

### Physics

1. A bus travels one-third of its total journey at a speed of 30km/hr and the remaining distance at 60km/hr. What is the average speed of the bus for the entire journey?

- A) 40km/hr                      B) 45km/hr  
C) 50km/hr                      D) 55km/hr

2. A cyclist covers one-fourth of a certain distance at 20km/hr and the rest of the distance at 60km/hr. Find the average speed of the cyclist.

- A) 30km/hr                      B) 35km/hr  
C) 40km/hr                      D) 45km/hr

3. A car travels  $\frac{1}{3}$  rd of the total distance with speed  $v_1$  and the remaining  $\frac{2}{3}$  rd distance with speed  $v_2$ . What is the average speed of the car for the entire journey?

- A)  $\frac{3v_1v_2}{2v_1+v_2}$                       B)  $\frac{v_1+2v_2}{3}$   
C)  $\frac{2v_1v_2}{v_1+v_2}$                       D)  $\frac{3v_1v_2}{v_1+2v_2}$

4. A particle covers  $\frac{2}{5}$  th of the total distance with speed  $v_1$  and the remaining distance with speed  $v_2$ . Find the average speed of the particle.

- A)  $\frac{5v_1v_2}{3v_1+2v_2}$                       B)  $\frac{2v_1+3v_2}{5}$   
C)  $\frac{5v_1v_2}{2v_1+3v_2}$                       D)  $\frac{v_1+v_2}{2}$

5. A car travels one-third of the total distance with velocity  $v_0$ . The remaining distance is covered with velocity  $v_1$  for half the time and with velocity  $v_2$  for the rest half. The average velocity of the car for the whole journey is:

- A)  $\frac{3v_0(v_1+v_2)}{v_0+4(v_1+v_2)}$                       B)  $\frac{3v_0(v_1+v_2)}{4v_0+v_1+v_2}$   
C)  $\frac{v_0+v_1+v_2}{3}$                       D)  $\frac{2v_0(v_1+v_2)}{2v_0+v_1+v_2}$

6. A particle covers  $\frac{1}{4}$ th of the total distance with speed  $v_1$ . The remaining part of the distance is covered with speed  $v_2$  for half the time and with speed  $v_3$  for the rest half. The average speed of the particle is:

- A)  $\frac{4v_1(v_2+v_3)}{6v_1+v_2+v_3}$                       B)  $\frac{4v_1(v_2+v_3)}{v_1+6(v_2+v_3)}$   
C)  $\frac{v_1+2v_2+2v_3}{5}$                       D)  $\frac{2v_1(v_2+v_3)}{3v_1+v_2+v_3}$

7. A particle moving in a straight line covers half the distance with a speed of 10 m/s. The other half of the distance is covered in two equal time intervals with speeds of 20 m/s and 40 m/s respectively. The average speed of the particle during this motion is:

- A) 15 m/s                      B) 20 m/s  
C) 25 m/s                      D) 30 m/s

8. A car travels one-third of the total distance with a speed of 10 m/s. The remaining distance is covered in two equal time intervals with speeds of 30 m/s and 50 m/s respectively. The average speed of the car for the whole journey is:

- A) 15 m/s                      B) 20 m/s  
C) 25 m/s                      D) 30 m/s

9. A body travels one-third of the total distance with speed  $v$ , the second one-third with speed  $3v$ , and the final one-third with speed  $6v$ . Its average speed is:

- A)  $v$                       B)  $1.5v$   
C)  $2v$                       D)  $3v$

10. A particle covers the first one-third of the total distance with speed  $v$ , the second one-third with speed  $2v$ , and the remaining one-third with speed  $4v$ . The average speed of the particle is:

- A)  $2v$                       B)  $\frac{12}{7}v$   
C)  $\frac{7}{12}v$                       D)  $3v$

11. A car travels a distance of 60 km at a speed of 30 km/h and another 60 km at a speed of 60 km/h. The average speed for the entire trip is:

- A) 45 km/h                      B) 40 km/h  
C) 50 km/h                      D) 55 km/h

12. A runner covers the first 100 meters with a speed of 5 m/s and the next 100 meters with a speed of 10 m/s. The average speed of the runner is:

- A) 7.5 m/s                      B) 6.67 m/s  
C) 8.0 m/s                      D) 5.5 m/s

13. A particle moves in the east direction with 6 m/s for 2 s then northwards with 8 m/s for 2 s. Average velocity of the particle is

- A) 4 m/s                      B) 5 m/s  
C) 7 m/s                      D) x

14. A body moves in the north direction with 12 m/s for 5 s then eastwards with 16 m/s for 5 s. The average velocity of the body is

- A) 10 m/s                      B) 14 m/s  
C) 20 m/s                      D) 28 m/s

15. A cyclist travels a distance  $S$  on a straight road in 4 hours and then returns to the starting point in the next 2 hours. Its average speed and average velocity are respectively:

- A)  $\frac{S}{3}, 0$                       B)  $\frac{S}{6}, 0$   
C)  $\frac{S}{2}, \frac{S}{6}$                       D)  $0, \frac{S}{3}$

16. A car travels one-fourth of the total distance with a speed of 20 km/hr and the remaining distance with a speed of 60 km/hr. The average speed of the car is:

- A) 30 km/hr                      B) 40 km/hr  
C) 45 km/hr                      D) 50 km/hr

17. A bus covers one-third of the total distance with a speed of 30 km/hr and the rest of the distance with a speed of 60 km/hr. The average speed of the bus is:

- A) 40 km/hr                      B) 45 km/hr  
C) 50 km/hr                      D) 55 km/hr

18. A student walks on a straight road from his home to a library 3 km away with a speed of 6 km/h. Finding the library closed, he instantly turns and walks back home with a speed of 9 km/h. The average speed of the student over the interval of time 0 to 40 min is equal to

- A) 6 km/h                      B)  $\frac{27}{4}$  km/h  
C) 7 km/h                      D)  $\frac{15}{2}$  km/h

19. A cyclist rides on a straight road from his village to a town 5 km away with a speed of 10 km/h. Finding the town market closed, he instantly turns and rides back to the village with a speed of 20 km/h. The average speed of the cyclist over the interval of time 0 to 45 min is equal to

- A) 10 km/h                      B)  $\frac{40}{3}$  km/h  
C) 15 km/h                      D)  $\frac{50}{3}$  km/h

20. A particle moves along a straight line covering a distance  $d$  in time  $t_1$  and then returns to the origin in time  $t_2$ . The average speed and average velocity of the particle are:

- A)  $\frac{d}{t_1+t_2}, 0$                       B)  $\frac{2d}{t_1+t_2}, 0$   
C)  $0, \frac{2d}{t_1+t_2}$                       D)  $\frac{d}{t_1+t_2}, \frac{d}{t_1+t_2}$

21. A train travels the first half of the distance between two stations at a speed of 40 km/hr and the second half of the distance at 60 km/hr. The average speed of the train for the whole journey is

- A) 50 km/hr                      B) 48 km/hr  
C) 45 km/hr                      D) 52 km/hr

22. A cyclist covers the first half of a route at a speed of 20 km/hr and the remaining half of the distance at 30 km/hr. What is the average speed of the cyclist for the entire trip?

- A) 25 km/hr                      B) 24 km/hr  
C) 26 km/hr                      D) 22 km/hr

23. A student walks to school at a distance of 12 km with a constant speed of 3 km/hr and walks back with a constant speed of 4 km/hr. His average speed for the round trip expressed in km/hour is

- A)  $\frac{24}{7}$                       B)  $\frac{7}{24}$   
C) 3.5                      D) 7

**24. A boat travels a distance of 20 km upstream with a constant speed of 5 km/hr and returns downstream with a constant speed of 10 km/hr. The average speed of the boat for the round trip expressed in km/hour is**

- A)** 7.5                      **B)**  $\frac{15}{2}$
- C)**  $\frac{20}{3}$                         **D)**  $\frac{3}{20}$

**25. A car travels from A to B at a speed of 30 km/hr and returns at a speed of 60 km/hr. The average speed of the car for the whole journey is**

- A) 35 km/hr**                      **B) 40 km/hr**  
**C) 45 km/hr**                      **D) 50 km/hr**

**26. A bus travels from X to Y at a speed of 40 km/hr and returns at a speed of 60 km/hr. The average speed of the bus for the whole journey is**

- A)** 48 km/hr      **B)** 45 km/hr  
**C)** 50 km/hr      **D)** 55 km/hr

**27. A train travels from station P to Q at a speed of 40 km/h and returns at a speed of 60 km/h. The average speed of the train for the whole journey is**

- A)** 50 km/h                      **B)** 48 km/h  
**C)** 45 km/h                      **D)** 100 km/h

**28. A cyclist rides from town X to Y at a speed of 30 km/h and returns at a speed of 60 km/h. The average speed of the cyclist for the whole journey is**

- A)** 45 km/h                      **B)** 40 km/h  
**C)** 90 km/h                    **D)** 20 km/h

**29. A car travels the first half of a distance between two places at a speed of 40 km/hr and the second half of the distance at 60 km/hr. The average speed of the car for the whole journey is**

- A)** 50 km/hr                      **B)** 48 km/hr  
**C)** 55 km/hr                      **D)** 45 km/hr

**30. A train covers the first half of the distance between two stations at a speed of 20 km/hr and the second half of the distance at 30 km/hr. The average speed of the train for the whole journey is**

- A)** 25 km/hr                      **B)** 22 km/hr  
**C)** 26 km/hr                      **D)** 24 km/hr

**31. A car travels the first half of the distance between two cities at a speed of 40 km/h and the second half of the distance at 60 km/h. The average speed of the car for the whole journey is**

- A)** 50 km/h                      **B)** 48 km/h  
**C)** 45 km/h                      **D)** 55 km/h

**32. A particle travels one-third of the total distance with speed  $v_1$  and the remaining distance with speed  $v_2$  along a straight line. The average speed of the particle is**

- A)**  $\frac{3v_1v_2}{2v_1+v_2}$       **B)**  $\frac{2v_1v_2}{v_1+v_2}$   
**C)**  $\frac{v_1+2v_2}{3}$       **D)**  $\frac{3v_1v_2}{v_1+2v_2}$

**33. The displacement of a particle is given by  $x = 5 - 3t + 4t^2$ . The initial velocity and acceleration are respectively**

- A)** 3, 4                      **B)** B)-3, 8  
**C)** C)5, -3                **D)** D)-3, 4

**34. The position of a particle moving along a straight line is given by  $s = A + Bt + Ct^2 + Dt^3$ . The initial velocity and initial acceleration are respectively**

- A) B, 2C**                      **B) B)B, C**  
**C) C)A, B**                      **D) D)2C, 6D**

**35. The position  $x$  of a particle varies with time  $t$  as  $x = At^3 - Bt^2$ . The acceleration of the particle will be zero at time  $t$  equal to**

- A)**  $\frac{A}{B}$                       **B)**  $\frac{B}{A}$   
**C)**  $\frac{B}{3A}$                       **D)**  $\frac{3B}{A}$

**36. The displacement  $y$  of a particle is given by  $y = 2at^2 - bt^3$ . The acceleration of the particle will be zero at time  $t$  equal to**

- A)**  $\frac{a}{b}$
- B)**  $\frac{2a}{3b}$
- C)**  $\frac{3a}{2b}$
- D)**  $\frac{a}{3b}$

37. The displacement of a particle, moving in a straight line, is given by  $s = 3t^2 + 5t + 2$  where  $s$  is in metres and  $t$  in seconds. The acceleration of the particle is

- A)  $3 \text{ m/s}^2$                       B)  $5 \text{ m/s}^2$   
C)  $6 \text{ m/s}^2$                       D)  $10 \text{ m/s}^2$

38. The position  $x$  of a particle varies with time  $t$  as  $x = 4t^2 - 6t + 3$ . The acceleration of the particle is

- A)  $4 \text{ m/s}^2$                       B)  $-6 \text{ m/s}^2$   
C)  $8 \text{ m/s}^2$                       D)  $2 \text{ m/s}^2$

39. The motion of a particle is described by the equation  $x = a + bt^2$  where  $a = 20 \text{ m}$  and  $b = 2 \text{ m/s}^2$ . Its instantaneous velocity at time 3 sec will be

- A)  $6 \text{ m/s}$                       B)  $12 \text{ m/s}$   
C)  $18 \text{ m/s}$                       D)  $24 \text{ m/s}$

40. The motion of a particle is described by the equation  $y = p + qt^2$  where  $p = 10 \text{ cm}$  and  $q = 5 \text{ cm/s}^2$ . Its instantaneous velocity at time 4 sec will be

