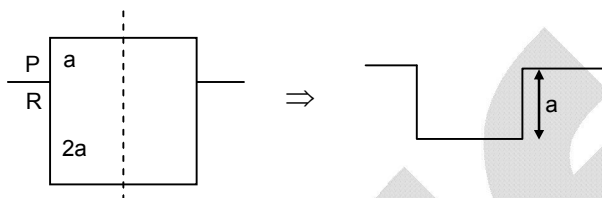


**INDIAN ASSOCIATION OF PHYSICS TEACHERS
NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE (NSEJS) 2017 – 18
Question Paper Code: JS534
Held on: November 19, 2017**

HINTS & SOLUTIONS

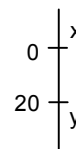
1. a
1. When wave having amplitude in opposite phase are superimposed resultant amplitude decreases while when they meet in same phase resultant amplitude increases.



2. b
2. $S = r_1 + r_2$, $P = \frac{r_1 r_2}{r_1 + r_2}$
 $S = nP \Rightarrow (r_1 + r_2)^2 = nr_1 r_2$
 $\Rightarrow n = \frac{(\sqrt{r_1} - \sqrt{r_2})^2 + 2\sqrt{r_1 r_2}}{r_1 r_2}$
 Value of 'n' will be minimum when, $r_1 = r_2$
 $\Rightarrow S = 2r$ or $P = \frac{r}{2}$.
 Hence, $n = 4$.
3. d
3. When disc is heated its radius increases and density decreases.
 Hence, $a_0 < a_t$, $b_0 < b_t$.

4. a
4. According to equation of continuity
 $\Delta m_1 = \Delta m_2$ (in same time)
 $\Rightarrow \rho a_1 v_1 t = \rho a_2 v_2 t$
 $\Rightarrow a_1 v_1 = a_2 v_2$

5. c
5. $\frac{20 + y}{20 + x + y} = \frac{\rho_b}{1}$... (i)
 $\frac{y}{20 + x + y} = \frac{\rho_b}{1.40}$... (ii)
 $\frac{10 + y}{20 + x + y} = \frac{\rho_b}{\sigma_{liq}}$... (iii)



From (i) and (ii) we get, $y = 50$
 From (i) and (iii) we get, $\sigma_{liq} = \frac{7}{6} = 1.17 \text{ g/cm}^3$

6. d
6. Only gravitational force mg is acting on the ball and it is constant.

7. a
 7. Positive work is done in bringing two α -particles together so potential energy of the system increases.

Or

Potential energy of the system increases in working against the repulsive forces.

8. b
 8. Force I is acting in downward direction.
 Force II is acting in upward direction.
 Force due to air will act in upward direction.
 Hence, I and II are correct.
9. b
 9. In figure I, $x - t$ curve is straight line with different slopes. So velocities are constant, but will be higher in 1st case and lower in 2nd case. Figure III satisfies it. Hence, answer is figure I and III.

10. d
 10. Evaporation causes cooling.

11. a
 11. Using Fleming's left hand rule.

12. a
 12. After the refraction from water surface the image of sun will still be at ∞ , using $v = \mu u$.
 \therefore For mirror: $u = \infty, v = f = 50 \text{ cm}$

13. b
-
- $\angle M_2CD = \angle M_2OB = 70^\circ$
 $\angle DCB = 40^\circ$
 $\angle OCB = 70^\circ$
 $\angle OBC = 40^\circ$
 Hence, $\angle CBN_1 = 50^\circ$

14. a
 14. As angle of refraction is minimum in medium A.
 Hence, μ_A is maximum and $v \propto \frac{1}{\mu}$

15. d
 15. By using Newton's third law of motion.
 For every action there is equal and opposite reaction.

16. d
 16. According to the Lenz's law.

17. c
 17. The ability of eye to focus both near and distant objects, by adjusting its focal length, is called accommodation of eye.

