

SOLUTION TO SCHOLASTIC APTITUDE TEST 2018
NTSE Stage I
NOVEMBER 2018
TOTAL QUESTIONS: 100
TOTAL MARKS: 100
DURATION: 120 MIN
DATE: 04.11.2018
PHYSICS

1. (1)

$$2\Omega + 2\Omega = 4\Omega$$

$$R_p = \frac{(4)(2)}{6} = \frac{8}{6}\Omega = \frac{4}{3}\Omega$$

$$V = IR$$

$$I = \frac{2}{4/3} = \frac{6}{4} = \frac{3}{2} = 1.5 \text{ A}$$

2. (3)

$$P = 880 \text{ W}, V = 220 \text{ V}$$

$$P = VI$$

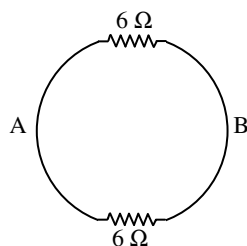
$$I = \frac{880 \text{ W}}{220 \text{ V}} = 4 \text{ A}$$

3. (4)

$$R = 12 \Omega$$

6Ω and 6Ω can be thought of to be in parallel with each other.

$$\therefore R_{\text{eff}} = 3 \Omega$$



4. (2)

$$P = -4.5 \text{ D}$$

$$f = \frac{1}{P} = -\frac{1}{4.5} = -0.22 \text{ m}$$

5. (4)

$$u = -100 \text{ cm}, v = -25 \text{ cm}$$

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

Substitute and solve

$$\frac{1}{f} = \frac{1}{-25 \text{ cm}} + \frac{1}{100 \text{ cm}} = \frac{75}{25}$$

$$\frac{1}{f} = 3$$

$$P = 3D$$

6. (2)

Due to change in magnetic field w.r.t. the rod, an emf is induced.

7. (3)

The given nail is of cone shape. More mass is concentrated near point R. Therefore it is easier to pick up the nail from point R.

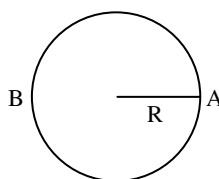
8. (2)

$$T = 140 \text{ s}$$

To complete one round, $t = 40 \text{ s}$

∴ In 140 s he will be at position B

∴ displacement = 2R



9. (2)

$$E = 4.5 \times 10^{14} \text{ J}, C = 3 \times 10^8 \text{ ms}^{-1}$$

$$E = mc^2$$

$$m = \frac{4.5 \times 10^{14}}{9 \times 10^{16}} = 0.5 \times 10^{-2} = 5 \times 10^{-3} \text{ kg}$$

$$= 5 \text{ g}$$

10. (4)

$$E = 48 \text{ kJ per minute} = \frac{48 \times 10^3}{60} = 800 \text{ J per second}$$

$$\text{Energy released per fission} = 3.2 \times 10^{-11} \text{ J}$$

Total energy = n (Energy per fission)

$$n = \frac{800 \text{ J}}{3.2 \times 10^{-11} \text{ J}} = 250 \times 10^{11} = 2.5 \times 10^{13}$$

11. (2)

Both focal length and power of a lens will have same sign.

12. (2)

$$m = \frac{-v}{u} = \frac{-(4 \text{ cm})}{(-6 \text{ cm})} = \frac{2}{3} = 0.66$$

13. (3)

Speed of sound is independent of pressure.

CHEMISTRY

14. (1)

Isoelectronic species are species that have same or equal number of electrons.

(a) $\text{Na}^+ = 2, 8$

(b) $\text{Al}^{3+} = 2, 8$

(c) $\text{Mg}^{2+} = 2, 8$

(d) $\text{Ca}^{2+} = 2, 8, 8$

Hence, a, b, c are isoelectronic to one another.

15. (4)

Metallic character refers to the set of chemical properties associated with elements that are metals. These chemical properties result from how readily metals lose their electron to form cations.