- A)  $20 \text{ cm/sec}$                       B)  $80 \text{ cm/sec}$   
C)  $50 \text{ cm/sec}$                       D)  $40 \text{ cm/sec}$

41. A man walks on a straight road from his home to a market 3 km away with a speed of 6 km/h. Finding the market closed, he instantly turns and walks back home with a speed of 9 km/h. The average speed of the man over the interval of time 0 to 40 min is equal to

- A)  $6 \text{ km/h}$                       B)  $\frac{27}{4} \text{ km/h}$   
C)  $\frac{30}{4} \text{ km/h}$                       D)  $\frac{45}{8} \text{ km/h}$

42. A boy walks on a straight road from his home to a park 4 km away with a speed of 8 km/h. Finding the park closed, he instantly turns and walks back home with a speed of 12 km/h. The average speed of the boy over the interval of time 0 to 45 min is equal to

- A)  $8 \text{ km/h}$                       B)  $\frac{28}{3} \text{ km/h}$   
C)  $\frac{32}{3} \text{ km/h}$                       D)  $\frac{45}{8} \text{ km/h}$

43. If a car covers  $\frac{1}{3}$ rd of the total distance with speed  $v_1$  and the remaining  $\frac{2}{3}$ rd distance with speed  $v_2$ , then the average speed is

- A)  $\frac{2v_1v_2}{v_1+v_2}$                       B)  $\frac{3v_1v_2}{2v_1+v_2}$   
C)  $\frac{v_1+2v_2}{3}$                       D)  $\sqrt{v_1v_2}$

44. A particle travels  $\frac{1}{4}$ th of the total distance with speed  $v_1$  and the remaining distance with speed  $v_2$ . The average speed of the particle is

- A)  $\frac{4v_1v_2}{3v_1+v_2}$                       B)  $\frac{v_1+3v_2}{4}$   
C)  $\frac{4v_1v_2}{v_1+3v_2}$                       D)  $\frac{3v_1+v_2}{4}$

45. A vehicle covers  $\frac{3}{5}$ th of the total distance with speed  $v_1$  and the remaining distance with speed  $v_2$ . The average speed for the whole journey is

- A)  $\frac{5v_1v_2}{3v_1+2v_2}$                       B)  $\frac{5v_1v_2}{2v_1+3v_2}$   
C)  $\frac{3v_1+2v_2}{5}$                       D)  $\frac{2v_1v_2}{v_1+v_2}$

### Chemistry

46. Which of the following sets of elements follows Newland's octave rule :-

- A) Be, Mg, Ca                      B) Na, K, Rb  
C) F, Cl, Br                      D) B, Al, Ga

47. Atomic wt. of P is 31 and Sb is 120. What will be the atomic wt. of As, as per Dobereiners triad rule :-

- A) 151                      B) 75.5  
C) 89.5                      D) Unpredictable

48. The places that were left empty by Mendeleev's were, for:-

- A) Aluminium & Silicon                      B) Gallium and germanium  
C) Arsenic and antimony                      D) Molybdenum and tungstun

49. Which is not anomalous pair of elements in the Medeleev's periodic table:-

- A) Ar and K                      B) Co and Ni  
C) Te and I                      D) Al and Si

50. IUPAC name of the element placed just after actinide series :-

- A) Unniltrium                      B) Unnilpentium  
C) Unnilquadium                  D) Ununbium

51. The element with atomic number  $Z = 115$  will be placed in :-

- A) 7th period, IA group      B) 8th period, IVA group  
C) 7th period, VA group    D) 6th period, VB group

52. Which of the following sequence contains atomic number of only representative elements

- A) 55, 12, 18, 53              B) 13, 33, 54, 83  
C) 3, 33, 53, 87               D) 22, 33, 55, 66

53. Which of the following order of atomic/ionic radius is not correct :-

- A)  $I^- > I > I^+$                   B)  $Mg^{+2} > Na^+ > F^-$   
C)  $P^{+5} < P^{+3}$                 D)  $Li > Be > B$

54. The correct order of stability of  $Al^+$ ,  $Al^{+2}$ ,  $Al^{+3}$  is :-

- A)  $Al^{+3} > Al^{+2} > Al^+$       B)  $Al^{+2} > Al^{+3} > Al^+$   
C)  $Al^{+2} < Al^+ > Al^{+3}$       D)  $Al^{+3} > Al^+ > Al^{+2}$

55. Among the following elements (Whose electronic configuration is given below) the one having the highest ionisation energy is

- A)  $[Ne]3s^23p^3$                   B)  $[Ne]3s^23p^4$   
C)  $[Ne]3s^23p^5$                   D)  $[Ar]3d^{10}4s^24p^2$

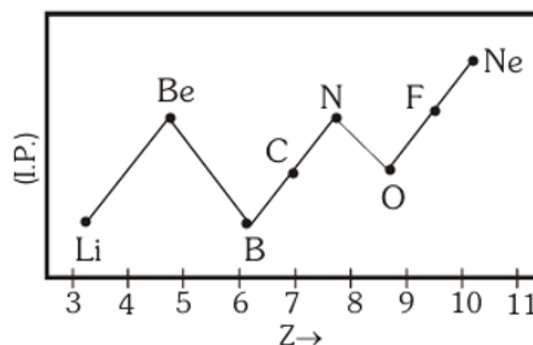
56. Successive ionisation energies of an element 'X' are given below (in K. Cal):  
 $IP_1 = 165, IP_2 = 195, IP_3 = 556, IP_4 = 595$   
. Electronic configuration of 'X' is:-

- A)  $1s^2, 2s^22p^6, 3s^23p^2$     B)  $1s^2, 2s^1$   
C)  $1s^2, 2s^22p^2$                D)  $1s^2, 2s^22p^6, 3s^2$

57. Second IP of which of the element is maximum-

- A) Lithium                          B) Oxygen  
C) Nitrogen                        D) Fluorine

58. Following graph shows variation of I.P. with atomic number in second period (Li – Ne). Value of I.P. of Na(11) will be :-



- A) Above Ne                      B) Below Ne but above O  
C) Below Li                       D) Between N and O

59. Consider the following ionisation reactions:  
 $A_{(g)} \rightarrow A_{(g)}^+ + e^-$  IE in (KJ/mol) is  $A_1$   
 $A_{(g)}^+ \rightarrow A_{(g)}^{+2} + e^-$  IE in (KJ/mol) is  $A_2$   
 $A_{(g)}^{+2} \rightarrow A_{(g)}^{+3} + e^-$  IE in (KJ/mol) is  $A_3$   
Then correct order of IE is :-

- A)  $A_1 > A_2 > A_3$               B)  $A_1 = A_2 = A_3$   
C)  $A_1 < A_2 < A_3$               D)  $A_3 = A_2 < A_1$

60. In which of the following process, least energy is required :-

- A)  $F_{(g)}^- \rightarrow F_{(g)} + e^-$       B)  $P_{(g)}^- \rightarrow P_{(g)} + e^-$   
C)  $S_{(g)}^- \rightarrow S_{(g)} + e^-$       D)  $Cl_{(g)}^- \rightarrow Cl_{(g)} + e^-$

61. The electronegativities of the following elements: H, O, F, S and Cl increase in the order :-

- A)  $H < O < F < S < Cl$       B)  $Cl < H < O < F < S$   
C)  $H < S < O < Cl < F$       D)  $H < S < Cl < O < F$

62. Which of the following does not act as an amphoteric oxide ?

- A)  $Al_2O_3$                           B) ZnO  
C) BeO                              D) NO

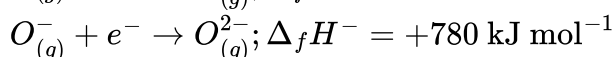
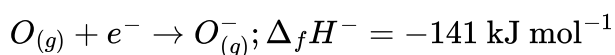
63. The anomalous behaviour of 2nd period elements from rest of the members of their respective families is due to :-

- A) small size                      B) large charge/radius ratio  
C) higher  $Z_{eff}$                   D) All

64. Amongst the elements with following electronic configurations, which one of them may have the highest ionization energy?

- A)  $[Ne]3s^23p^1$       B)  $[Ne]3s^23p^3$   
 C)  $[Ne]3s^23p^2$       D)  $[Ar]3d^{10}4s^24p^3$

65. The formation of the oxide ion,  $O_{(g)}^{2-}$ , from oxygen atom requires first an exothermic and then an endothermic step as shown below:



Thus process of formation of  $O^{2-}$  in gas phase is unfavourable even though  $O^{2-}$  is isoelectronic with neon. It is due to the fact that:

- A) Oxygen is more electronegative      B) Addition of electron in oxygen results in larger size of the ion  
 C) Electron repulsion outweighs the stability gained by achieving noble gas configuration      D)  $O^-$  ion has comparatively smaller size than oxygen atom

66. In which of the following options the order of arrangement does not agree with the variation of property indicated against it?

- A)  $Al^{3+} < Mg^{2+} < Na^+$  (increasing first ionisation enthalpy)      B)  $B < C < N < O$  (increasing first ionisation enthalpy)  
 C)  $I < Br < Cl < F$  (increasing electron gain enthalpy)      D)  $Li < Na < K < Rb$  (increasing metallic radius)

67. For the second period elements the correct increasing order of first ionisation enthalpy is:

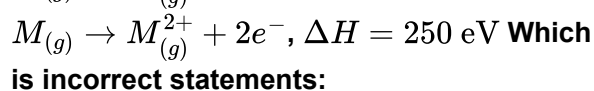
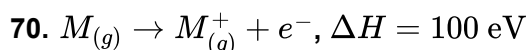
- A)  $Li < Be < B < C < N < O < F < Ne$       B)  $Li < O < B < F < Ne < C < N$   
 C)  $Li < B < Be < C < N < O < F < Ne$       D)  $Li < O < Be < F < Ne < C < N$

68. Which of the following represents the correct order of increasing electron gain enthalpy with negative sign for the elements O, S, F and Cl?

- A)  $S < O < Cl < F$       B)  $Cl < F < O < S$   
 C)  $O < S < F < Cl$       D)  $F < S < O < Cl$

69. Atomic number of Ag is 47. In the same group the atomic number of elements placed above and below Ag will be:

- A) 37, 67      B) 29, 79  
 C) 39, 69      D) 29, 65



- A)  $I_1$  of  $M_{(g)}$  is 100 eV      B)  $I_2$  of  $M_{(g)}$  is 150 eV  
 C)  $I_2$  of  $M_{(g)}$  is 250 eV      D) None

71. Successive ionisation energies of an element A are 100 eV, 150 eV, 181 eV, 2000 eV, 2200 eV correct statement regarding A is:

- A) Element 'A' may be metal      B) Formula of oxide of A may be  $A_2O_3$   
 C) Oxide of element A may be amphoteric      D) All are correct

72. Elements of which group form anions most readily:

- A) Oxygen family      B) Nitrogen group  
 C) Halogens      D) Alkali metals

73. Which is the weakest base among NaOH,  $Ca(OH)_2$ , KOH and  $Zn(OH)_2$ :

- A) NaOH      B) KOH  
 C)  $Ca(OH)_2$       D)  $Zn(OH)_2$

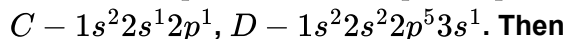
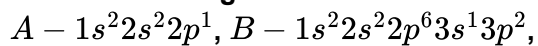
74. Identify the incorrect are:

- A) Shielding constant ( $\sigma$ ):  $Li > Na > K > Rb$       B)  $Z_{eff}$ :  $Li > Na > K > Rb$   
 C) Ionic radius:  $O^{2-} > F^- > Na^+ > Mg^{2+}$       D) Atomic size:  $Li > Na > K > Rb$

75. The order of ionisation potential between  $He^+$  ion and H-atom (both species are in gaseous state) is:

- A)  $F < Ne$       B)  $I.P.(He^+) = I.P.(H)$   
 C)  $I.P.(He^+) < I.P.(H)$       D) Cannot be compared  
 E)  $I.P.(He^+) > I.P.(H)$

76. Electronic configuration are:



which among these will belong to the same group in the periodic table?

A) A & B

B) A, B, C

C) A, B, D

D) A, B, C, D

77. The  $IE_1$  &  $IE_2$  of three elements A, B & C are given as (IE in KJ/mol). A:

$IE_1 = 400, IE_2 = 2650$ ; B:

$IE_1 = 550, IE_2 = 1070$ ; C:

$IE_1 = 1150, IE_2 = 2090$ . Identify the element which represent a non-metal:

A) A

B) B

C) Both A & B

D) C

78. In which of the following arrangements the order is NOT according to the property indicated against it?

A)  $Al^{3+} < Mg^{2+} < Na^+$  (increasing first

(increasing ionic size) ionization energy)

C)  $I < Br < F < Cl$

(increasing electron gain enthalpy with negative sign)

D)

$Li < Na < K < Rb$  (increasing metallic radius)

79. Which one of the following orders represents the correct sequence of the increasing basic nature of the given oxides?