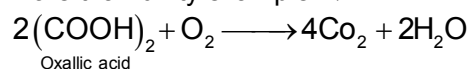
18. b
18. $S = \left(\frac{v+u}{2} \right) t = \left(\frac{80+0}{2} \right) 50 = 2000 \text{ m}$ $v = 288 \text{ km/h} = 80 \text{ m/s}$
19. c
19. $R_{\text{eq}} = 10 + 10 + 20 = 40 \Omega$
 $I = \frac{120}{40} = 3\text{A}$, current in N to k is 1 A, as all 60Ω resistors are connected in parallel.
 So, equal current will flow in all the 60Ω resistors.
20. d
20. Both the blocks move equal distance in equal interval of time, so in both cases acceleration is zero.
21. d
21. Panting is a means of thermoregulation in dogs. This is due to heat energy equal to the latent heat of vapourization is absorbed from the body leaving the body cool.
22. c
22. In a dihybrid cross, $4/16$ is the proportion of organisms with dihybrid genotype.
23. c
23. A mammal adapted to desert conditions is likely to have large pinnae.
24. d
24. If a flower is producing a large number of minute and smooth pollen, the agency for cross pollination is most likely to be Air.
25. b
25. A-T base pair has 2 H bonds, the area rich in A-T base pairs can undergo easy denaturation (melting). The base pair G-C is comparatively more stable and dense because of three hydrogen bonds. So we can say that G-C base pairs (high melting area) require maximum temperature for melting than A-T base pairs (low melting area).
26. a
26. A plant may not exchange CO_2 or O_2 with air at twilight.
27. a
27. Metamerism is a characteristic of Hirudinaria.
28. c
28. According to the question, we have given
 6 bases (3 Pyrimidies + 3 purines)
 $(6)^n$ to know the length of codon, so that minimum 400 amino acid can be made
 \downarrow
 Base
 4 cases are possible \rightarrow
 Case I: $(6)^6 = 46,656$
 Case II: $(6)^5 = 7776$
 Case III: $(6)^4 = 1296$
 Case IV: $(6)^3 = 216$
 So, minimum required 400 amino acid = $(6)^4 = 1296$
 Which covers the range of 400
 \therefore The length of codon is 4.

29. c
 29. Many single celled organisms (Amoeba) reproduce by binary fission, where a cell divided into two halves. So according to arithmetic progression, the number of cells increases as follows:
 $64 \rightarrow 128 \rightarrow 256 \rightarrow 512 \rightarrow 1024$

30. b
 30. From the above mentioned organisms. Euglena is the only unicellular eukaryotic organism which shows the characters of both plants (shows photosynthesis in the presence of sunlight) and animals (behave like heterotrophs by predated on other smaller organisms).

31. b
 31. Respiratory Quotient (RQ) = $\frac{\text{Volume of } \text{CO}_2 \text{ evolved}}{\text{Volume of } \text{O}_2 \text{ absorbed}}$

So, if a cell is using less oxygen than RQ should be more than unity. RQ of organic acids are more than unity example \rightarrow



$$\text{RQ} = \frac{4\text{CO}_2}{1\text{O}_2} = 4.0$$

32. a
 32. Presence of canines as well as premolars and molars indicates the omnivore feeding of human species.

33. b
 33. Higher cattle population leads to release of methane (CH_4) more than CO_2 .

34. a
 34. To produce a seed, you require the production of pollen (n) and egg (x) and their fusion.

Let start's with pollen grain (n)

$\rightarrow 4$ pollen grains = 1 meiotic division

For production of x pollen grains

$$x \text{ pollen grains} = \frac{x}{4} \text{ meiotic division}$$

Then production of egg (n)

1egg = 1 meiotic division

\rightarrow So for production of x number of eggs.

x egg = x meiotic division

\rightarrow For production of x number of seeds (2n)

$$x \text{ seeds} = x + \frac{x}{4} \text{ meiotic divisions}$$

$$400 \text{ seeds} = 400 + \frac{400}{4}$$

\therefore 400 seeds require 500 meiotic divisions

35. b
 35. If a small part of the esophagus of a person is excised, the consequence would be small portion of food at small time interval.

36. d
 36. When we fast for extended periods, our cells clean out and recycle the intracellular garbage. The organelles responsible for this is lysosomes.

