BPSC TEST-02—FULL LENGTH

Date: 29 July, 2018

ANSWERS

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

BPSC TEST-02—FULL LENGTH
SOLUTIONS

Date: 29 July, 2018

1. **(d)**
2. **(b)**
3. **(c)**
4. **(a)**
5. **(d)**
6. **(b)**
7. **(c)**
8. **(a)**
9. **(d)**
10. **(b)**
11. **(c)**
12. **(a)**
13. **(d)**
14. **(b)**
15. **(c)**
16. **(a)**
17. **(d)**
18. **(b)**
19. **(c)**
20. **(a)**
21. **(d)**
22. **(b)**
23. **(c)**
24. **(a)**
25. **(d)**
26. **(b)**
27. **(c)**
28. **(a)**
29. **(d)**
30. **(b)**
31. **(c)**
32. **(a)**
33. **(d)**
34. **(b)**
35 **(c)**
36. **(a)**
37. **(d)**
38. **(b)**
39. **(c)**
40. **(a)**
41. **(d)**
42. **(b)**
43. **(c)**
44. **(a)**
45. **(d)**
46. **(b)**
47. **(c)**
48. **(a)**
49. **(d)**
50. **(b)**
51. **(b)**
52. **(c)**

Let resultant be 'R'

$$R = \sqrt{P_1^2 + P_2^2 + 2P_1P_2 \times \cos\theta}$$

Given, $R = P_1 = P_2 = P$

$$P^2 = P^2 + P^2 + 2P^2 \times \cos\theta$$

$$-\frac{1}{2} = \cos\theta$$

$$\theta = 120°$$

53. **(a)**
54. **(c)**
55. **(c)**
56. **(c)**

At t = 10 seconds

$$v = U + at = U - gt$$
$$= 98 - 9.8 \times 10 = 0$$

Distance covered in 10 seconds

$$= S_1 = Ut - \frac{1}{2} \times g \times t^2$$
$$= 98 \times 10 - \frac{1}{2} \times 9.8 \times 10^2$$
$$= 490 \text{ m}$$

In the next 1 second, distance covered

$$= S_2 = \frac{1}{2}gt^2 = 0.5 \times 9.8 \times 1^2$$
$$= 4.9 \text{ m}$$

$\therefore$ Total distance = 494.9 m

57. **(b)**

For a circular sector.

Centroidal distance along the radius

$$= \frac{2r\sin(\alpha)}{3\alpha}$$

(where 'α' = 45°)

$$= \frac{2 \times r \times \frac{1}{2}}{3 \times \frac{\pi}{4}} = 0.6\ r$$

58. **(d)**

Mass of body is constant.

It is the weight which varies proportional to the acceleration due to gravity.

59. **(c)**

$$T_1 = 2\pi\sqrt{\frac{l}{g}}$$

$$T_2 = 2\pi\sqrt{\frac{l'}{g}}$$

For $T_2 = 2\,T_1$

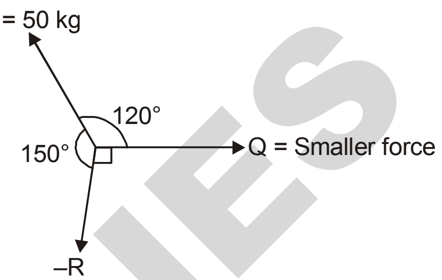
$$2 \times 2\pi\sqrt{\frac{l}{g}} = 2\pi\sqrt{\frac{l}{g}}$$