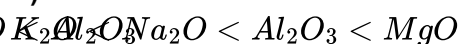
A)



C)



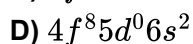
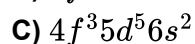
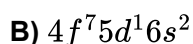
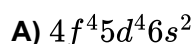
B)



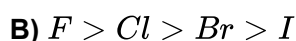
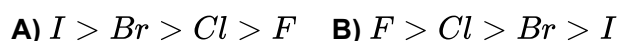
D)



80. The outer electron configuration of Gd (Atomic No. : 64) is:



81. The correct order of electron gain enthalpy with negative sign of F, Cl, Br and I, having atomic number 9, 17, 35 and 53 respectively, is:



82. The first ionisation potential of Na is 5.1 eV.

The value of electron gain enthalpy of  $Na^+$  will be:

A) -2.55 eV

B) -5.1 eV

C) -10.2 eV

D) +2.55 eV

83. For electron affinity of halogens which of the following is correct:

A)  $Br > F$

B)  $F > Cl$

C)  $Br > Cl$

D)  $F > I$

84. The pair of amphoteric hydroxide is:

A)  $Al(OH)_3, LiOH$

B)

$Be(OH)_2, Mg(OH)_2$

C)

$B(OH)_3, Be(OH)_2$

D)

$Be(OH)_2, Zn(OH)_2$

85. Electronegativity is the measurement of capacity of an atom by which:

A) Electrons get repelled

B) Electrons get attracted

C) Gain of electron

D) Loose of proton

86. The ions  $O^{2-}, F^-, Na^+, Mg^{2+}$  and  $Al^{3+}$  are isoelectronic. Their ionic radii show:

A) an increase from  $O^{2-}$  to  $F^-$  and then decrease from  $Na^+$  to  $Al^{3+}$

B) a decrease from  $O^{2-}$  to  $F^-$  and then increase from  $Na^+$  to  $Al^{3+}$

C) a significant increase from  $O^{2-}$  to  $Al^{3+}$

D) a significant decrease from  $O^{2-}$  to  $Al^{3+}$

87. Ionic radii are:

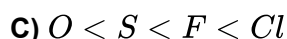
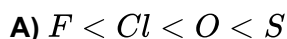
A) Directly proportional to square of effective nuclear charge

B) Inversely proportional to effective nuclear charge

C) Inversely proportional to square of effective nuclear charge

D) Directly proportional to effective nuclear charge

88. Which one of the following arrangements represents the correct order of electron gain enthalpy (with negative sign) of the given atomic species:



89. Which of the following E.A. order is not correct?

- A)  $N < O < S$                       B)  $Cl > O > N > C$   
 C)  $O < S < F < Cl$                 D)  $B < C < Si < S$

90. Which one of the following order of given properties is correct?

- A) Atomic radius -  $Li < Be < B$                       B) Ionisation potential -  $Li < Be < B$   
 C) Electron affinity -  $Li < Be < B$                 D) Electronegativity -  $Li < Be < B$

### Botany.

91. Five kingdom system of classification suggested by R.H. Whittaker is NOT based on:

- A) Presence or absence of a well-defined nucleus                      B) Mode of reproduction  
 C) Mode of nutrition                      D) Complexity of body organization

92. Match Column I with Column II regarding Kingdom Monera:

| Column I (Bacteria Type) | Column II (Habitat / Feature)      |
|--------------------------|------------------------------------|
| A. Halophiles            | 1. Marshy areas / Gut of ruminants |
| B. Thermoacidophiles     | 2. Hot springs                     |
| C. Methanogens           | 3. Extremely salty areas           |
| D. Cyanobacteria         | 4. Oxygenic photosynthesis         |

- A) A-3, B-2, C-1, D-4                      B) A-1, B-2, C-3, D-4  
 C) A-3, B-1, C-2, D-4                      D) A-2, B-4, C-1, D-3

93. In Aristotle's classification system, animals were split into two broad groups based on:

- A) Presence or absence of red blood                      B) Mode of locomotion (flying or walking)  
 C) Presence or absence of a cellular backbone                      D) Oviparous or viviparous reproduction

94. The Two-Kingdom classification system (Plantae and Animalia) was developed and proposed by:

- A) R.H. Whittaker                      B) Carolus Linnaeus  
 C) Ernst Haeckel                      D) Herbert Copeland

95. Read the following statements regarding Mycoplasma: Statement I: Mycoplasma are organisms that completely lack a cell wall. Statement II: They are the smallest living cells known and can survive without oxygen. Choose the correct

- A) Both Statement I and Statement II are correct.                      B) Both Statement I and Statement II are incorrect.  
 C) Statement I is correct but Statement II is incorrect.                      D) Statement I is incorrect but Statement II is correct.

96. Which of the following was a major limitation or drawback of the Two-Kingdom classification system?

- A) It did not distinguish between eukaryotes and prokaryotes.                      B) It did not distinguish between unicellular and multicellular organisms.  
 C) It did not distinguish between photosynthetic (green algae) and non-photosynthetic (fungi) organisms.                      D) All of the above are major limitations.

97. Read the following statements regarding historical classification transitions: Statement I: Chlamydomonas and Chlorella were placed along with Paramecium and Amoeba under Kingdom Protista in Whittaker's system. Statement II: In earlier classification systems, Chlamydomonas and Chlorella were kept inside Algae under Plants because of the presence of a cell wall. Choose the correct option

- A) Both Statement I and Statement II are correct.                      B) Both Statement I and Statement II are incorrect.  
 C) Statement I is correct but Statement II is incorrect.                      D) Statement I is incorrect but Statement II is correct.

98. Which of the following statements is completely correct regarding Mycoplasma?

- A) They have a thick cell wall made up of peptidoglycan.                      B) They are sensitive to penicillin antibiotics.  
 C) They are the smallest living cells known and can survive without oxygen.                      D) They are strictly non-pathogenic to animals and plants.

**99. Toxins released by large populations of which organism can kill marine life like fish during "Red Tides"?**

- A) Gonyaulax**                      **B) Euglena**  
**C) Amoeba**                        **D) Plasmodium**

**100.**

**In the Five-Kingdom system, into which kingdom are unicellular eukaryotes like Amoeba, Paramecium, and Chlorella grouped?**

- A) Monera**                      **B) Fungi**  
**C) Protista**                   **D) Plantae**

101.

**Organisms belonging to Kingdom Monera are characterised by which type of cellular organisation?**

- A) Unicellular eukaryotes**  
**B) Multicellular eukaryotes**  
**C) Unicellular prokaryotes**  
**D) Acellular entities**

102.

**Who proposed the classic Two-Kingdom system of classification, dividing living world into Plantae and Animalia?**

- A) Aristotle**                      **B) Carolus Linnaeus**  
**C) R.H. Whittaker**            **D) Ernst Haeckel**

103.

**What was the primary criteria used by Linnaeus to differentiate between Kingdom Plantae and Kingdom Animalia?**

- A)** Complexity of cell structure
- B)** Mode of nutrition and presence of a cell wall
- C)** Type of nuclear membrane
- D)** DNA replication mechanism

104.

**Which major drawback of the Two-Kingdom system led to its eventual rejection by modern taxonomists?**

- A)** It did not distinguish between eukaryotes and prokaryotes.
- B)** It put multi-cellular plants and single-celled algae into different kingdoms.
- C)** It completely omitted flowering plants.
- D)** It gave too much importance to viral genetics.

**105.**

**Consider the following two statements regarding the Two-Kingdom classification system: Statement I: The Two-Kingdom system easily distinguished between photosynthetic (green algae) and non-photosynthetic (fungi) organisms by placing them in separate kingdoms. Statement II: This system used gross morphology as its primary basis for classification. Choose the correct option:**

- A)** Both Statement I and Statement II are correct.
- B)** Both Statement I and Statement II are incorrect.
- C)** Statement I is correct but Statement II is incorrect.
- D)** Statement I is incorrect but Statement II is correct.

**106.**

**Read the statements given below about R.H. Whittaker's Five-Kingdom classification: Statement I: Whittaker used phylogenetic relationships and cell structure complexity as criteria for classification. Statement II: Under this system, all prokaryotic organisms were brought together under Kingdom Protista. Choose the correct option:**

- A)** Both Statement I and Statement II are true.
- B)** Both Statement I and Statement II are false.
- C)** Statement I is true but Statement II is false.
- D)** Statement I is false but Statement II is true.

107.

**Which of the following combinations of statements accurately highlights why the 5-Kingdom system improved upon the 2-Kingdom system? Statement A: It separated unicellular plants from multicellular plants by moving Chlamydomonas to Protista. Statement B: It grouped fungi with plants because both possess a cellulosic cell wall. Statement C: It recognized the unique heterotrophic absorptive nutrition of fungi and gave them a dedicated kingdom. Choose the correct option:**

- A)** Only A and B are correct
- B)** Only A and C are correct
- C)** Only B and C are correct
- D)** A, B, and C are all correct

108.

Evaluate the following statements regarding the placement of organisms in different systems: **Statement I: Bacteria and Cyanobacteria were placed in Kingdom Plantae in the Two-Kingdom system because they possess a cell wall.** **Statement II: In the Five-Kingdom system, Cyanobacteria are classified under Kingdom Monera. Choose the correct option:**

- |                                                                 |                                                                |
|-----------------------------------------------------------------|----------------------------------------------------------------|
| <b>A) Both Statement I and Statement II are correct.</b>        | <b>B) Both Statement I and Statement II are incorrect.</b>     |
| <b>C) Statement I is correct but Statement II is incorrect.</b> | <b>D) Statement I is incorrect but Statement II is correct</b> |

109.

Which of the following organisms are known as the structural backbone and the sole members of Kingdom Monera?

- |                        |                    |
|------------------------|--------------------|
| <b>A) Protozoans</b>   | <b>B) Bacteria</b> |
| <b>C) Slime moulds</b> | <b>D) Fungi</b>    |

110.

Select the correct match regarding bacterial shapes and their corresponding examples or terms:

- |                                |                                 |
|--------------------------------|---------------------------------|
| <b>A) Rod-shaped → Coccus</b>  | <b>B) Comma-shaped → Vibrio</b> |
| <b>C) Spherical → Bacillus</b> | <b>D) Spiral → Spore</b>        |

111.

Read the following statements regarding Cyanobacteria and choose the correct option: **Statement I: Cyanobacteria (blue-green algae) possess chlorophyll a similar to green plants and are oxygenic photoautotrophs.** **Statement II: They often form blooms in polluted water bodies and some can fix atmospheric nitrogen in specialized cells called heterocysts.**

- |                                                                 |                                                                 |
|-----------------------------------------------------------------|-----------------------------------------------------------------|
| <b>A) Statement I is correct but Statement II is incorrect.</b> | <b>B) Statement I is incorrect but Statement II is correct.</b> |
| <b>C) Both Statement I and Statement II are correct.</b>        | <b>D) Both Statement I and Statement II are incorrect.</b>      |

112.

**Mycoplasma are distinct monerans. Which statement is FALSE regarding them?**

- |                                             |                                                                      |
|---------------------------------------------|----------------------------------------------------------------------|
| <b>A) They completely lack a cell wall.</b> | <b>B) They are the smallest living cells known.</b>                  |
| <b>C) They can survive without oxygen.</b>  | <b>D) They are completely harmless and non-pathogenic to plants.</b> |

113.

**The cell walls of diatoms form two thin overlapping shells that fit together tightly like a soap box. These walls are structurally indestructible because they are embedded with:**

- |                     |                         |
|---------------------|-------------------------|
| <b>A) Cellulose</b> | <b>B) Chitin</b>        |
| <b>C) Silica</b>    | <b>D) Peptidoglycan</b> |

114.

**Because of its specific abrasive and gritty texture, soil derived from "diatomaceous earth" is industrially utilized in:**

- |                                             |                                                       |
|---------------------------------------------|-------------------------------------------------------|
| <b>A) Making bio-fertilizers and biogas</b> | <b>B) Polishing and filtration of oils and syrups</b> |
| <b>C) Culturing pathogenic bacteria</b>     | <b>D) Manufacturing plastic and synthetic rubber</b>  |

115.

**Which group of protists is biologically recognized as the "chief producers in the oceans"?**

- |                         |                           |
|-------------------------|---------------------------|
| <b>A) Cyanobacteria</b> | <b>B) Dinoflagellates</b> |
| <b>C) Euglenoids</b>    | <b>D) Diatoms</b>         |

116.