Metallic character increase down the group and decreases across the period. Hence the correct order is $K > Mg > Al > B$

16. (4)



When electricity is passed through an aqueous solution of sodium chloride (brine solution), it decomposes to form sodium hydroxide and chlorine. This process is called chloralkali process.

17. (2)

Principle quantum number – $n = 1, 2, 3, \dots$

Azimuthal quantum number – $l = 0$ to $n - 1$

Magnetic quantum number – $m = -l$ to $+l$

Spin quantum number – m_s or $s = +\frac{1}{2}$ or $-\frac{1}{2}$

(a) $n = 0$, not allowed

(b) $n = 1, l = 0, m_l = 0, m_s = -\frac{1}{2}$ is allowed

(c) $n = 1, l = 1$ not allowed

(d) $n = 2, l = 1, m_l = 0, m_s = -\frac{1}{2}$ is allowed

Therefore (a) and (c) are not allowed

18. (4)

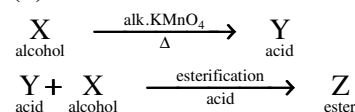
Dilution of sulphuric acid is exothermic.

Sublimation of dry ice is endothermic

Condensation of water vapour is exothermic

Evaporation of water is endothermic

19. (3)

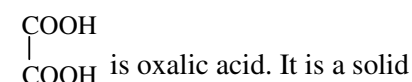


X – Ethanol $\text{CH}_3\text{-CH}_2\text{-OH}$

Y – Ethanoic acid $\text{CH}_3\text{-COOH}$

Z – Ethylethanoate $\text{CH}_3\text{-COO-CH}_2\text{-CH}_3$

20. (1)

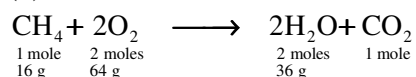


CH_3COOH is acetic acid. It is a colourless liquid.

H_2CO_3 is carbonic acid. It is a liquid as it is formed by dissolving CO_2 gas in water

HCOOH is formic acid. It is a colourless liquid

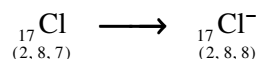
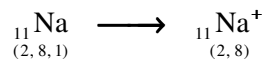
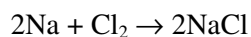
21. (3)



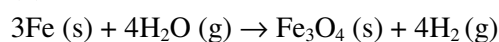
Assertion is incorrect

Reason is correct

22. (1)



23. (3)



Fe is accepting oxygen forming Fe_3O_4 . It is undergoing oxidation. It is reducing agent.

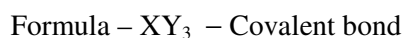
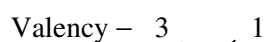
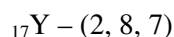
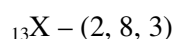
H_2O is losing oxygen to form H_2 . It is undergoing reduction. It is oxidizing agent.

24. (2)

Half life = 4 hour

Initial mass	Time	Final mass
200 g	4 hours	100 g
100 g	4 hours	50 g
50 g	4 hours	25 g
25 g	4 hours	12.5 g
12.5 g	4 hours	6.25 g
6.25 g	4 hours	3.125 g

25. (3)



26. (3)

Olfactory indicators are substances which have different odour in acidic and basic solutions.

Example: Vanilla essence, clove oil, onion etc.

BIOLOGY

27. (3)

Larger sized animals not only depend on diffusion for oxygen transport, they need specialized pigments to carry oxygen. Haemoglobin is the pigment in humans responsible for oxygen carrying.

28. (2)

Lenticels (in the roots) and stomata (in the leaves) help in regulation of gaseous exchange during respiration in plants.

29. (1)

Column – I		Column – II	
(A)	Oxytocin	(iii)	Uterus contraction during child birth
(B)	Leutinizing hormone	(v)	Induces ovulation
(C)	Vasopressin	(i)	Reabsorption of water
(D)	Melatonin	(ii)	Regulation of diurnal rhythm of our body

30. (4)

Green seed is the recessive character in pea plant and yellow seed being the dominant.