$$2\pi\sqrt{\frac{4l}{g}} = 2\pi\sqrt{\frac{l'}{g}}$$

$\therefore \quad l' = 4l$

60. **(c)**

61. **(b)**

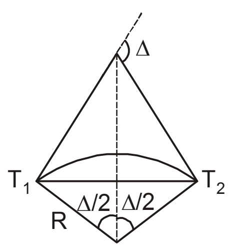


Applying lamis theorem

$$\frac{P}{\sin 90°} = \frac{Q}{\sin 150°}$$

$\therefore \quad Q = 25$ kg

62. **(d)**



T_1T_2 = length of long chord

$$= 2 \times R \sin\frac{\Delta}{2}$$

63. **(a)**

64. **(b)**

65. **(d)**

66. **(d)**

True length of a line = $\frac{l'}{l}$ × measured length

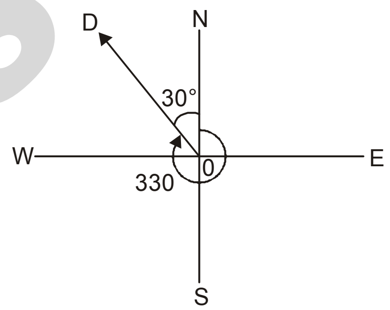
where, l' = true length

l = nominal length

$\therefore \quad 500 = \frac{l'}{l} \times 502$

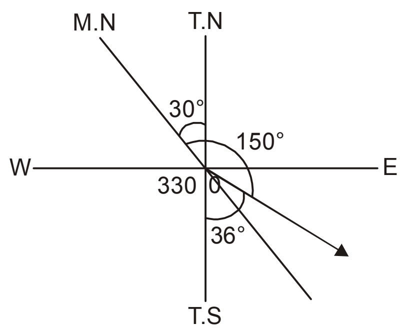
$\therefore \quad l' = \frac{500 \times 20}{502} = 19.92$ m

67. **(d)**



$\therefore$ Reduced bearing of line 'OD' = N 30° W

68. **(a)**



Reduced magnetic bearing = S 30° E

W.C.B = 180° – 30° = 150°

$\therefore$ Correct bearing = 150° – 6° = 144°

Reduced corrected bearing = S 36° E

69. **(d)**

Correction due to refraction is positive

In general,

The correction due to refraction is 1/7 of correction due to curvature.

$$\therefore\ C_r = +\frac{1}{7}\times\left(\frac{d^2}{2R}\right) = +\frac{1}{7}\times\left(\frac{d^2}{2\times 6367}\right)\times 1000$$

Where, h = height in 'metres'

d = distance in kilometers

R = radius of earth $\approx$ 6367 km

$\therefore$ C_r = + 0.0112 d^2

70. (c)

PMMC instruments have uniform scale.

In PMMC ammeter,

Current, I = (K/G) θ

$\therefore$ $I \propto \theta$

71. (b)

72. (a)

73. (b)

Euler's model assumes that the length of the column is very large as compared to its cross-sectional dimensions.

74. (d)

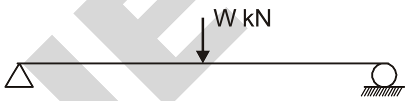
Because the bar is free to contract, no stress will be induced in the bar.

75. (b)

Strain roseltes measure linear strain only.

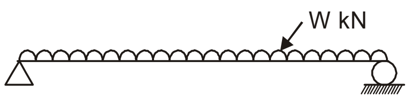
76. (b)

For beam



$$\Delta_{max_A} = \frac{WL^3}{48EI}$$

For B,



$$\Delta_{max_B} = \frac{5}{384}\frac{WL^3}{EI}$$

$$\therefore\ \frac{\Delta_{max_A}}{\Delta_{max_B}} = \frac{(1/48)}{(5/384)} = \frac{8}{5}$$

77. (a)

Proof resilience is defined as the maximum energy that can be absorbed upto the elastic limit without creating a permanent deformation.

Toughness is the ability to absorb mechanical energy up to the point of failure.

78. (c)

Torsional strain energy

$$U_T = \frac{1}{2}\times T\times\theta$$

But, from torsion equation

$$\frac{T}{J} = \frac{\tau}{R} = \frac{G\theta}{L}$$

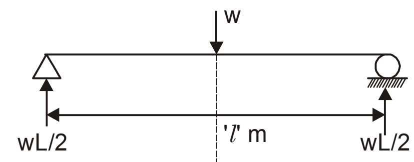
$$\therefore\ U_T = \frac{1}{2}\times\frac{\tau}{R}\times J\times\frac{\tau}{R}\times\frac{L}{G}$$

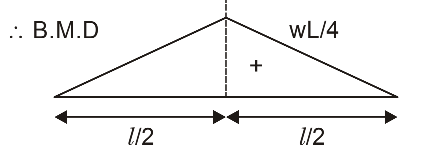
$$U_T = \frac{1}{2}\times\frac{\tau^2}{G}\times\frac{\pi D^4\times 4\times L}{32\times D^2}$$

$$= \frac{1}{4}\times\frac{\tau^2}{G}\times\frac{\pi D^2}{4}\times L$$

$$= \frac{\tau^2}{4G}\times \text{volume of shaft}$$

79. (b)