**Most dinoflagellates possess two distinct flagella to assist in locomotion. How are these flagella structurally arranged?**

- |                                                                         |                                                                                                   |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| <b>A) Both are arranged longitudinally at the anterior pole.</b>        | <b>B) One lies longitudinally and the other transversely in a furrow between the wall plates.</b> |
| <b>C) Both are arranged transversely around the middle of the cell.</b> | <b>D) They completely lack flagella and move passively via water currents.</b>                    |

117.

**Which of the following features is a prominent point of difference between Chrysophytes and Dinoflagellates?**

- |                                                                                                                                                |                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| <b>A)</b> Chrysophytes are photosynthetic while Dinoflagellates are purely heterotrophic.                                                      | <b>B)</b> Chrysophytes lack cell walls, whereas Dinoflagellates have walls embedded with silica.      |
| <b>C)</b> Chrysophytes have walls resembling a soap box with silica, while Dinoflagellates have stiff cellulose plates on their outer surface. | <b>D)</b> Chrysophytes are only found in marine water, while Dinoflagellates are strictly freshwater. |

118.

**Which of the following structural features is completely missing in Mycoplasma, distinguishing it from almost all other prokaryotes?**

- |                         |                                        |
|-------------------------|----------------------------------------|
| <b>A)</b> 70S Ribosomes | <b>B)</b> Plasma membrane              |
| <b>C)</b> Cell wall     | <b>D)</b> Double-stranded circular DNA |

119.

**Which of the following statements perfectly defines the size and respiratory capabilities of Mycoplasma?**

- |                                                                                 |                                                                                    |
|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| <b>A)</b> They are the largest prokaryotes and are strictly aerobic.            | <b>B)</b> They are the smallest living cells known and can survive without oxygen. |
| <b>C)</b> They are primitive eukaryotic cells that require oxygen to replicate. | <b>D)</b> They are non-cellular structures that only respire inside a host cell    |

120.

**Read the following statements regarding the pathogenic nature of Mycoplasma:**

**Statement I: Mycoplasma species are strictly saprophytic and only decompose dead organic matter. Statement II: Many Mycoplasma species are pathogenic in both plants and animals.] Choose the correct option:**

- |                                                                 |                                                                |
|-----------------------------------------------------------------|----------------------------------------------------------------|
| <b>A)</b> Both Statement I and Statement II are correct.        | <b>B)</b> Both Statement I and Statement II are incorrect.     |
| <b>C)</b> Statement I is correct but Statement II is incorrect. | <b>D)</b> Statement I is incorrect but Statement II is correct |

121.

**Match the Kingdom with its specific Cell Wall composition**

- |                                      |                                                                |
|--------------------------------------|----------------------------------------------------------------|
| <b>A)</b> Monera → Cellulosic        | <b>B)</b> Fungi → Non-cellulosic (Polysaccharide + amino acid) |
| <b>C)</b> Plantae → Present (Chitin) | <b>D)</b> Fungi → Present (with chitin)                        |

122.

**Which one of the following shows a complete absence of a nuclear membrane?**

- |                  |                    |
|------------------|--------------------|
| <b>A)</b> Monera | <b>B)</b> Protista |
| <b>C)</b> Fungi  | <b>D)</b> Animalia |

123.

**Identify the correct matches regarding "Body Organisation" across the five kingdoms from the options below: •**

**Kingdom X: Cellular • Kingdom Y: Multicellular / loose tissue • Kingdom Z: Tissue / organ / organ system What are X, Y, and Z?**

- |                                                |                                               |
|------------------------------------------------|-----------------------------------------------|
| <b>A)</b> X = Protista, Y = Fungi, Z = Plantae | <b>B)</b> X = Monera, Y = Fungi, Z = Animalia |
| <b>C)</b> X = Fungi, Y = Plantae, Z = Animalia | <b>D)</b> X = Monera, Y = Protista, Z = Fungi |

124.

**Holozoic and Saprophytic modes of nutrition are explicitly clubbed together under which kingdom's column?**

- |                    |                    |
|--------------------|--------------------|
| <b>A)</b> Fungi    | <b>B)</b> Plantae  |
| <b>C)</b> Animalia | <b>D)</b> Protista |

125.

**Read the following statements: Statement**

**I: The cell wall is completely absent in Kingdom Animalia, but is present in all members of Kingdom Protista. Statement**

**II: Nuclear membrane status changes from 'Absent' to 'Present' when transitioning from Monera to Protista. Choose the correct option:**

- |                                                                 |                                                                 |
|-----------------------------------------------------------------|-----------------------------------------------------------------|
| <b>A)</b> Both Statement I and Statement II are correct.        | <b>B)</b> Both Statement I and Statement II are incorrect.      |
| <b>C)</b> Statement I is correct but Statement II is incorrect. | <b>D)</b> Statement I is incorrect but Statement II is correct. |

126.

**Assertion (A):** Chlamydomonas and Amoeba are placed together in Kingdom Protista under Whittaker's system. **Reason (R):** R.H. Whittaker grouped all unicellular eukaryotic organisms into Kingdom Protista, irrespective of whether they have a plant-like cell wall or animal-like traits.

- A) Both (A) and (R) are true and (R) is the correct explanation of (A).  
 B) Both (A) and (R) are true but (R) is NOT the correct explanation of (A).  
 C) (A) is true but (R) is false.  
 D) (A) is false but (R) is true.

127.

**Assertion (A):** Mycoplasma are naturally resistant to the antibiotic Penicillin. **Reason (R):** Mycoplasma are the smallest living cells known to science and can survive seamlessly without oxygen.

- A) Both (A) and (R) are true and (R) is the correct explanation of (A).  
 B) Both (A) and (R) are true but (R) is NOT the correct explanation of (A).  
 C) (A) is true but (R) is false.  
 D) (A) is false but (R) is true.

128.

**Assertion (A):** Diatomaceous earth is industrially valuable and used in polishing, filtration of oils, and syrups. **Reason (R):** The cell walls of diatoms are indestructible because they are securely embedded with silica, leaving behind gritty deposits after they die.

- A) Both (A) and (R) are true and (R) is the correct explanation of (A).  
 B) Both (A) and (R) are true but (R) is NOT the correct explanation of (A).  
 C) (A) is true but (R) is false.  
 D) (A) is false but (R) is true.

129.

**Which of the following metabolic groups of monerans plays the most significant role in recycling nutrients like nitrogen, phosphorus, iron, and sulphur?**

- A) Photosynthetic autotrophs  
 B) Chemoautotrophic bacteria  
 C) Parasitic heterotrophs  
 D) Saprophytic fungi

130.

**Under unfavorable conditions, bacteria primarily ensure their survival over long periods by producing:**

- A) Zoospores  
 B) spores  
 C) Conidia  
 D) Gemmules

131.

**Read the following statements regarding Cyanobacteria: Statement I: Cyanobacteria are unicellular, colonial, or filamentous, freshwater/marine or terrestrial algae.**

**Statement II: The colonies of cyanobacteria are generally surrounded by a gelatinous/mucilaginous sheath. Choose the correct option:**

- A) Both Statement I and Statement II are correct.  
 B) Both Statement I and Statement II are incorrect.  
 C) Statement I is correct but Statement II is incorrect.  
 D) Statement I is incorrect but Statement II is correct.

132.

**Match the specialized Monerans (Column I) with their respective habitats or traits (Column II):**

| Column I (Organism)  | Column II (Trait / Habitat)    |
|----------------------|--------------------------------|
| A. Methanogens       | I. Hot springs                 |
| B. Halophiles        | II. Gut of ruminants           |
| C. Thermoacidophiles | III. Extreme salty areas       |
| D. Mycoplasma        | IV. Lacks a cell wall entirely |

**Choose the correct combination:**

- A) A-I, B-III, C-II, D-IV  
 B) A-II, B-III, C-I, D-IV  
 C) A-II, B-I, C-III, D-IV  
 D) A-IV, B-III, C-I, D-II

133.

**Match the Protist Subgroup (Column I) with its precise diagnostic trait or ecological impact (Column II):**

| Column I (Subgroup) | Column II (Trait / Impact)                                |
|---------------------|-----------------------------------------------------------|
| A. Diatoms          | I. Stiff cellulose plates on the outer cell surface       |
| B. Desmids          | II. Releases toxins that can cause massive fish mortality |
| C. Dinoflagellates  | III. Commonly referred to as golden algae                 |
| D. Gonyaulax        | IV. Cell wall deposits used in polishing and filtration   |

**Choose the correct combination from the options below:**

- A) A-IV, B-III, C-I, D-II  
 B) A-IV, B-I, C-III, D-II  
 C) A-I, B-III, C-IV, D-II  
 D) A-IV, B-III, C-II, D-I

134.

**What was the primary basis for the earliest classifications of living organisms by humans?**

- |                                                              |                                                             |
|--------------------------------------------------------------|-------------------------------------------------------------|
| <b>A)</b> Phylogenetic or evolutionary relationships         | <b>B)</b> Cell structure and presence of a nuclear membrane |
| <b>C)</b> Practical uses such as food, shelter, and clothing | <b>D)</b> Gross morphological traits like height and weight |

135.

**In diatoms, the cell walls form two thin overlapping shells that fit together as in a soap box. What are these walls embedded with?**

- |                             |                     |
|-----------------------------|---------------------|
| <b>A)</b> Calcium carbonate | <b>B)</b> Silica    |
| <b>C)</b> Chitin            | <b>D)</b> Cellulose |

### **Zoology**

136.

**Rana tigrina displays all of the following habits except**

- |                       |                       |
|-----------------------|-----------------------|
| <b>A)</b> camouflage  | <b>B)</b> aestivation |
| <b>C)</b> hibernation | <b>D)</b> endothermy  |

137.

**The frogs have the ability to change its colour to hide them from their enemies. This protective colouration is called**

- |                       |                       |
|-----------------------|-----------------------|
| <b>A)</b> hibernation | <b>B)</b> aestivation |
| <b>C)</b> mimicry     | <b>D)</b> camouflage  |

138.

**The skin of frog is slippery and smooth due to the presence of**

- |                     |                    |
|---------------------|--------------------|
| <b>A)</b> mucus     | <b>B)</b> gelatin  |
| <b>C)</b> waxy skin | <b>D)</b> mucilage |

139.

**Body of a frog is divisible into**

- |                          |                                      |
|--------------------------|--------------------------------------|
| <b>A)</b> head and trunk | <b>B)</b> head, neck and trunk       |
| <b>C)</b> trunk and tail | <b>D)</b> head, neck, trunk and tail |

140.

**The forelimbs and hindlimbs of frogs are**

- |                                              |                                              |
|----------------------------------------------|----------------------------------------------|
| <b>A)</b> four digits                        | <b>B)</b> five digits                        |
| <b>C)</b> four and five digits, respectively | <b>D)</b> five and four digits, respectively |

141.

**Male frog can be distinguished from female frog by the presence of**

- |                                                                            |                                                                   |
|----------------------------------------------------------------------------|-------------------------------------------------------------------|
| <b>A)</b> vocal sacs and copulatory pad on the first digit of the forelimb | <b>B)</b> a neck and tail is absent                               |
| <b>C)</b> the hindlimb ends in the five digits                             | <b>D)</b> eyes are bulged and covered by the nictitating membrane |

142.

**The alimentary canal of frog is short because frogs are**

- |                      |                        |
|----------------------|------------------------|
| <b>A)</b> herbivores | <b>B)</b> carnivores   |
| <b>C)</b> omnivores  | <b>D)</b> heterotrophs |

143.

**In frog, excess of the bile juice secreted by the liver is stored in**

- |                        |                    |
|------------------------|--------------------|
| <b>A)</b> intestine    | <b>B)</b> pancreas |
| <b>C)</b> gall bladder | <b>D)</b> rectum   |

144.

**In frog, for the digestion of food, walls of the stomach secrete**

- |                                  |                                     |
|----------------------------------|-------------------------------------|
| <b>A)</b> pepsin and renin       | <b>B)</b> amylase and tryptophanase |
| <b>C)</b> HCl and gastric juices | <b>D)</b> HCl and pepsin            |

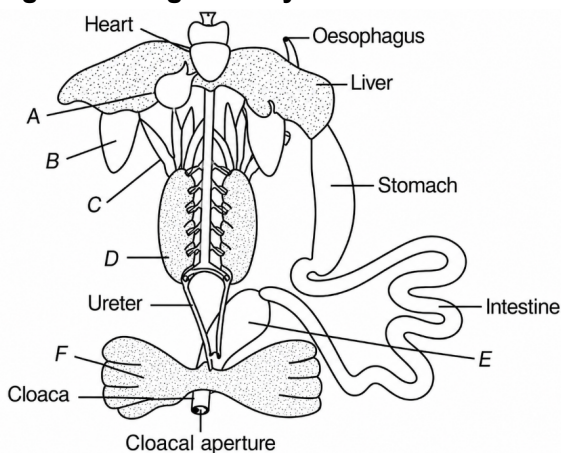
145.