31. (3)

The walls of ventricles are thicker in order to pump the blood to long distance and to various organs of the body.

32. (2)

Coliform, kind of bacteria that indicates the contamination of water by disease causing bacteria.

33. (4)

The type of absorption of water seen in plant cells is through osmosis. Imbibition is seen in germinating seeds during which seed coat rupture.

34. (2)

The formation of chlorophyll depends on the exposure of the plant to the sunlight.

35. (4)

Haemophilia is an X-linked recessive trait. Since X-chromosome is dominant gene than Y, it is commonly seen in males.

36. (1)

Proximal convoluted tubule helps in reabsorption of glucose and water.

37. (3)

Ethylene helps in ripening of fruits and gibberlins helps in cell elongation.

38. (4)

Statement B is not correct because when oxygen combines with haemoglobin it forms oxyhaemoglobin.

39. (2)

Vernalization is the process during which the cooling of seed during germination causes acceleration of flowering. Hence the farmer has to adapt vernalization to have early flowering.

40. (2)

Genetic variation helps an individual to adapt to a particular environment.

SOCIAL SCIENCE

41.	(3)	42.	(3)	43.	(2)	44.	(1)	45.	(2)
46.	(4)	47.	(2)	48.	(1)	49.	(4)	50.	(2)
51.	(1)	52.	(4)	53.	(4)	54.	(3)	55.	(3)
56.	(4)	57.	(1)	58.	(3)	59.	(4)	60.	(4)
61.	(2)	62.	(1)	63.	(3)	64.	(4)	65.	(2)
66.	(2)	67.	(2)	68.	(2)	69.	(4)	70.	(4)
71.	(3)	72.	(1)	73.	(2)	74.	(2)	75.	(2), (4)
76.	(3)	77.	(2)	78.	(1)	79.	(1)	80.	(2)

MATHEMATICS

81. (3)

$$S_n = 3n + 2n^2$$

$$S_2 - S_1 = a_2$$

$$3(2) + 2(2)^2 - (3(1) + 2(1)^2) = a_2$$

$$6 + 8 - (3 + 2) = a_2$$

$$14 - 5 = 9 = a_2$$

$$d = 4$$

$$a_2 - a_1 = d$$

$$9 - 5 = 4$$

82. (1), (3)

$$(2\sqrt{7} + 3\sqrt{3})^2 = 28 + 27 + 12\sqrt{21}$$

$$= 55 + 12\sqrt{21}$$

$$\Rightarrow \left({}^{2010}\sqrt{2\sqrt{7} - 3\sqrt{3}} \right) \left({}^{4020}\sqrt{(2\sqrt{7} + 3\sqrt{3})^2} \right)$$

$$\left({}^{2010}\sqrt{2\sqrt{7} - 3\sqrt{3}} \right) \left({}^{2010}\sqrt{2\sqrt{7} + 3\sqrt{3}} \right)$$

$${}^{2010}\sqrt{(2\sqrt{7})^2 - (3\sqrt{3})^2}$$

$${}^{2010}\sqrt{1}$$

83. (4)

$$x - y = 2$$

$$kx + y = 3 \quad \frac{1}{k} = -1 \quad k \neq 1$$

If $k < -1$, then x is negative

$$\Rightarrow k > -1$$

and $k > \frac{4}{3}$ gives negative values for x and y

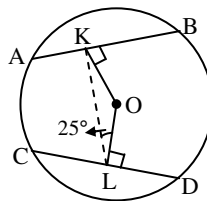
\Rightarrow option (4) is the correct answer.