80. (c)

Minimum normal stress

$$= \frac{300}{2} - \sqrt{\left(\frac{300}{2}\right)^2 + 200^2}$$

= 150 – 250

= – 100 MPa

81. (d)

$$\text{Poissons ratio} = -\frac{\text{lateral strain}}{\text{longitudinal strain}}$$

Youngs modulus = $\dfrac{\text{normal stress}}{\text{normal strain}}$

Modulus of rigidity = $\dfrac{\text{shear stress}}{\text{shear strain}}$

82. **(a)**

I = section modulus = $\dfrac{I}{y}$

I = Moment of inertia of section

y = Maximum distance of extreme fibre from neutral axis.

83. **(b)**

Given,

$$\frac{PL}{AE} = \Delta$$

$$\frac{P\times 1000}{\frac{\pi}{4}\times 12^2\times\frac{2\times 10^6}{10\times 10}} = 0.045$$

$$P = 0.045\times 10\times 2\times 36\times\pi$$

$$= 32.4\times\pi = 101.78 \text{ kg}$$

84. **(d)**

As per max. shear strain energy theory,

$$\frac{1}{2}\left((\sigma_1-\sigma_2)^2+(\sigma_2-\sigma_3)^2+(\sigma_3-\sigma_1)^2\right) \le fy^2$$

For 2D, pure shear case

$$\sigma_1 = \tau,\ \sigma_2 = -\tau$$

$$\therefore \quad 3\tau^2 \le fy^2$$

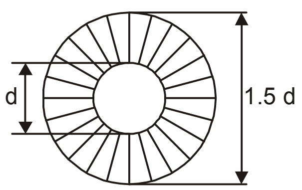
$$\tau \le \frac{fy}{\sqrt{3}}$$

Hence, this theory is in perfect agreement with pure shear case.

85. **(b)**

For no tension,

Middle fourth rule for circle.



$$e_{max} \le \frac{D^2+d^2}{8D}$$

$$e_{max} \le \frac{\frac{9d^2}{4}+d^2}{8\times 1.5d}$$

$$\le \frac{13/4}{12}d$$

$$e_{max} \le \frac{13}{48}d$$

86. **(a)**

87. **(d)**

88. **(c)**

89. **(a)**

- Vicat's apparatus is used to measure consistency and setting time
- Le-chatelier appartus tests soundness of cement
- Fineness of cement is measured by sieve method, air permeability method and Wagner turbidimeter test

90. **(d)**

91. **(d)**

92. **(b)**

93. **(a)**

94. **(a)**

95. **(b)**

d_{mean} = mean size of aggregate

$$= \frac{40+30}{2} = 35\text{mm}$$

$\therefore$ For flakiness index,

Slot length of gauge = 0.6 × d_{mean}

= 0.6 × 35 = 21 mm

96. **(c)**

97. **(a)**

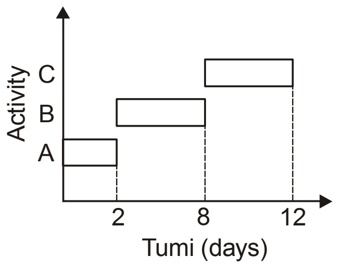
98. **(a)**

99. **(c)**

Gantt chart is a graphical representation of activity v/s time.

The beginning and end of each bar show the 'time of start' and 'time of finish' of activity respectively.

Thus the length of bar represents the time required for the completion of that activity.



100. (c)

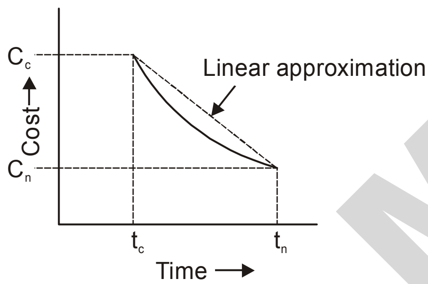
Slack = Scheduled completion time – earliest expected time

= (18 – 20) weeks = – 2 weeks

101. (b)

$$te = \frac{t_0 + 4tm + tp}{6} = \frac{4 + 5 \times 4 + 8}{6} = 5.33 \text{ months}$$

102. (c)



$$\text{Cost slope} = \frac{C_c - C_n}{t_n - t_c}$$

103. (c)

In resource smoothing.