**In frogs, digested food is absorbed by**

- |                                             |                                                         |
|---------------------------------------------|---------------------------------------------------------|
| <b>A)</b> villi and microvilli in intestine | <b>B)</b> villi in cloaca                               |
| <b>C)</b> microvilli in cloaca              | <b>D)</b> villi and microvilli in stomach and intestine |

146.

Given below is the diagram of internal organs of frog. Identify A to F.



A) A–Gall bladder, B–Lungs, C–Testis, D–Kidney, E–Urethra, F–Urinary bladder

C) A–Gall bladder, B–Lungs, C–Ovary, D–Kidney, E–Ileum, F–Urinary bladder

B) A–Gall bladder, B–Lungs, C–Fat bodies, D–Kidney, E–Rectum, F–Urinary bladder

D) A–Gall bladder, B–Lungs, C–Fat bodies, D–Kidney, E–Colon, F–Urinary bladder

147.

The respiration by lungs in frog is called

A) pulmonary respiration

C) alveolar respiration

B) pericardial respiration

D) None of these

148.

During aestivation and hibernation in frogs, gaseous exchange takes place through

A) skin

C) lungs

B) nose

D) scales

149.

The vascular system of the frog is

A) open type

C) double circulatory

B) closed type

D) portal

150.

The blood vascular system of the frog consists of

A) heart, blood vessels and blood without haemoglobin

C) haemolymph, blood vessels and heart

B) blood vessels, capillaries and neurogenic heart

D) arteries, veins, capillaries, heart and blood containing RBCs and WBCs

151.

Three-chambered heart of the frog contains

A) two ventricles and one atrium

C) one auricle and two ventricles

B) two atria and one ventricle

D) one auricle, one ventricle and one atrium

152.

Heart of the frog is covered by a membrane called

A) pericardium

C) pleuromembrane

B) plasma membrane

D) duramater

153.

The lymph of frog lacks

A) plasma proteins only

C) RBCs and few proteins

B) WBCs and RBCs

D) RBCs, WBCs and proteins

154.

In male frog, ureters act as

A) urinogenital ducts

C) urinary bladder

B) cloaca

D) genital ducts

155.

Which of the following is the structural and functional unit of kidney in the frog?

A) Ureters

C) Nephrons

B) Cloaca

D) Bidder's canal

156.

In frogs, cloaca is an opening of

A) excretory ducts

C) Both (a) and (b)

B) reproductive ducts

D) None of these

157.

The frog is a/an

A) ureotelic animal

C) uricotelic animal

B) ammonotelic animal

D) None of these

158.

Excretory system of the frog consists of

A) pair of kidneys, ureters, urinary bladder, cloaca

C) kidney and cloaca

B) single kidney, urinary bladder and cloaca

D) urethra and cloaca

**159.**

**The system for control and coordination in frogs comprises**

- |                                                               |                                                                             |
|---------------------------------------------------------------|-----------------------------------------------------------------------------|
| <b>A)</b> highly evolved neural system and endocrine glands   | <b>B)</b> highly evolved exocrine glands and least developed nervous system |
| <b>C)</b> least developed endocrine system and nervous system | <b>D)</b> endocrine and exocrine glands                                     |

**160.**

**The number of pairs of cranial nerves arising from the brain of frog is**

- |              |             |
|--------------|-------------|
| <b>A)</b> 10 | <b>B)</b> 9 |
| <b>C)</b> 8  | <b>D)</b> 7 |

**161.**

**The forebrain of frog consists of**

- |                                                     |                                     |
|-----------------------------------------------------|-------------------------------------|
| <b>A)</b> optic and olfactory lobes                 | <b>B)</b> paired diencephalon lobes |
| <b>C)</b> olfactory lobes and unpaired diencephalon | <b>D)</b> Both (a) and (b)          |

**162.**

**The midbrain of the frog is characterised by a pair of**

- |                               |                           |
|-------------------------------|---------------------------|
| <b>A)</b> cerebral hemisphere | <b>B)</b> cerebellum      |
| <b>C)</b> optic lobes         | <b>D)</b> olfactory lobes |

**163.**

**Hindbrain of a frog consists of**

- |                                            |                                                    |
|--------------------------------------------|----------------------------------------------------|
| <b>A)</b> cerebellum and medulla oblongata | <b>B)</b> olfactory lobes and cerebral hemispheres |
| <b>C)</b> a pair of optic lobes            | <b>D)</b> cerebrum and cranium                     |

**164.**

**Find out the pair in reference to the frog which is not correctly matched.**

- |                                                 |                                    |
|-------------------------------------------------|------------------------------------|
| <b>A)</b> Hearing – Tympanum with external ears | <b>B)</b> Touch – Sensory papillae |
| <b>C)</b> Smell – Nasal epithelium              | <b>D)</b> Vision – Simple eyes     |

**165.**

**In frogs, sensory papillae, taste buds and nasal epithelium are ....., while eyes and internal ears are well-organised structures.**

- |                                                        |                                                      |
|--------------------------------------------------------|------------------------------------------------------|
| <b>A)</b> cellular aggregations around muscular tissue | <b>B)</b> cellular aggregations around nerve endings |
| <b>C)</b> cellular aggregations around fatty tissue    | <b>D)</b> cellular aggregations around heart         |

**166.**

**The number of vasa efferentia that arises from testes in frog's male reproductive system is**

- |                   |                   |
|-------------------|-------------------|
| <b>A)</b> 9 - 12  | <b>B)</b> 10 - 12 |
| <b>C)</b> 13 - 16 | <b>D)</b> 16 - 19 |

**167.**

**In male frogs, cloaca is a small median chamber that is used to pass**

- |                         |                            |
|-------------------------|----------------------------|
| <b>A)</b> sperms        | <b>B)</b> urine            |
| <b>C)</b> faecal matter | <b>D)</b> All of the above |

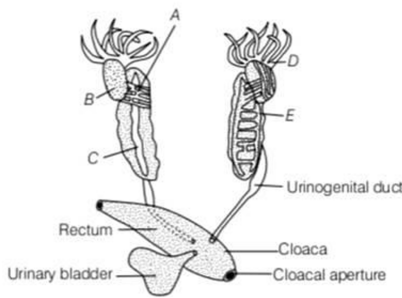
**168.**

**Select the correct route for the passage of sperms in male frogs.**

- |                                                                                           |                                                                                            |
|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| <b>A)</b> Testes → Bidder's canal → Kidney → Vasa efferentia → Urinogenital duct → Cloaca | <b>B)</b> Testes → Vasa efferentia → Kidney → Seminal vesicle → Urinogenital duct → Cloaca |
| <b>C)</b> Testes → Vasa efferentia → Bidder's canal → Ureter → Cloaca                     | <b>D)</b> Testes → Vasa efferentia → Kidney → Bidder's canal → Urinogenital duct → Cloaca  |

169.

Identify A, B, C and D in the given figure of male reproductive system of frog.



**A)** A–Fat bodies, B–Testis, C–Ureters, D–Vasa efferentia, E–Kidney

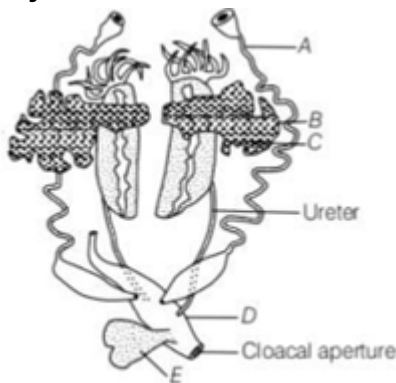
**C)** A–Vasa efferentia, B–Testis, C–Adrenal gland, D–Fat bodies, E–Kidney

**B)** A–Nephrons, B–Testis, C–Ureters, D–Villi, E–Kidney

**D)** A–Mesorchium, B–Testis, C–Adrenal gland, D–Fat bodies, E–Kidney

170.

Observe the following figure of female reproductive system of earthworm and identify A to D



**A)** A–Urinary duct, B–Ova, C–Ovary, D–Cloaca, E–Urethra

**C)** A–Oviduct, B–Ovary, C–Ova, D–Rectum, E–Adrenal gland

**B)** A–Oviduct, B–Ovary, C–Ova, D–Cloaca, E–Urinary bladder

**D)** A–Urinogenital duct, B–Ovary, C–Ovum, D–Coelom, E–Urethra

171.

In female frogs,

**A)** ovaries are absent

**C)** ovaries are not connected with kidney functionally

**B)** ovaries are functionally connected with kidneys

**D)** ovaries and oviducts are rudimentary

172.

Consider the following statements. I.

Malpighian tubules help in the removal of excretory products from the haemolymph in cockroach. II. Female cockroach bears mushroom glands, while male cockroach bears collateral glands. Select the correct option.

**A)** Both I and II are true **B)** I is true, II is false

**C)** Both I and II are false **D)** I is false, II is true

173.

Which of the following statements are correct in reference with the frog? I. Eyes are bulged and covered by nictitating membrane. II. Membranous tympanum receives the sound signals. III. The frog never drinks water. IV. Heart possesses sinus venosus.

**A)** I and II

**B)** III and IV

**C)** I and IV

**D)** I, II, III and IV

174.

Consider the following statements about frog. I. Skin acts as a respiratory organ only in water. II. Development is indirect through tadpole larva. III. Bidder canal is present in kidneys into which vasa efferentia opens in male frog. IV. They possess well-developed renal portal system. Which of the statements given above is/are incorrect?

**A)** Only I

**B)** I and III

**C)** I, II, and III

**D)** II and IV

175.

Frog's heart when taken out of the body continues to beat for some time. Select the option containing the correct statements. I. Frog is not a poikilotherm. II. Frog does not have any coronary circulation. III. Heart is 'myogenic' in nature. IV. Heart is autoexcitable.

**A)** Only III

**B)** Only IV

**C)** I and II

**D)** III and IV

176.

Match the following columns with reference to frog.

| Column I (Body parts in frog) | Column II (Location in the body) |
|-------------------------------|----------------------------------|
| A. Respiratory organ          | 1. Endocrine gland               |
| B. Excretory system           | 2. Skin                          |
| C. Thymus                     | 3. Cloaca                        |
| D. Brain box                  | 4. Cranium                       |
| E. Nasal epithelium           | 5. Smell                         |

Codes:

A) A-2, B-3, C-1, D-4, E-5      B) A-1, B-2, C-3, D-4, E-5

C) A-5, B-4, C-3, D-2, E-1      D) A-4, B-3, C-2, D-1, E-5

177.

Match the following columns with reference to frog.

| Column I             | Column II                    |
|----------------------|------------------------------|
| A. Touch             | 1. Nasal epithelium          |
| B. Smell             | 2. Foramen magnum            |
| C. Cranial nerves    | 3. Sensory papillae          |
| D. Medulla oblongata | 4. Peripheral nervous system |

Codes:

A) A-3, B-1, C-2, D-4      B) A-2, B-1, C-4, D-3

C) A-3, B-4, C-2, D-1      D) A-3, B-1, C-4, D-2

178.

Special venous connection between liver and intestine as well as the kidney and lower parts of the body are present in frogs. The former is called (A) system and the latter is called (B) system.

A) Hepatic portal system and renal portal system

C) Digestive system and circulatory system

B) Blood vascular system and lymphatic system

D) Renal portal system and Hepatic portal system

179.

Question: The A B C D are • Type of fertilization in Frog (external / Internal) – A • Fertilization of Frog takes place in \_\_\_\_ – B • Type of development in Frog (Direct / Indirect) – C • Development of frog involves a larval stage called \_\_\_\_ – D

A) external, water, indirect, tadpole larva

C) External, water, indirect, caterpillar larva

B) internal, water, direct, tadpole larva

D) internal, cloaca, indirect, tadpole larva

180.

Number true statements from the given 1. The frog never drinks water but absorb it through the skin. 2. Adult frog bear neck but do not bear tail. 3. Ventricle of Frog pumps mixed blood. 4. Digits of hind limbs are larger and muscular than digits of fore limbs. 5. Blood vascular system of frog is poorly developed and open type. 6. Frogs have a lymphatic system also. 7. The body cavity of frogs accommodates different organ systems such as digestive, circulatory, respiratory, nervous, excretory and reproductive systems with well developed structures and functions.

