

2008년 국가직 토목직 7급 수리수문학 봉책형 정답

1	②	2	①	3	③	4	③	5	④	6	①	7	②	8	③	9	④	10	②
11	①	12	④	13	③	14	④	15	①	16	②	17	③	18	④	19	①	20	③

문제 풀이 및 해설

1. [정답] ② 번

뉴턴의 마찰법칙에 의하면, 전단응력 τ 와 각변형률 $\frac{dv}{dy}$ 사이에 원점을 지나는 관계가 성립된다.

2. [정답] ① 번

$$P = wh\left(1 - \frac{a}{g}\right) = 9.8 \times 1 \times \left(1 - \frac{4.9}{9.8}\right) = 9.8 \times 1 \times 0.5 = 4.9 \text{ (kN/m}^2\text{)}$$

3. [정답] ③ 번

$$1) A_A V_A = A_B V_B$$

$$1^2 V_A = 0.5^2 V_B$$

$$4 V_A = V_B$$

$$D_A = 2D_B$$

$$2) Re_A = \frac{V_A D_A}{\nu} = \frac{V_A D_A}{\nu} = \frac{0.25 V_B 2D_B}{\nu} = \frac{0.5 V_B D_B}{\nu}$$

$$Re_B = \frac{V_B D_B}{\nu} = \frac{V_B D_B}{\nu} = \frac{V_B D_B}{\nu}$$

$$Re_A = 0.5 Re_B$$

4. [정답] ③ 번

$$h_L = f \frac{L}{D} \frac{V^2}{2g} = f \frac{L}{D} \frac{Q^2}{A^2 2g} = 0.04 \times \frac{400}{0.2} \times \frac{0.0314^2}{\left(\frac{3.14 \times 0.2^2}{4}\right) \times 2 \times 9.8} = 4.08 \text{ (m)}$$

5. [정답] ④ 번

$$R = \frac{A}{P} = \frac{20}{15} = \frac{4}{3}$$

$$A = (2 \times 3) + (2 \times 7) = 20$$

$$P = (2 \times 4) + (2 \times 2) + 3 = 15$$

6. [정답] ① 번

$$F = MLT^{-2}, M = FL^{-1}T^2$$

$$1) \text{ 밀도} = \frac{M}{V} = \frac{M}{L^3} = ML^{-3} = FL^{-4}T^2$$

$$2) \text{ 운동량} = F\Delta t = FT = MLT^{-1}$$

$$3) \text{ 표면장력} = g/cm = FL^{-1} = MT^{-2}$$

$$4) \text{ 일} = N \cdot m = FL = ML^2T^{-2}$$

7. [정답] ② 번

$$1) P = wh_G A = 1.3 \times 3 \times \left(\frac{2 \times 3}{2}\right) = 11.7(t)$$

$$11.7 \times 9.8 = 114.7(kN)$$

$$2) h_c = h_G + \frac{I_x}{h_G A} = 3 + \frac{\frac{2 \times 3^3}{12}}{3 \times \left(\frac{2 \times 3}{2}\right)} = \frac{19}{6}$$

8. [정답] ③ 번

$$1) P = P_1 + P_2 + P_3 \text{ 이며, } P_1 = P_2 = P_3 \text{ 이므로}$$

$$P_1 = P_2 = P_3 = \frac{P}{3} \text{ 이다.}$$

$$2) P = w \times \frac{h}{2} \times bh = \frac{wbh^2}{2}$$

$$P_1 = w \times \frac{h_1}{2} \times bh_1 = \frac{wbh_1^2}{2}$$

$$P_2 = w \times \left(h_1 + \frac{h_2}{2}\right) \times bh_2 = \frac{wb[(h_1 + h_2)^2 - h_1^2]}{2}$$

$$3) P_2 = \frac{P}{3}$$

$$\frac{wb[(h_1 + h_2)^2 - h_1^2]}{2} = \frac{1}{3} \times \frac{wbh^2}{2}$$

$$[(h_1 + h_2)^2 - h_1^2] = \frac{1}{3}h^2$$

$$(h_1 + h_2)^2 = \frac{2}{3}h^2$$

$$h_2 = \sqrt{\frac{2}{3}}h - h_1$$

$$4) P_1 = \frac{P}{3}$$

$$\frac{wbh_1^2}{2} = \frac{1}{3} \frac{wbh^2}{2}$$

$$h_1 = \sqrt{\frac{2}{3}}h$$

9. [정답] ④ 번

$$Q = \frac{9.8 Q(H - \Sigma h)}{\eta} = \frac{9.8 \times 10 \times (90 - 10)}{0.9} = 8,711 \text{ (kW)}$$