- Activities having floats are rescheduled such that uniform demand for resources is achieved.
- Project duration is not changed
- Resources are unlimited
- Critical path is unchanged.

104. (c)

105. (a)

106. (b)

107. (a)

$$\text{Specific gravity} = \frac{\gamma_{oil}}{\gamma_{water}} = \frac{7.848}{9.81} = 0.8$$

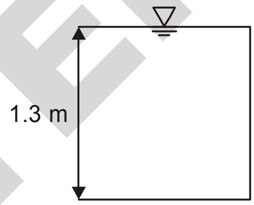
108. (d)

$$\text{Euler no.} = \sqrt{\frac{\text{Inertia force}}{\text{Pressure force}}}$$

$$\text{Mach no.} = \sqrt{\frac{\text{Inertia force}}{\text{Elastic force}}}$$

$$\text{Webber no.} = \sqrt{\frac{\text{Inertia force}}{\text{Surface tension}}}$$

109. (b)



$$F_p = \gamma \bar{h} \times A$$

$$= 9.81 \times \frac{1.3}{2} \times 1.3 \times 1$$

$$= 8.289 \text{ kN}$$

$$\approx 8.29 \text{ kN}$$

110. (b)

In case of laminar flow,

$$h_L = \frac{32 \mu v L}{\rho g D^2}$$

$$\therefore \quad \boxed{h_L \alpha v}$$

111. (d)

112. (c)

$$T = 2\pi \sqrt{\frac{k^2}{gGM}}$$

$$20 = 2\pi \sqrt{\frac{k^2}{9.81 \times 1}}$$

$$k^2 = \frac{20^2 \times 9.81 \times 1}{4\pi^2} = 100$$

$$k = 10 \text{ m}$$

113. (d)

In turbulent flow through rough pipe

$$\frac{U_{max}}{U} = 1 + 1.33\sqrt{f}$$

114. (a)

$$\frac{u}{U} = \frac{y}{\delta}$$

Momentum thickness

$$\theta = \int_0^\delta \left(1-\frac{u}{U}\right)\times\frac{u}{U}dy$$

$$= \int_0^\delta \frac{y}{\delta}\left(1-\frac{y}{\delta}\right)dy$$

$$= \left[\frac{y^2}{2\delta}-\frac{y^3}{3\delta^2}\right]_0^\delta$$

$$= \frac{\delta}{6}$$

115. (d)

Poise is the C.G.S unit of dynamic viscosity

$$1 \text{ poise} = 0.1\frac{\text{Nsec}}{\text{m}^2}$$

$$= \frac{0.1\times10^5 \text{dyne sec}}{100\times100 \text{ cm}^2}$$

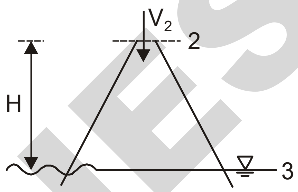
$$= \frac{1 \text{ dyne sec}}{\text{cm}^2}$$

116. (c)

117. (b)

Backward curved vanes offer less resistance and hence helps to achieve high speed.

118. (c)



Applying energy equation = between 2 and 3

$$\frac{P_2}{r}+H+\frac{V_2^2}{2g} = \frac{P_3}{r}+0+\frac{V_3^2}{2g}+h_L$$

$$\frac{P_2}{r} = -H-\frac{V_2^2}{2g}+\frac{V_3^2}{2g}+h_L$$

$\therefore$ An additional head equal to height of runner above tail race is provided.

119. (b)

120. (d)

Kaplan is an axial flow turbine

121. (c)

Specific speed of multi-jet turbine = $\sqrt{n}$ × specific speed of single jet turbine.

$\therefore$ Specific speed of 4 – jet turbine = $\sqrt{4}$ × specific speed of single jet turbine

= 2 × specific speed of single jet turbine.

122. (a)

EDTA method of hardness determination :

EDTA (Ethylene diamine tetra acetic acid) and EBT give wine red colour in hard water due to formation of unstable complex with Ca^{2+} and Mg^{2+} and EBT

The end of titration is indicated by change of colour to blue.