A) seven

C) four

B) five

D) six

## ANSWER KEY

### Physics

|     |   |     |   |     |   |     |   |
|-----|---|-----|---|-----|---|-----|---|
| 1.  | 2 | 13. | 2 | 25. | 2 | 37. | 3 |
| 2.  | 3 | 14. | 1 | 26. | 1 | 38. | 3 |
| 3.  | 1 | 15. | 1 | 27. | 2 | 39. | 2 |
| 4.  | 1 | 16. | 2 | 28. | 2 | 40. | 4 |
| 5.  | 2 | 17. | 2 | 29. | 2 | 41. | 2 |
| 6.  | 1 | 18. | 2 | 30. | 4 | 42. | 2 |
| 7.  | 1 | 19. | 2 | 31. | 2 | 43. | 2 |
| 8.  | 2 | 20. | 2 | 32. | 1 | 44. | 3 |
| 9.  | 3 | 21. | 2 | 33. | 2 | 45. | 2 |
| 10. | 2 | 22. | 2 | 34. | 1 |     |   |
| 11. | 2 | 23. | 1 | 35. | 3 |     |   |
| 12. | 2 | 24. | 3 | 36. | 2 |     |   |

### Chemistry

|     |   |     |     |     |   |     |   |
|-----|---|-----|-----|-----|---|-----|---|
| 46. | 1 | 58. | 3   | 70. | 3 | 82. | 2 |
| 47. | 2 | 59. | 3   | 71. | 4 | 83. | 4 |
| 48. | 2 | 60. | 2   | 72. | 3 | 84. | 4 |
| 49. | 4 | 61. | 4   | 73. | 4 | 85. | 2 |
| 50. | 3 | 62. | 4   | 74. | 2 | 86. | 4 |
| 51. | 3 | 63. | 4   | 75. | 3 | 87. | 2 |
| 52. | 3 | 64. | 2   | 76. | 1 | 88. | 3 |
| 53. | 1 | 65. | 3   | 77. | 4 | 89. | 2 |
| 54. | 4 | 66. | 2,3 | 78. | 2 | 90. | 4 |
| 55. | 3 | 67. | 2   | 79. | 3 |     |   |
| 56. | 4 | 68. | 3   | 80. | 2 |     |   |
| 57. | 1 | 69. | 2   | 81. | 3 |     |   |

### Botany

|     |   |      |   |      |   |      |   |
|-----|---|------|---|------|---|------|---|
| 91. | 1 | 100. | 3 | 109. | 2 | 118. | 3 |
| 92. | 1 | 101. | 3 | 110. | 2 | 119. | 2 |
| 93. | 1 | 102. | 2 | 111. | 3 | 120. | 4 |
| 94. | 2 | 103. | 2 | 112. | 4 | 121. | 4 |
| 95. | 1 | 104. | 1 | 113. | 3 | 122. | 1 |
| 96. | 4 | 105. | 4 | 114. | 2 | 123. | 2 |
| 97. | 1 | 106. | 3 | 115. | 4 | 124. | 3 |
| 98. | 3 | 107. | 2 | 116. | 2 | 125. | 4 |
| 99. | 1 | 108. | 1 | 117. | 3 | 126. | 1 |

|      |          |      |          |      |          |
|------|----------|------|----------|------|----------|
| 127. | <b>2</b> | 130. | <b>2</b> | 133. | <b>1</b> |
| 128. | <b>1</b> | 131. | <b>1</b> | 134. | <b>3</b> |
| 129. | <b>2</b> | 132. | <b>2</b> | 135. | <b>2</b> |

### **Zoology.**

|      |          |      |          |      |          |      |          |
|------|----------|------|----------|------|----------|------|----------|
| 136. | <b>4</b> | 148. | <b>1</b> | 160. | <b>1</b> | 172. | <b>2</b> |
| 137. | <b>3</b> | 149. | <b>2</b> | 161. | <b>3</b> | 173. | <b>4</b> |
| 138. | <b>1</b> | 150. | <b>4</b> | 162. | <b>3</b> | 174. | <b>1</b> |
| 139. | <b>1</b> | 151. | <b>2</b> | 163. | <b>1</b> | 175. | <b>4</b> |
| 140. | <b>3</b> | 152. | <b>1</b> | 164. | <b>1</b> | 176. | <b>1</b> |
| 141. | <b>1</b> | 153. | <b>3</b> | 165. | <b>2</b> | 177. | <b>4</b> |
| 142. | <b>2</b> | 154. | <b>1</b> | 166. | <b>2</b> | 178. | <b>1</b> |
| 143. | <b>3</b> | 155. | <b>3</b> | 167. | <b>4</b> | 179. | <b>1</b> |
| 144. | <b>3</b> | 156. | <b>3</b> | 168. | <b>4</b> | 180. | <b>2</b> |
| 145. | <b>1</b> | 157. | <b>1</b> | 169. | <b>3</b> |      |          |
| 146. | <b>2</b> | 158. | <b>1</b> | 170. | <b>2</b> |      |          |
| 147. | <b>1</b> | 159. | <b>1</b> | 171. | <b>3</b> |      |          |

## SOLUTIONS

**Q1.**

**Answer:** B

**Explanation:**

Let the total distance be  $D$ . The time taken for the first part is  $t_1 = \frac{D/3}{30} = \frac{D}{90}$ . The time for the remaining  $2/3$  distance is  $t_2 = \frac{2D/3}{60} = \frac{D}{90}$ . Total time is  $\frac{2D}{90} = \frac{D}{45}$ . Average speed is  $\frac{D}{D/45} = 45$  km/hr.

**Q2.**

**Answer:** C

**Explanation:**

Let total distance be  $D$ . Time for first part ( $D/4$ ) at 20 km/hr is  $\frac{D}{80}$ . Time for rest ( $3D/4$ ) at 60 km/hr is  $\frac{3D/4}{60} = \frac{D}{80}$ . Total time is  $\frac{D}{40}$ . Average speed is  $\frac{D}{D/40} = 40$  km/hr.

**Q3.**

**Answer:** A

**Explanation:**

Let total distance be  $D$ . Time for first part ( $D/3$ ) is  $t_1 = \frac{D}{3v_1}$ . Time for remaining part ( $2D/3$ ) is  $t_2 = \frac{2D}{3v_2}$ . Total time  $T = \frac{D}{3} \left( \frac{1}{v_1} + \frac{2}{v_2} \right) = \frac{D(2v_1 + v_2)}{3v_1v_2}$ . Average speed  $V_{avg} = \frac{D}{T} = \frac{3v_1v_2}{2v_1 + v_2}$ .

**Q4.**

**Answer:** A

**Explanation:**

Let total distance be  $D$ . Time for first part ( $2D/5$ ) is  $t_1 = \frac{2D}{5v_1}$ . Time for remaining part ( $3D/5$ ) is  $t_2 = \frac{3D}{5v_2}$ . Total time  $T = \frac{D}{5} \left( \frac{2}{v_1} + \frac{3}{v_2} \right) = \frac{D(3v_1 + 2v_2)}{5v_1v_2}$ . Average speed  $V_{avg} = \frac{D}{T} = \frac{5v_1v_2}{3v_1 + 2v_2}$ .

**Q5.**

**Answer:** B

**Explanation:**

Let total distance be  $S$ . Time for first part ( $S/3$ ) is  $t_1 = \frac{S}{3v_0}$ . For the remaining distance ( $2S/3$ ), the average velocity during that segment (since time is split equally) is  $\frac{v_1 + v_2}{2}$ . Time for remaining part is  $t_2 = \frac{2S/3}{(v_1 + v_2)/2} = \frac{4S}{3(v_1 + v_2)}$ . Total time  $T = \frac{S}{3} \left[ \frac{1}{v_0} + \frac{4}{v_1 + v_2} \right]$ .  $V_{avg} = \frac{S}{T} = \frac{3v_0(v_1 + v_2)}{4v_0 + v_1 + v_2}$ .

**Q6.**

**Answer:** A

**Explanation:**

Let total distance be  $S$ . Time for first part ( $S/4$ ) is  $t_1 = \frac{S}{4v_1}$ . Remaining distance is  $3S/4$ . Average speed for this part (equal time split) is  $\frac{v_2 + v_3}{2}$ . Time for remaining part is  $t_2 = \frac{3S/4}{(v_2 + v_3)/2} = \frac{3S}{2(v_2 + v_3)}$ . Total time  $T = S \left[ \frac{1}{4v_1} + \frac{3}{2(v_2 + v_3)} \right]$ . Simplifying gives  $V_{avg} = \frac{4v_1(v_2 + v_3)}{6v_1 + v_2 + v_3}$ .

**Q7.**

**Answer:** A

**Explanation:**

Let total distance be  $2D$ . Time for first half ( $d$ ) at 10 m/s is  $t_1 = d/10$ . For the second half ( $d$ ), the motion is split into equal times with speeds 20 and 40, so the average speed for this segment is  $(20 + 40)/2 = 30$  m/s. Time for second half is  $t_2 = d/30$ . Total time  $T = d/10 + d/30 = 4d/30$ . Average speed =  $2d/(4d/30) = 15$  m/s.

**Q8.**

**Answer:** B

**Explanation:**

Let total distance be  $3D$ . First part ( $d$ ) at 10 m/s takes  $t_1 = d/10$ . Remaining part ( $2d$ ) has equal time intervals at 30 and 50 m/s, so average speed for this part is  $(30 + 50)/2 = 40$  m/s. Time for remaining part is  $t_2 = 2d/40 = d/20$ . Total time  $T = d/10 + d/20 = 3d/20$ . Average speed =  $3d/(3d/20) = 20$  m/s.

**Q9.**

**Answer:** C

**Explanation:**

Let total distance be  $S$ . Time for first part ( $S/3$ ) is  $t_1 = \frac{S}{3v}$ . Time for second part ( $S/3$ ) is  $t_2 = \frac{S}{9v}$ . Time for third part ( $S/3$ ) is  $t_3 = \frac{S}{18v}$ . Total time  $T = \frac{S}{3v} + \frac{S}{9v} + \frac{S}{18v} = \frac{6S + 2S + S}{18v} = \frac{9S}{18v} = \frac{S}{2v}$ . Average speed  $V_{avg} = \frac{S}{S/2v} = 2v$ .

**Q10.**

**Answer:** B

**Explanation:**

Let total distance be  $S$ . Time for parts are  $t_1 = \frac{S}{3v}$ ,  $t_2 = \frac{S}{6v}$ , and  $t_3 = \frac{S}{12v}$ . Total time  $T = \frac{S}{3v} + \frac{S}{6v} + \frac{S}{12v} = \frac{4S + 2S + S}{12v} = \frac{7S}{12v}$ . Average speed  $V_{avg} = \frac{S}{7S/12v} = \frac{12v}{7}$ .

**Q11.**

**Answer:** B

**Explanation:**

Since the distances are equal, we use the formula for average speed:  $V_{avg} = \frac{2v_1v_2}{v_1+v_2}$ . Substituting  $v_1 = 30$  and  $v_2 = 60$ , we get  $V_{avg} = \frac{2(30)(60)}{30+60} = \frac{3600}{90} = 40$  km/h.

**Q12.**

**Answer:** B

**Explanation:**

Using the formula for average speed over equal distances:  $V_{avg} = \frac{2v_1v_2}{v_1+v_2}$ . Substituting  $v_1 = 5$  and  $v_2 = 10$ , we get  $V_{avg} = \frac{2(5)(10)}{5+10} = \frac{100}{15} \approx 6.67$  m/s.

**Q13.**

**Answer:** B

**Explanation:**

Displacement in east:  $d_1 = 6 \times 2 = 12$  m.  
Displacement in north:  $d_2 = 8 \times 2 = 16$  m. Resultant displacement  $D = \sqrt{12^2 + 16^2} = 20$  m. Total time  $T = 2 + 2 = 4$  s. Average velocity  $V_{avg} = \frac{20}{4} = 5$  m/s.

**Q14.**

**Answer:** A

**Explanation:**

Displacement north:  $d_1 = 12 \times 5 = 60$  m.  
Displacement east:  $d_2 = 16 \times 5 = 80$  m. Resultant displacement  $D = \sqrt{60^2 + 80^2} = 100$  m. Total time  $T = 5 + 5 = 10$  s. Average velocity  $V_{avg} = \frac{100}{10} = 10$  m/s.

**Q15.**

**Answer:** A

**Explanation:**

Total distance covered is  $S$  (forward) +  $S$  (backward) =  $2S$ . Total time taken is  $4 + 2 = 6$  hours. Average speed =  $\frac{\text{Total Distance}}{\text{Total Time}} = \frac{2S}{6} = \frac{S}{3}$ . Since the cyclist returns to the starting point, the net displacement is 0, so average velocity is 0.