37. a
37. Life – style disorder is hypertension.
38. c
38. A plant kept in a box with only a hole for entry of light shows bending, the process called phototropism. It occurs due to synthesis and diffusion of auxin in the shoot. When light is coming from one side of the plant, auxin diffuses towards the shady side of the shoot.
39. d
39. Tonoplasts is not a plastid.
40. b
40. Ravi mixed two substances A and B in a vessel and left it as it is. A is fruit juices and B is species of *Saccharomyces cerevisial* which converts the sugar in the fruit juices into alcohol and organic acids.
41. d
41. $x^2 - 3x + 2 = (x - 1)(x - 2)$
then $x^4 - px^2 + q$ will be satisfied by $x = 1$ and 2
 $\Rightarrow 1 - p + q = 0 \Rightarrow p = 1 + q \Rightarrow p - q = 1$ (i)
 $\Rightarrow 16 - 4p + q = 0 \Rightarrow 16 + q = 4p = 4p - q = 16$ (ii)
 By equation (i) and (ii)
 $\Rightarrow 3p = 15 \Rightarrow p = 5$
 $\therefore q = 4$
42. c
42. $\frac{x^2 - bx}{ax - c} = \frac{m - 1}{m + 1}$
 $(x^2 - bx)(m + 1) = (ax - c)(m - 1)$
 $\Rightarrow (m + 1)x^2 - (bm + b + ma - a)x + c - mc = 0$
 \therefore roots are equal and opposite in sign
 $\therefore \frac{mb + b + ma - a}{m + 1} = 0$
 $\Rightarrow m(b + a) = a - b \Rightarrow m = \frac{a - b}{a + b}$
43. b
43. $p^2 + q^2 + r^2 = 30$ and $pqr = 10$
 $p + q + r = 2 \Rightarrow p^2 + q^2 + r^2 + 2(pq + rq + pr) = 4$
 $\Rightarrow 30 + 2(pq + qr + pr) = 4 \Rightarrow pq + qr + pr = -13$
 then $(1 - p)(1 - q)(1 - r)$
 $= 1 - (p + q + r) + (pq + qr + rp) - pqr$
 $= 1 - 2 - 13 - 10 = -24$
44. Not in option (18.75)
44. $a = 30, b = 36, c = 30$

$$s = \frac{a+b+c}{2} = \frac{30+36+30}{2} = 48$$

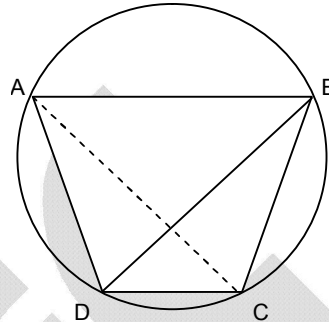
$$\Delta = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{48 \times 12 \times 18 \times 18} = 432$$

$$\therefore R = \frac{abc}{4\Delta} = \frac{30 \times 36 \times 30}{4 \times 432} = \frac{75}{4} = 18.75$$

45. c

45. By Ptolemy's theorem,
 $AB \times DC + AD \times BC = AC \times BD$
 $204 \times 195 + 85 \times 104 = 221 \times AC$
 $\Rightarrow AC = \frac{48620}{221} = 220$



46. c

46. $19839618 = 3^2 \times 1001^2 \times 22$
Hence we should divide by 22 to get a perfect square number

47. a

47. $a+b+c+d=4$

On simplification, the given expression is equal to $\frac{(1-d)+(1-a)+(1-b)+(1-c)}{(1-a)(1-b)(1-c)(1-d)} = 0$

48. a

48. $AB \times AC = 172.8 \text{ cm}^2$
 $BE \times CF = 108.3 \text{ cm}^2$
 $AD \times BC = ?$
 $[ABC] = \frac{1}{2} \times AD \times BC \dots\dots\dots(i)$
 $[ABC] = \frac{1}{2} \times BE \times AC \dots\dots\dots(ii)$
 $[ABC] = \frac{1}{2} \times CF \times AB \dots\dots\dots(iii)$
 $AD \times BC = BE \times AC = CF \times AB$
 $\Rightarrow (AD \times BC)^2 = (BE \times AC) \times (CF \times AB) = 172.8 \times 108.3$
 $\Rightarrow AD \times BC = 136.8 \text{ cm}^2$