123. (c)

CO having affinity for haemoglobin, combines with it to form carboxyhemoglobin (HbCO) preventing the blood from carrying oxygen.

124. (c)

CO_2 reacts with water to form carbonic acid (H_2CO_3)

125. (d)

In rapid gravity filters, head loss goes on increasing as more and more impurities are trapped. A stage comes when frictional resistance by media exceeds static head of water over filter bed. The bottom sand then acts like a vacuum. Hence water gets sucked in filter media without getting filtered. The negative pressure releases dissolved gases; thus making bubbles which stick to sand grains. This is called air bending.

126. (b)

Alum required

= 10 MLD × 10 ppm

$$= 10\times10^6\frac{\text{litres}}{\text{day}}\times10\frac{\text{mg}}{\text{l}}$$

= 10 × 10^6 × 10 mg/day

= 1 quantal per day.

127. (c)

128. (d)

Concentration of OH^- ion = 10^{-6} mmol/l

= 10^{-6} × 10^{-3} mol/litre = 10^{-9} mol/l

$P_{OH} = -\log_{10}[10^{-9}] = 9$

$PH = 14 - 9 = 5$

129. (b)

Let initial volume be 'V'

and final volume be 'V''

we hour

$$V \times (1-0.95) = V' \times (1-0.9)$$

$$V' = 0.5\ V$$

$$\therefore \text{ Reduction in volume} = \frac{V-0.5V}{V} \times 100 = 50\%$$

130. (a)

Photochemical smog is formed photochemically when NO_x and HC, two groups of chemical compounds combine in the presence of sunlight.

$$HC + NO_x \xrightarrow{\text{sunlight}} \text{smog}$$

The end product of photochemical reactions is photochemical smog consisting of air contaminants such as O_3, PAN, aldehydes, CO etc.

131. (a)

Regenerator: In it hot and cold fluid pass alternately through space containing solid particles(matrix). e.g. Ic engine

Recuperators: It is the most important type of heat exchanger in which the flowing fluids exchanging heat are on either side of dividing wall(in the form of pipes or tubes generally). These exchangers are used when two fluid cannot be allowed to mix i.e when mixing is undesirable

e.g. oil coolers, air preheaters, economisers cross flow heat exchangers: in it two fluids (hot and cold) cross one another in space, usually at right angles. e.g automobile radiators

132. (d)

Glasses are diathermanous body as it passes all the short wavelength but not allow pass the higher wavelength. e.g. heating of car parked in sun light.

Highly polished surface are termed as white body which reflect all the incident radiation so there emissivity is lower compared to the rough surfaces.

Emissive power is wavelength depended as per Stefans-Boltzman law so statement d is wrong.

133. (a)

134. (b)

135. (a)

136. (d)

137. (c)

Work done = PdV = 400(1 – 0) = 400 kJ

138. (b)

$$0 = \Delta V + dw \qquad (dQ = 0 \text{ for adiabatic})$$

$$\Delta V = dw$$

$$\therefore \text{ Work done} = 20\text{ kJ}$$

139. (c)

$$COP_{ref} = \frac{T_2}{T_1 - T_2} = \frac{300}{600-300} = 1$$

140. (b)

141. (a)

The covalent bond energy in germanium is about 7.4 eV

142. (a)

$$J = \sigma E$$

where, J = current density

σ = Conductivity

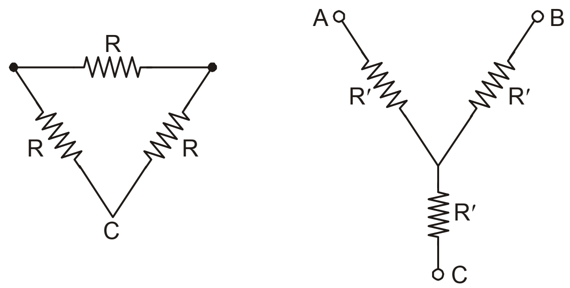
E = Electric field intensity

143. (b)

144. (b)

145. (a)

Given



$$R' = R_{star} = \frac{R \times R}{R+R+R} = \frac{R}{3}$$

146. (c)

147. (a)

148. (c)

149. (b)

150. (c)