10. [정답] ② 번

$$1) h_c = \left(\frac{\alpha Q^2}{gb^2}\right)^{\frac{1}{3}}$$

$$1 = \left(\frac{1 \times Q^2}{10 \times 3^2}\right)^{\frac{1}{3}}$$

$$2) M = \eta \frac{QV}{g} + h_c A = 1 \frac{\sqrt{90} \times \frac{\sqrt{90}}{3 \times 2}}{10} + \frac{2}{2} \times (2 \times 3) = 7.5 \text{ (m}^3/\text{s)}$$

11. [정답] ① 번

$$h_e = h + \alpha \frac{V^2}{2g} = h + \alpha \frac{Q^2}{A^2 2g} = 3 + 1 \times \frac{30^2}{45^2 \times 2 \times 10} = 3.022 \text{ (m)}$$

12. [정답] ④ 번

시간(분)	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45
누가강우량 (mm)	0	1.0	4.0	6.0	10.0	17.0	22.0	25.0	28.0
강우량(mm)	0	1	3	2	4	7	5	3	3

1) 최대 강우량 16mm

$$2) \text{강우강도} \frac{16 \text{ mm}}{15 \text{ min}} \times \frac{60 \text{ min}}{\text{hr}} = 64 \text{ mm/hr}$$

13. [정답] ③ 번

$$\text{비피압대수층 } Q = \frac{\pi k(h_o^2 - h^2)}{\ln\left(\frac{r_o}{r}\right)}$$

$$\therefore (h_o^2 - h^2) = \frac{Q \ln\left(\frac{r_o}{r}\right)}{\pi k}$$

$$cf) \text{ 피압대수층 } Q = \frac{2\pi ck(h_o - h)}{\ln\left(\frac{r_o}{r}\right)}$$

14. [정답] ④ 번

갈수량은 1년 중 355일 이상 유지되는 유량이다.

15. [정답] ① 번

1) 여수로는 중력의 영향이 지배적이므로 *Froude* 상사법칙을 적용한다.

$$2) V_r = L_r^{\frac{1}{2}}$$

$$\left(\frac{V_m}{2}\right) = \left(\frac{9}{1}\right)^{\frac{1}{2}}, V_m = 6 (m/s)$$

$$3) T_r = L_r^{\frac{1}{2}}$$

$$\left(\frac{T_m}{5}\right) = \left(\frac{9}{1}\right)^{\frac{1}{2}}, T_m = 15 (s)$$

16. [정답] ② 번

$$b = \frac{2}{\sqrt{3}}h, h = \frac{\sqrt{3}}{2}b$$

17. [정답] ③ 번

$$\text{유효수량} = \frac{\sum q \times t}{A} = \frac{Q_p \times 10 \times 3,600}{3.6 \times 10^6} = 0.01$$

$$Q_p = 2 (m^3/s)$$

18. [정답] ④ 번**19. [정답] ① 번**

$$\text{Darcy 유속} = ki = 0.002 \times 0.01 = 2 \times 10^{-5} (m/s)$$

$$\text{실제유속} = \frac{\text{Darcy 유속}}{\text{공극률}} = \frac{2 \times 10^{-5}}{0.2} = 1 \times 10^{-4} (m/s)$$

20. [정답] ③ 번

$$V = \frac{S}{T}, T = \frac{S}{V} \text{이므로}$$

$$T = T_1 + T_2 = \frac{50}{0.1} + \frac{50}{0.5} = 500 + 100 = 600 (s)$$