49. b

49. $1\frac{1}{2} + 1\frac{1}{6} + 1\frac{1}{12} + \dots\dots\dots + 1\frac{1}{380}$
 $= 19 + \frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \dots\dots\dots + \frac{1}{380}$
 $= 19 + \frac{1}{1} - \frac{1}{2} + \frac{1}{2} - \frac{1}{3} + \dots\dots\dots + \frac{1}{19} - \frac{1}{20}$

$$= 19 + 1 - \frac{1}{20}$$

$$= 19 + \frac{19}{20}$$

$$= 19.95$$

50. d

$$x = \sqrt{21} - \sqrt{20}$$

$$\Rightarrow x = \frac{1}{\sqrt{2} + \sqrt{20}}$$

$$y = \sqrt{18} - \sqrt{17}$$

$$\Rightarrow y = \frac{1}{\sqrt{18} + \sqrt{17}}$$

$$\Rightarrow x < y$$

51. a

$$x + \frac{1}{x} = 5$$

$$x^2 + \frac{1}{x^2} = \left(x + \frac{1}{x}\right)^2 - 2$$

$$= 25 - 2$$

$$= 23$$

$$x^3 + \frac{1}{x^3} = \left(x + \frac{1}{x}\right)^3 - 3\left(x + \frac{1}{x}\right)$$

$$= 125 - 15$$

$$= 110$$

$$\therefore \left(x^3 + \frac{1}{x^3}\right) - 5\left(x^2 + \frac{1}{x^2}\right) + \left(x + \frac{1}{x}\right)$$

$$= 110 - 5(23) + 5 = 0$$

52. c

Class Interval	Class Mark (x)	Frequency (f)	fx
0 - 10	5	4	20
10 - 20	15	6	90
20 - 30	25	8	200
30 - 40	35	10	350
40 - 50	45	12	540
Total		40	1200

$$\text{Mean} = \frac{1200}{40} = 30$$

53. c

53. 15.08.2017 → Tuesday
After 6 years in 2023, independence day will be on Tuesday

54. c

$$54. x^2 + xy + xz = 135$$

$$y^2 + yz + xy = 351$$

$$z^2 + xz + yz = 243$$

$$x^2 + y^2 + z^2 + 2(xy + yz + zx) = 729$$

$$x + y + z = 27$$

$$x(x + y + z) = 135$$

$$x = 135 \div 27 = 5$$

$$y = 351 \div 27 = 13$$

$$z = 243 \div 27 = 9$$

$$\therefore x^2 + y^2 + z^2 = 25 + 169 + 81$$

$$= 275$$

55.

b

55.

$$7^2 \pmod{25} = -1$$

$$\Rightarrow 7^{2016} \pmod{25} = (-1)^{1008} = 1$$

$$\Rightarrow 7^{2017} \pmod{25} = 7$$

56.

d

56.

$$a + b = 13 \text{ and } a^3 + b^3 = 1066$$

$$\text{Using } (a + b)^3 = a^3 + b^3 + 3ab(a + b)$$

$$\Rightarrow ab = 29$$

57.

a

57.

Quadrilateral whose diagonals bisect each other is definitely a parallelogram.

58.

b

58.

$$\text{Speed} = 54 \text{ km/hr} = 15 \text{ m/sec}$$

$$\text{Length of train} = 20 \times 15$$

$$= 300 \text{ m}$$

59.

b

59.

Numbers are 501, 503, 505,, 599

$$\text{Sum} = 25 \times (501 + 599) = 27500$$

60.

a

60.

Number are 1008, 1109, 1210,9997

$$9997 = 1008 + (n - 1) 101$$

$$\Rightarrow n = 90$$

61.

a

61.

As meteoroid is considered to have a composition mainly oxides of iron, nickel & magnesium so due to basic oxides pH of water body was measured > 7 .

62.

c

62.

342 g of $C_{12}H_{22}O_{11}$ cane sugar contain = $12 N_A$ atoms of C

$$1.71 \text{ g of } C_{12}H_{22}O_{11} \text{ cane sugar contain} = \frac{12 \times 6.023 \times 10^{23}}{342} \times 1.71 = 6 \times 6.023 \times 10^{21}$$

$$= 3.66 \times 10^{22}$$

63.

b

63. $1 \text{ eq H}_3\text{PO}_4 = \frac{1}{3} \text{ mole of H}_3\text{PO}_4 = 1 \text{ mole of [H}^+]$