84. (2)

$$\text{Given } \hat{OLK} = 25^\circ$$

$$\Rightarrow \hat{OKL} = 25^\circ \quad [OK = OL]$$

$$\Rightarrow \hat{LKB} = 90^\circ + 25^\circ = 115^\circ$$



85. (2), (3)

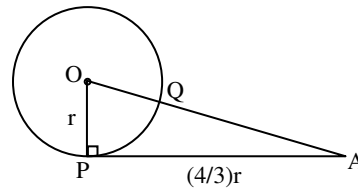
$$\text{Given } OP = r$$

$$AP = \frac{4}{3}r = L$$

$$\text{We know that } OP^2 + AP^2 = OA^2$$

$$r^2 + \left(\frac{4}{3}r\right)^2 = AO^2$$

$$AO^2 = \frac{25r^2}{9}$$



$$AO = \frac{5r}{3} \Rightarrow AQ = \frac{5r}{3} - r = \frac{2r}{3}$$

$$\therefore L = \frac{4r}{3} \Rightarrow \frac{L}{2} = \frac{2r}{3}$$

\Rightarrow Options (2) and (3) are correct.

86. (3)

In the given figure

$$BP = OP = OB = OA = r$$

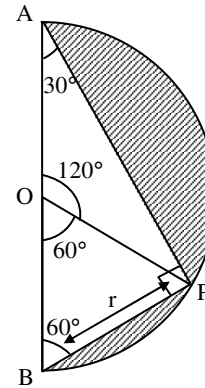
In $\triangle APB$, $\angle APB = 90^\circ$ (angle in a semicircle)

$$\sin 60^\circ = \frac{AP}{AB}$$

$$\frac{\sqrt{3}}{2} = \frac{AP}{2r} \Rightarrow AP = \sqrt{3}r \quad \dots(1)$$

$$\frac{\text{Area of larger shaded region}}{\text{Area of smaller shaded region}} = \frac{\frac{120^\circ}{360^\circ} \times \pi r^2 - \frac{\sqrt{3}}{4} r^2}{\frac{60^\circ}{360^\circ} \pi r^2 - \frac{\sqrt{3}}{4} r^2}$$

$$\frac{\frac{\pi r^2}{3} - \frac{\sqrt{3}r^2}{4}}{\frac{\pi r^2}{6} - \frac{\sqrt{3}r^2}{4}} = \frac{4\pi - 3\sqrt{3}}{2\pi - 3\sqrt{3}} \quad (\text{Option (3)})$$



87. (3)

$\left(\frac{-3-15}{2}, \frac{20+8}{2}\right)$ is the mid-point.

$$\left(-\frac{18}{2}, 14\right) \Rightarrow C = -18$$

88. (3)

$$P = \left(\frac{3 \times -1 + 4 \times 2}{7}, \frac{3 \times 2 + 4 \times 3}{7}\right)$$

$$\Rightarrow P = \frac{5}{7}, \frac{18}{7}$$

Given $x + 2y = k$

$$\Rightarrow \frac{5}{7} + 2 \times \frac{18}{7} = k$$

$$\Rightarrow k = \frac{41}{7}$$

89. (2)

$$(\sin \theta + \operatorname{cosec} \theta)^2 + (\cos \theta + \sec \theta)^2 = \tan^2 \theta + \cot^2 \theta + k$$

$$\text{LHS} = \sin^2 \theta + \operatorname{cosec}^2 \theta + 2 + \cos^2 \theta + \sec^2 \theta + 2$$

$$= 1 + 2 + 2 + 1 + \cot^2 \theta + 1 + \tan^2 \theta$$

$$= 7 + \cot^2 \theta + \tan^2 \theta$$

$$\Rightarrow k = 7$$

90. (2)

$$\text{Given: } 3 \sin \theta + 5 \cos \theta = 5$$

$$3 \sin \theta + 5\sqrt{1 - \sin^2 \theta} = 5$$

$$5\sqrt{1 - \sin^2 \theta} = 5 - 3 \sin \theta$$

$$25(1 - \sin^2 \theta) = 25 + 9 \sin^2 \theta - 30 \sin \theta$$

$$25 - 25 \sin^2 \theta = 25 + 9 \sin^2 \theta - 30 \sin \theta$$

$$30 \sin \theta - 34 \sin^2 \theta = 0$$

$$\sin \theta (30 - 34 \sin \theta) = 0$$

$$\Rightarrow \sin \theta = 0 \text{ or } \sin \theta = \frac{30}{34} = \frac{15}{17}$$

