)

90. (c)

BOTANY

91. (c)
The position of gynoecium is not explain with the help of floral formula.
92. (a)
Axillary buds is the "Eyes" of the potato tuber, which develop the new plant.
93. (d)
These roots originate from the base of the stem constitute the Fibrous roots.
94. (a)
The primary root then develop into tap root.
95. (c)
Place of origin other than radical.
96. (d)
The stem does not having the root cap and root hair but having the node and internodes.
97. (a)
Pneumatophores root is negatively geotropic and having the Pneumatophores for respiration.
98. (d)
The fruit which develop from inflorescence is called composite fruit.
99. (b)
Maturation zone – Elongation zone – Cell division zone.
100. (c)
Phylloclade reduce the rate of transpiration and do the photosynthesis.
101. (b)
Grasses and strawberry do the vegetative propagation.
102. (d)
103. (d)
Leaf is not a traspiratory organ, the prime function of the leaf is photosynthesis.
104. (c)
105. (c)
Australian acacia to reduce the rate of transpiration.
106. (d)
In Racemose inflorescence there is acropetal arrangement of flowers on peduncle and continuous growth of main axis.
107. (b)
Monadelphous in Malvaceae.
108. (a)
109. (a)

110. (a)
A – Hypogynous flower, B – Perigynous flower, C – Epigynous flower
111. (a)
112. (d)
113. (a)
A - Epicarp, B - Mesocarp, C - Seed, Endocarp

114. (c)
A – Endosperm, B – Embryo, C – Scutellum, D – Coleoptile, E – Colerrhiza
115. (b)
Along the margin of single carpel in the case of Pea.
116. (d)
Multicarpellary syncarpous uniloculalr ovary single ovule in each locule.
117. (b)
Seedless fruit is parthenocarpic fruit, it develop without fertilization.
118. (b)
In mango and coconut, fruit is Drupe, Pericarp is differentiated into Epicarp, mesocarp and endocarp.
119. (a)
One cotyledon is found in Wheat and maize.
120. (a)
Maize grain is a Seed, it having one cotyledon.
121. (c)
Plumule is covered by Coleoptile in monocot seed.
122. (b)
123. (d)
124. (d)
These are the floral characteristic of Solanaceae.
125. (b)
K denotes gamosepalous.
126. (c)
Trimerous, actinomorphic, polyandrous, superior ovary, axile placentation.
127. (c)
Neel is obtained from *Indigofera tinctoria*.
128. (b)
Pisum in Fabaceae, Solanum nigrum in Solanaceae and Allium cepa is Liliaceae.
129. (a)
Leguminosae is subdivided into 3 sub-family the one of them is Popiliionoideae / Febaceae.
130. (b)
Colchicine is obtained from corm corm of Colchicum which belongs to the family Liliaceae.
131. (b)
Potato tuber is an underground stem because it having node and internode and bud.

132. (b)
Still roots develop from the basal nodes of the stem, it is adventitious root.
133. (a)
It is possible to distinguish a leaf from a leaflet because a bud is never present in the axil of a leaflet.
134. (c)
Bulb is modified underground stem but food stored in flashy leaf.
135. (a)
It is possible to identify nodes on a stem because leaves arise from the nodes of a stem.

ZOOLOGY

136. Trachea is supported by C-shaped rings of incomplete cartilage.
139. Medulla has medullary rhythmicity area which maintains basic rhythm of respiration.
140. Residual volume is the volume of air which always remains entrapped in alveoli.
142. Aquatic molluscs have gills (ctenidia)
144. Stomach is located in the left portion of the abdominal cavity.
146. Brunner's glands are also called duodenal digestive glands and these secrete mucus bicarbonate ions.
149. Conducting zone conditions the incoming air i.e. it filter, warms and moistens the air.
153. Salivary amylase of saliva breaks starch into maltose and isomaltose
154. Parietal cells or oxyntic cells secrete HCl which activates pepsinogen.
156. Parietal cells secrete castle's intrinsic factor which is a glycoprotein and helps in absorption of vitamin B_{12} in ileum.
161. Lacteals are present in villi of small intestine.

164. Herbivores have a complex alimentary canal.
167. Hepatic cells or hepatocytes are cells of liver and produce bile juice.
168. Bile juice contains bile salts which help in emulsification of fats
171. Liver stores the absorbed nutrients.