**Q16.**

**Answer:** B

**Explanation:**

Let total distance be  $D$ . Time for first part ( $D/4$ ) is  $t_1 = \frac{D/4}{20} = \frac{D}{80}$ . Time for remaining part ( $3D/4$ ) is  $t_2 = \frac{3D/4}{60} = \frac{3D}{240} = \frac{D}{80}$ . Total time  $T = \frac{D}{80} + \frac{D}{80} = \frac{2D}{80} = \frac{D}{40}$ . Average speed  $V_{avg} = \frac{D}{D/40} = 40$  km/hr.

**Q17.**

**Answer:** B

**Explanation:**

Let total distance be  $D$ . Time for first part ( $D/3$ ) is  $t_1 = \frac{D/3}{30} = \frac{D}{90}$ . Time for remaining part ( $2D/3$ ) is  $t_2 = \frac{2D/3}{60} = \frac{2D}{180} = \frac{D}{90}$ . Total time  $T = \frac{D}{90} + \frac{D}{90} = \frac{2D}{90} = \frac{D}{45}$ . Average speed  $V_{avg} = \frac{D}{D/45} = 45$  km/hr.

**Q18.**

**Answer:** B

**Explanation:**

Time to reach library (3 km at 6 km/h) is  $t_1 = 0.5$  h = 30 min. Remaining time in the 40 min interval is 10 min =  $\frac{1}{6}$  h. Distance covered returning in this time at 9 km/h is  $d_{\text{return}} = 9 \times \frac{1}{6} = 1.5$  km. Total distance =  $3 + 1.5 = 4.5$  km. Total time =  $\frac{40}{60} = \frac{2}{3}$  h. Average speed =  $\frac{4.5}{2/3} = \frac{27}{4}$  km/h.

**Q19.**

**Answer:** B

**Explanation:**

Time to reach town (5 km at 10 km/h) is  $t_1 = 0.5$  h = 30 min. Remaining time in the 45 min interval is 15 min = 0.25 h. Distance covered returning in this time at 20 km/h is  $d_{\text{return}} = 20 \times 0.25 = 5$  km. Total distance =  $5 + 5 = 10$  km. Total time =  $\frac{45}{60} = \frac{3}{4}$  h. Average speed =  $\frac{10}{3/4} = \frac{40}{3}$  km/h.

**Q20.**

**Answer:** B

**Explanation:**

Total distance is  $d$  (out) +  $d$  (back) =  $2D$ . Total time is  $t_1 + t_2$ . Average speed =  $\frac{2d}{t_1+t_2}$ . Displacement is 0 because it returns to the origin, so average velocity is 0.

**Q21.**

**Answer:** B

**Explanation:**

Since the distances are equal, we use the formula for average speed:  $V_{avg} = \frac{2v_1v_2}{v_1+v_2}$ . Substituting  $v_1 = 40$  and  $v_2 = 60$ , we get  $V_{avg} = \frac{2(40)(60)}{40+60} = \frac{4800}{100} = 48$  km/hr.

**Q22.**

**Answer:** B

**Explanation:**

Using the formula for average speed over equal distances:  $V_{avg} = \frac{2v_1v_2}{v_1+v_2}$ . Substituting  $v_1 = 20$  and  $v_2 = 30$ , we get  
 $V_{avg} = \frac{2(20)(30)}{20+30} = \frac{1200}{50} = 24 \text{ km/hr.}$

**Q23.**

**Answer:** A

**Explanation:**

Since the distance is the same for both legs of the trip, we use the formula for average speed:  $V_{avg} = \frac{2v_1v_2}{v_1+v_2}$ . Substituting  $v_1 = 3$  and  $v_2 = 4$ , we get  
 $V_{avg} = \frac{2(3)(4)}{3+4} = \frac{24}{7} \text{ km/hr.}$

**Q24.**

**Answer:** C

**Explanation:**

Using the formula for average speed over equal distances:  $V_{avg} = \frac{2v_1v_2}{v_1+v_2}$ . Substituting  $v_1 = 5$  and  $v_2 = 10$ , we get  $V_{avg} = \frac{2(5)(10)}{5+10} = \frac{100}{15}$ . Simplifying the fraction by dividing numerator and denominator by 5 gives  $\frac{20}{3} \text{ km/hr.}$

**Q25.**

**Answer:** B

**Explanation:**

Since distances are equal, average speed  
 $V_{avg} = \frac{2v_1v_2}{v_1+v_2} = \frac{2(30)(60)}{30+60} = \frac{3600}{90} = 40 \text{ km/hr.}$

**Q26.**

**Answer:** A

**Explanation:**

Using the formula for equal distances:  
 $V_{avg} = \frac{2v_1v_2}{v_1+v_2} = \frac{2(40)(60)}{40+60} = \frac{4800}{100} = 48 \text{ km/hr.}$

**Q27.**

**Answer:** B

**Explanation:**

Since the distance covered in both directions is the same, we use the formula for average speed:  
 $v_{avg} = \frac{2v_1v_2}{v_1+v_2}$ . Substituting  $v_1 = 40$  and  $v_2 = 60$ , we get  $v_{avg} = \frac{2(40)(60)}{40+60} = \frac{4800}{100} = 48 \text{ km/h.}$

**Q28.**

**Answer:** B

**Explanation:**

Using the formula for average speed over equal distances:  $v_{avg} = \frac{2v_1v_2}{v_1+v_2}$ . Substituting  $v_1 = 30$  and  $v_2 = 60$ , we get  $v_{avg} = \frac{2(30)(60)}{30+60} = \frac{3600}{90} = 40 \text{ km/h.}$

**Q29.**

**Answer:** B

**Explanation:**

Since the distances are equal, the average speed is given by the harmonic mean formula:  $v_{avg} = \frac{2v_1v_2}{v_1+v_2}$ . Substituting  $v_1 = 40$  and  $v_2 = 60$ , we get  
 $v_{avg} = \frac{2(40)(60)}{40+60} = \frac{4800}{100} = 48 \text{ km/hr.}$

**Q30.**

**Answer:** D

**Explanation:**

Using the formula for average speed over equal distances:  $v_{avg} = \frac{2v_1v_2}{v_1+v_2}$ . Substituting  $v_1 = 20$  and  $v_2 = 30$ , we get  
 $v_{avg} = \frac{2(20)(30)}{20+30} = \frac{1200}{50} = 24 \text{ km/hr.}$

**Q31.**

**Answer:** B

**Explanation:**

Since the distances are equal, the average speed is the harmonic mean of the two speeds:  $v_{avg} = \frac{2v_1v_2}{v_1+v_2}$ . Substituting  $v_1 = 40$  and  $v_2 = 60$ , we get  
 $v_{avg} = \frac{2(40)(60)}{40+60} = \frac{4800}{100} = 48 \text{ km/h.}$

**Q32.**

**Answer:** A

**Explanation:**

Let total distance be  $D$ . Time for first part ( $D/3$ ) is  $t_1 = \frac{D}{3v_1}$ . Time for remaining part ( $2D/3$ ) is  $t_2 = \frac{2D}{3v_2}$ . Total time  $T = \frac{D}{3} \left( \frac{1}{v_1} + \frac{2}{v_2} \right) = \frac{D(2v_1+v_2)}{3v_1v_2}$ . Average speed  $v_{avg} = \frac{D}{T} = \frac{3v_1v_2}{2v_1+v_2}$ .

**Q33.**

**Answer:** B

**Explanation:**

Velocity is the first derivative of displacement:  
 $v = \frac{dx}{dt} = -3 + 8t$ . At  $t = 0$ ,  $v = -3$ . Acceleration is the derivative of velocity:  $a = \frac{dv}{dt} = 8$ . At  $t = 0$ ,  $a = 8$ .

**Q34.**

**Answer:** A

**Explanation:**

Velocity  $v = \frac{ds}{dt} = B + 2Ct + 3Dt^2$ . At  $t = 0$ ,  $v = B$ .  
Acceleration  $a = \frac{dv}{dt} = 2C + 6Dt$ . At  $t = 0$ ,  
 $a = 2C$ .

**Q35.**

**Answer:** C

**Explanation:**

Velocity  $v = \frac{dx}{dt} = 3At^2 - 2Bt$ . Acceleration  
 $a = \frac{dv}{dt} = 6At - 2B$ . Setting  $a = 0$ , we get  
 $6At = 2B$ , which implies  $t = \frac{2B}{6A} = \frac{B}{3A}$ .

**Q36.**

**Answer:** B

**Explanation:**

Velocity  $v = \frac{dy}{dt} = 4at - 3bt^2$ . Acceleration  
 $a_{cc} = \frac{dv}{dt} = 4a - 6bt$ . Setting  $a_{cc} = 0$ , we get  
 $4a = 6bt$ , which implies  $t = \frac{4a}{6b} = \frac{2a}{3b}$ .

**Q37.**

**Answer:** C

**Explanation:**

Velocity is the first derivative of displacement:  
 $v = \frac{ds}{dt} = 6t + 5$ . Acceleration is the derivative of  
velocity:  $a = \frac{dv}{dt} = 6$ . Thus, the acceleration is  
constant at  $6 \text{ m/s}^2$ .

**Q38.**

**Answer:** C

**Explanation:**

Velocity  $v = \frac{dx}{dt} = 8t - 6$ . Acceleration  $a = \frac{dv}{dt} = 8$ .  
Therefore, the acceleration is  $8 \text{ m/s}^2$ .

**Q39.**

**Answer:** B

**Explanation:**

Velocity is the derivative of position with respect to time  
( $v = \frac{dx}{dt}$ ). Differentiating  $x = a + bt^2$  gives  $v = 2bt$ .  
Substituting  $b = 2$  and  $t = 3$ , we get  
 $v = 2(2)(3) = 12 \text{ m/s}$ .

**Q40.**

**Answer:** D

**Explanation:**

The velocity is given by the derivative  $v = \frac{dy}{dt} = 2qt$ .  
Substituting  $q = 5$  and  $t = 4$ , we get  
 $v = 2(5)(4) = 40 \text{ cm/sec}$ .

**Q41.**

**Answer:** B

**Explanation:**

Time to reach market (3 km at 6 km/h) is  
 $t_1 = 0.5 \text{ h} = 30 \text{ min}$ . Remaining time in the 40 min  
interval is  $10 \text{ min} = \frac{1}{6} \text{ h}$ . Distance covered returning  
in this time at 9 km/h is  $d_{\text{return}} = 9 \times \frac{1}{6} = 1.5 \text{ km}$ .  
Total distance =  $3 + 1.5 = 4.5 \text{ km}$ . Total time =  
 $\frac{40}{60} = \frac{2}{3} \text{ h}$ . Average speed =  $\frac{4.5}{2/3} = \frac{27}{4} \text{ km/h}$ .

**Q42.**

**Answer:** B

**Explanation:**

Time to reach park (4 km at 8 km/h) is  
 $t_1 = 0.5 \text{ h} = 30 \text{ min}$ . Remaining time in the 45 min  
interval is  $15 \text{ min} = 0.25 \text{ h}$ . Distance covered  
returning in this time at 12 km/h is  
 $d_{\text{return}} = 12 \times 0.25 = 3 \text{ km}$ . Total distance =  
 $4 + 3 = 7 \text{ km}$ . Total time =  $\frac{45}{60} = \frac{3}{4} \text{ h}$ . Average speed  
 $= \frac{7}{3/4} = \frac{28}{3} \text{ km/h}$ .

**Q43.**

**Answer:** B

**Explanation:**

Let total distance be  $D$ . Time for first part ( $D/3$ ) is  
 $t_1 = \frac{D}{3v_1}$ . Time for remaining part ( $2D/3$ ) is  $t_2 = \frac{2D}{3v_2}$ .  
Total time  $T = \frac{D}{3} \left( \frac{1}{v_1} + \frac{2}{v_2} \right) = \frac{D(2v_1+v_2)}{3v_1v_2}$ . Average  
speed  $V_{\text{avg}} = \frac{D}{T} = \frac{3v_1v_2}{2v_1+v_2}$ .