If $\theta = 0$,

$$5 \sin \theta - 3 \cos \theta = -3$$

$$\text{If } \sin \theta = \frac{15}{17}, \text{ then } \cos \theta = \frac{8}{17}$$

$$\Rightarrow 5 \times \frac{15}{17} - 3 \times \frac{8}{17} = \frac{51}{17} = +3$$

91. (4)

Let α and $\alpha + 1$ be the roots of $x^2 - px + q = 0$

$$\alpha + \alpha + 1 = p$$

$$\alpha(\alpha + 1) = q$$

$$\Rightarrow 2\alpha + 1 = p$$

$$\alpha = \frac{p-1}{2}$$

$$\frac{(p-1)}{2} \left[\frac{p-1}{2} + 1 \right] = q$$

$$\frac{p^2 - 1}{4} = q \Rightarrow p^2 - 4q = 1$$

92. (2)

$$\text{Mean of } n \text{ numbers} = \bar{X}$$

$$\text{Sum of } n \text{ numbers} = n\bar{X}$$

$$\text{Sum of } (n - 1) \text{ terms} = K$$

$$\text{nth number} = n\bar{X} - k$$

93. (1)

$$\text{When 2 white squares selected and 1 black square selected} = {}^{32}C_2 \times {}^{32}C_1$$

$$\text{When 2 black squares are selected and 1 white square selected} = {}^{32}C_2 \times {}^{32}C_1$$

$$\text{Total possible outcomes} = {}^{64}C_3$$

$$\text{Probability} = \frac{2({}^{32}C_2 \times {}^{32}C_1)}{{}^{64}C_3}$$

$$= \frac{2 \times \frac{32!}{30! \times 21!} \times \frac{32!}{3! \times 1!}}{\frac{64!}{61! \times 3!}}$$

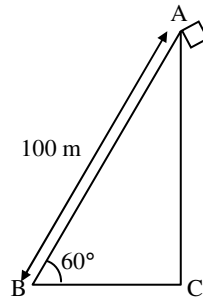
$$\begin{aligned}
 &= \frac{2 \times \frac{32 \times 31}{2} \times \frac{32 \times 3!}{1}}{64 \times 63 \times 62} \\
 &= \frac{32 \times 3 \times 2}{2 \times 63 \times 2} = \frac{16}{21}
 \end{aligned}$$

94. (1)

$$\sin 60^\circ = \frac{AC}{AB}$$

$$\frac{\sqrt{3}}{2} = \frac{AC}{100}$$

$$\Rightarrow AC = 50\sqrt{3}$$



95. (2)

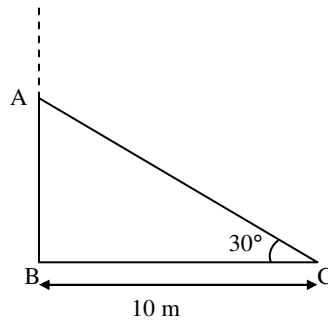
$$\text{In } \triangle ABC, \tan 30^\circ = \frac{AB}{BC}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{10} \Rightarrow AB = \frac{10}{\sqrt{3}}$$

$$\text{Also } \cos 30^\circ = \frac{BC}{AC}$$

$$\frac{\sqrt{3}}{2} = \frac{10}{AC}$$

$$AC = \frac{20}{\sqrt{3}}$$



Height of the tree = AB + AC

$$= \frac{10}{\sqrt{3}} + \frac{20}{\sqrt{3}} = \frac{30}{\sqrt{3}} = 10\sqrt{3} \text{ m}$$