So far neutralization we will need 1 mole of $[\text{OH}^-]$ which can come for 1 mole NaOH

$$\frac{1}{2} \text{ mole Ca(OH)}_2$$

$$\frac{1}{3} \text{ mole Al(OH)}_3$$

$$1 : \frac{1}{2} : \frac{1}{3}$$

64. c

64. Previous atomic no +32 i.e. ${}_{85}\text{At}$

65. a

65. In open vessel
P, V are constant

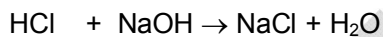
$$\text{i.e. } n_1 T_1 = n_2 T_2$$

$$n_1 \times 300 = \frac{3n_1}{5} \times T_2$$

$$T_2 = 500 \text{ K}$$

66. c

66. Neeta mixed



10 mL 15 mL

0.1 M 0.067

1 mmoles 1.005 mmoles

$1.005 - 1 = 0.005$ milli moles of NaOH

$$= 5 \times 10^{-3}$$

$$N = \frac{5 \times 10^{-3}}{25} = \frac{1}{5} \times 10^{-3} = 2 \times 10^{-4}$$

$$\text{pOH} = -\log[2 \times 10^{-4}] = 4 - \log 2 = 4 - 0.3010 = 3.69$$

$$\text{pH} = 14 - 3.69 = 10.31$$


\therefore Pale Blue

67. d

67. Fact based.

68. d

68. Most appropriate, otherwise except $\text{C}_3\text{H}_8\text{O}$, all can have ketonic group, if we adjust the

structure of the compound. Like $\text{C}_3\text{H}_4\text{O}$ can be  cyclopropone and other structure are also possible.

69. d

69. Suppose ${}^{79}\text{X}_{35} = x\%$

$$\frac{x}{100} \times 79 + \frac{100-x}{100} \times 82 = 80$$

$$x = \frac{200}{3} = 66.67\%$$

i.e., ${}^{79}\text{X}_{35} = 66.67\%$ and ${}^{82}\text{X}_{35} = 33.34\%$,

70. Not in option

$$70. \text{ No. of atoms present in 4 g of Mg} = \frac{4}{24} \times N_A = \frac{N_A}{6}$$

$$\text{No. of atoms present in 4 g of S} = \frac{4}{256} \times 8N_A = \frac{N_A}{8}$$

Ratio of atoms

Mg : S

$$\frac{N_A}{6} : \frac{N_A}{8}$$

i.e. 4 : 3

No appropriate option is given.

71. d

71. As Acidic : basic : neutral : amphoteric

CO₂ : MgO : N₂O : H₂O

SO₃ : CaO : N₂O : PbO

72. d

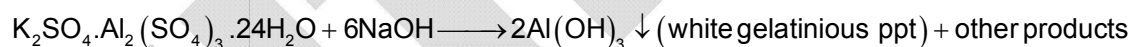
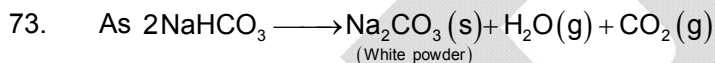
72. As moles will remain constant since P, V, T are constant

$$\text{So, } n_{\text{SO}_2} = n_{\text{O}_2}$$

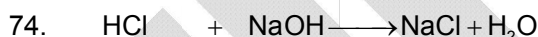
$$\frac{W_{\text{SO}_2}}{64} = \frac{W_{\text{O}_2}}{32}$$

$$\text{i.e. } W_{\text{SO}_2} = 2W_{\text{O}_2}$$

73. d



74. b



$$N = \frac{73}{36.5 \times 1000}, \quad N = \frac{0.46}{23 \times 1\text{L}} = 2 \times 10^{-2} \text{N}$$

Gm eq of HCl = gm eq of NaOH

$$N_1V_1 = N_2V_2$$

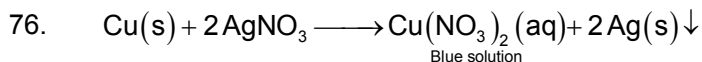
$$2 \times V_1 = 2 \times 10^{-2} \times 1000 \text{ mL}$$

$$V_1 = 10 \text{ mL}$$

75. c

75. As per reactivity series Zn will displace Ag from AgNO₃(aq)

76. c



77. b

77. Fact based

78. c

78. Fact based

79. a
79. Noble gases have zero valency.
80. a
80. Loss of weight = Weight of displaced fluid = density of fluid \times g \times Vol. of immersed object
i.e. Higher the density, higher the loss of weight, as density of sea water is high so loss of weight is more in sea water.

FITJEE