96. (2)

$$f(x) = 2x^3 + 5x^2 + 6x + 10 \Rightarrow m + l + n = -\frac{5}{2}$$

$$ml + ln + mn = \frac{6}{2} = 3$$

$$lmn = -\frac{10}{2} = -5$$

$$\frac{1}{l} + \frac{1}{m} + \frac{1}{n} = \frac{mn + ln + ln}{lmn} = \frac{3}{-5} = -\frac{3}{5}$$

97. (3)

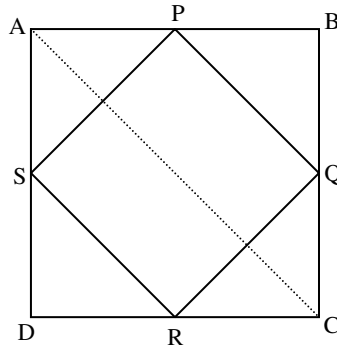
Perimeter of $\triangle ABC = 60$ cm and $\triangle DEF = 36$ cm

$$\Rightarrow \frac{\text{Perimeter } \triangle ABC}{\text{Perimeter } \triangle DEF} = \frac{BC}{EF}$$

$$\frac{60}{36} = \frac{18}{EF} \Rightarrow EF = \frac{18 \times 36}{60} = 10.8 \text{ cm}$$

98. (1)

$$\begin{aligned} \text{Let } AB = BC = CD = AD = a \\ \Rightarrow AC = a\sqrt{2} \\ \Rightarrow PQ = \frac{a\sqrt{2}}{2} \Rightarrow PQ^2 = \frac{1}{2}a^2 \\ \Rightarrow \frac{\text{Area of PQRS}}{\text{Area of ABCD}} = \frac{1}{2} \end{aligned}$$



99. (1)

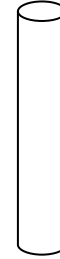
Radius of the cylinder = 2.1 cm

Height of cylinder = 80 cm

Radius of hemisphere = 2.1 cm

Volume of Burette = volume of cylinder + volume of hemisphere

$$\begin{aligned} &= \pi r^2 h + \frac{2}{3} \pi r^3 \\ &= \pi r^2 \left[h + \frac{2}{3} r \right] = \frac{22}{7} \times 2.1 \times 2.1 \left[80 + \frac{2}{3} \times 2.1 \right] \\ &= 1128.204 \text{ cm}^3 \approx 1.1 \text{ l} \end{aligned}$$



100. (1)

$$\text{Volume of conical vessel} = \frac{1}{3} \pi r^2 h = \frac{1}{3} \pi \times 6^2 \times 8 = 96 \pi \text{ cm}^3$$

$$AB = l = \sqrt{r^2 + h^2} = 10 \text{ cm}$$

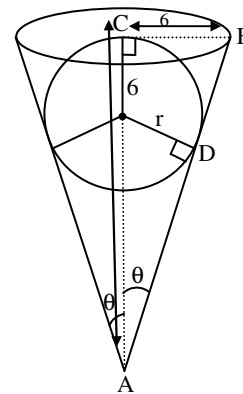
$$\text{In } \triangle ACB, \sin \theta = \frac{CB}{AB} = \frac{6}{10} = \frac{3}{5}$$

$$\text{In } \triangle OAD, \sin \theta = \frac{OD}{OA}$$

$$\frac{3}{5} = \frac{r}{8-r} \Rightarrow r = 3 \text{ cm}$$

$$\text{Volume sphere} = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi (3)^3 = 36 \pi$$

$$\text{Volume of water overflowing} = \frac{\text{volume of sphere}}{\text{volume of cone}} = \frac{36 \pi}{96 \pi} = \frac{3}{8}$$



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