**Q44.**

**Answer:** C

**Explanation:**

Let total distance be  $D$ . Time for first part ( $D/4$ ) is  
 $t_1 = \frac{D}{4v_1}$ . Time for remaining part ( $3D/4$ ) is  $t_2 = \frac{3D}{4v_2}$ .  
Total time  $T = \frac{D}{4} \left( \frac{1}{v_1} + \frac{3}{v_2} \right) = \frac{D(3v_1+v_2)}{4v_1v_2}$ . Average  
speed  $V_{\text{avg}} = \frac{D}{T} = \frac{4v_1v_2}{3v_1+v_2}$ . Wait, looking at the  
algebra:  $T = \frac{D(v_2+3v_1)}{4v_1v_2}$ . So  $V_{\text{avg}} = \frac{4v_1v_2}{3v_1+v_2}$ . Let me re-  
check the options. Ah, in the explanation I wrote  
 $3v_1 + v_2$  in the denominator of the time fraction sum.  
 $\frac{1}{v_1} + \frac{3}{v_2} = \frac{v_2+3v_1}{v_1v_2}$ . So  $T = \frac{D(3v_1+v_2)}{4v_1v_2}$ .  
 $V_{\text{avg}} = \frac{4v_1v_2}{3v_1+v_2}$ . So Option A is correct. Let me adjust  
the options and answer key. Corrected Options for  
Problem 2: A)  $\frac{4v_1v_2}{3v_1+v_2}$  B)  $\frac{v_1+3v_2}{4}$  C)  $\frac{4v_1v_2}{v_1+3v_2}$  D)  $\frac{3v_1+v_2}{4}$   
Correct Answer: A

**Q45.**

**Answer:** B

**Explanation:**

Let total distance be  $D$ . Time for first part ( $3D/5$ ) is  $t_1 = \frac{3D}{5v_1}$ . Time for remaining part ( $2D/5$ ) is  $t_2 = \frac{2D}{5v_2}$ .  
Total time  $T = \frac{D}{5} \left( \frac{3}{v_1} + \frac{2}{v_2} \right) = \frac{D(2v_1+3v_2)}{5v_1v_2}$ . Average speed  $V_{avg} = \frac{D}{T} = \frac{5v_1v_2}{2v_1+3v_2}$ .

**Q46.**

**Answer:** A

**Explanation:**

Newland's Octave rule states that when elements are arranged by increasing atomic mass, every 8th element has similar properties to the 1st. This pattern is only valid up to Calcium (Ca).

**Q47.**

**Answer:** B

**Explanation:**

In a Dobereiner triad, the atomic weight of the middle element is approximately equal to the arithmetic average of the weights of the first and third elements.

**Q48.**

**Answer:** B

**Explanation:**

Mendeleev predicted the properties and positions of then-unknown elements, leaving gaps in his table for "Eka-Aluminium" (Gallium) and "Eka-Silicon" (Germanium).

**Q49.**

**Answer:** D

**Explanation:**

Anomalous pairs were those placed out of atomic weight order to maintain chemical similarity. Aluminum (26.9) and Silicon (28.1) follow the correct increasing order of weights.

**Q50.**

**Answer:** C

**Explanation:**

The actinide series ends at atomic number  $Z=103$ . The next element is  $Z=104$ , which is named Unnilquadium (1=un, 0=nil, 4=quad) per IUPAC rules.

**Q51.**

**Answer:** C

**Explanation:**

Elements with  $Z=104$  to  $118$  belong to the 7th period. The group is determined by the last two digits (15), which corresponds to the VA group (Pnicogens).

**Q52.**

**Answer:** C

**Explanation:**

Representative elements are those in the s-block and p-block, excluding noble gases (group 18). Sequence C consists of Li, As, I, and Fr.

**Q53.**

**Answer:** A

**Q54.**

**Answer:** D

**Explanation:**

Stability is determined by ionization energy differences ( $\Delta IE$ ).  $Al^{+3}$  is highly stable due to its noble gas configuration, while  $Al^{+}$  is more stable than  $Al^{+2}$  because  $\Delta IE_1$  to  $IE_2 > 11eV$ .

**Q55.**

**Answer:** C

**Explanation:**

Ionization energy increases from left to right across a period. Halogens (configuration C) have the highest effective nuclear charge and thus the highest ionization energy in their period.

**Q56.**

**Answer:** D

**Explanation:**

A massive jump in IP values occurs after all valence electrons are removed. The jump between  $IP_2$  and  $IP_3$  ( $195 \rightarrow 556$ ) indicates the element has 2 valence electrons.

**Q57.**

**Answer:** A

**Explanation:**

After losing one electron, Lithium ( $Li^{+}$ ) achieves the highly stable Helium configuration ( $1s^2$ ). Removing a second electron requires a huge amount of energy.

**Q58.**

**Answer:** C

**Explanation:**

Ionization potential decreases down a group because atomic size increases. Since Sodium (Na) is below Lithium (Li) in group 1, its IP is lower than that of Lithium.

**Q59.**

**Answer:** C

**Explanation:**

Successive ionization energies for any atom always increase ( $IE_1 < IE_2 < IE_3 \dots$ ) because it is increasingly difficult to remove an electron from a more positively charged ion.

**Q60.**

**Answer:** B

**Explanation:**

The energy to remove an electron from an anion is equal to the Electron Affinity (EA) of the neutral atom. Phosphorus (P) has a stable half-filled  $3p^3$  configuration and thus the lowest EA among these.

**Q61.**

**Answer:** D

**Explanation:**

Electronegativity values on the Pauling scale are:  $H(2.1)$ ,  $S(2.5)$ ,  $Cl(3.0)$ ,  $O(3.5)$ , and  $F(4.0)$ . The increasing order is  $H < S < Cl < O < F$ .

**Q62.**

**Answer:** D

**Explanation:**

Amphoteric oxides like  $Al_2O_3$ ,  $ZnO$ , and  $BeO$  react with both acids and bases.  $NO$  is classified as a neutral oxide.

**Q63.**

**Answer:** D

**Explanation:**

Second-period elements differ from their group members because of their unique properties: exceptionally small size, high ionization potential (linked to  $Z_{eff}$ ), and high ionic potential (charge/radius ratio).

**Q64.**

**Answer:** B

**Explanation:**

Ionization energy is highest for half-filled p-subshells ( $p^3$ ) within the same period due to increased stability. Option B represents Phosphorus, which has a stable  $3p^3$  configuration.

**Q65.**

**Answer:** C

**Explanation:**

Adding a second electron to a negatively charged ion ( $O^-$ ) requires energy to overcome the strong electrostatic repulsion between the ion and the incoming electron.

**Q66.**

**Answer:** B,C

**Explanation:**

Nitrogen has a higher  $IE_1$  than Oxygen due to its half-filled  $p^3$  configuration, and Chlorine has a more negative electron gain enthalpy than Fluorine due to Fluorine's small size and high electron density.

**Q67.**

**Answer:** B

**Explanation:**

$IE_1$  generally increases across a period but has anomalies:  $Be > B$  (full  $s^2$  vs  $p^1$ ) and  $N > O$  (half-filled  $p^3$  vs  $p^4$ ).

**Q68.**

**Answer:** C

**Explanation:**

$Cl$  has the highest EA in the periodic table.  $3^{rd}$  period elements ( $S$ ,  $Cl$ ) have higher EA than  $2^{nd}$  period elements ( $O$ ,  $F$ ) of their groups because the latter's small size causes high electron-electron repulsion.

**Q69.**

**Answer:** B

**Explanation:**

Silver ( $Ag$ ,  $Z=47$ ) is in group 11. The elements above and below it are Copper ( $Cu$ ,  $Z=29$ ) and Gold ( $Au$ ,  $Z=79$ ), found using magic number intervals.

**Q70.**

**Answer:** C

**Explanation:**

The second ionization energy ( $I_2$ ) is the energy to remove an electron from the unipositive ion ( $M^+$ ), not the neutral atom ( $M$ ). It is calculated as the difference between the total energy for  $M^{2+}$  and the energy for  $M^+$ .

**Q71.**

**Answer:** D

**Explanation:**

A massive jump in IE occurs after removing 3 electrons ( $181 \rightarrow 2000$ ), indicating the element has 3 valence electrons. This is characteristic of Aluminum, which is a metal with an amphoteric oxide ( $Al_2O_3$ ).

**Q72.**

**Answer:** C

**Explanation:**

Halogens have the highest effective nuclear charge and the most negative electron gain enthalpies in their periods, allowing them to attract and hold an extra electron very easily.

**Q73.**

**Answer:** D

**Explanation:**

Basic strength decreases across a period and increases down a group. Metals form basic hydroxides, but Zinc is less metallic and its hydroxide ( $Zn(OH)_2$ ) is amphoteric, making it the weakest base here.

**Q74.**

**Answer:** B

**Explanation:**

According to Slater's rules, the effective nuclear charge ( $Z_{eff}$ ) for valence electrons remains nearly constant down a group because the increase in nuclear charge is balanced by the increase in shielding.

**Q75.**

**Answer:** C

**Explanation:**

$He^+$  is a hydrogen-like species with one electron and  $Z = 2$ . Since  $I.P. \propto Z^2$  for such species, the ionization energy for  $He^+$  is four times that of atomic Hydrogen.

**Q76.**

**Answer:** A

**Explanation:**

Both A and B have 3 valence electrons ( $2s^2 2p^1$  and  $3s^1 3p^2$  in excited/ground state forms), placing them both in group 13. C and D represent excited states of other groups.

**Q77.**

**Answer:** D

**Explanation:**

Non-metals characteristically have very high ionization energies because they hold their electrons tightly. Element C has the highest  $IE_1$  (1150), identifying it as a non-metal.

**Q78.**

**Answer:** B

**Explanation:**

This duplicates the analytical error check: Nitrogen ( $2p^3$ ) is higher than Oxygen ( $2p^4$ ) due to subshell stability, so the trend  $N < O$  is incorrect.

**Q79.**

**Answer:** C

**Explanation:**

Basic nature of oxides increases down a group and decreases across a period. Group 1 (K, Na) oxides are most basic, and  $Al_2O_3$  is amphoteric (least basic here).

**Q80.**

**Answer:** B

**Explanation:**

Gadolinium (Gd) has an anomalous configuration to achieve a stable half-filled  $f^7$  subshell, shifting one electron to the 5d orbital.

**Q81.**

**Answer:** C

**Explanation:**

Chlorine has the highest EA. Fluorine is lower due to extreme electron repulsion in its small 2p subshell.

**Q82.**

**Answer:** B

**Explanation:**

The energy released when an electron is added to a cation (EA of  $Na^+$ ) is numerically equal but opposite in sign to the energy required to remove that same electron (IE of Na).

**Q83.**

**Answer:** D

**Explanation:**

Although  $Cl > F$ , Fluorine still has a much higher electron affinity than the larger halogens Bromine and Iodine.

**Q84.**

**Answer:** D

**Explanation:**

Hydroxides of Beryllium and Zinc are well-known to react with both acids and bases, classifying them as amphoteric.

**Q85.**

**Answer:** B

**Explanation:**

By definition, electronegativity is the tendency of an atom in a molecule to attract shared pair of electrons towards itself.

**Q86.**

**Answer:** D

**Explanation:**

In an isoelectronic series (all have 10 electrons), the radius decreases continuously as the atomic number (number of protons) increases.

**Q87.**

**Answer:** B

**Explanation:**

As effective nuclear charge ( $Z_{eff}$ ) increases, the nucleus pulls electrons closer, thereby decreasing the ionic radius.

**Q88.**

**Answer:** C

**Explanation:**

Cl is the maximum, O is the minimum, and  $S > O$ .

**Q89.**

**Answer:** B

**Explanation:**

Carbon ( $2p^2$ ) has a higher electron affinity than Nitrogen ( $2p^3$ ) because Nitrogen has a stable half-filled configuration that resists gaining an electron.

**Q90.**

**Answer:** D

**Explanation:**

Electronegativity increases regularly from left to right across a period without being affected by subshell stability, unlike IP or EA.

**Q91.**

**Answer:** A

**Q92.**

**Answer:** A

**Q93.**

**Answer:** A

**Q94.**

**Answer:** B

**Q95.**

**Answer:** A

**Q96.**

**Answer:** D

**Q97.**

**Answer:** A

**Q98.**

**Answer:** C

**Q99.**

**Answer:** A

**Q100.**

**Answer:** C

**Q101.**

**Answer:** C

**Q102.**

**Answer:** B

**Q103.**

**Answer:** B

**Q104.**

**Answer:** A

**Q105.**

**Answer:** D

**Q106.**

**Answer:** C

**Q107.**

**Answer:** B

**Q108.**

**Answer:** A

**Q109.**

**Answer:** B

**Q110.**

**Answer:** B

**Q111.**

**Answer:** C

**Q112.**

**Answer:** D

**Q113.**

**Answer:** C

**Q114.**

**Answer:** B

**Q115.**

**Answer:** D

**Q116.**

**Answer:** B

**Q117.**

**Answer:** C

**Q118.**  
**Answer: C**

**Q119.**  
**Answer: B**

**Q120.**  
**Answer: D**

**Q121.**  
**Answer: D**

**Q122.**  
**Answer: A**

**Q123.**  
**Answer: B**

**Q124.**  
**Answer: C**

**Q125.**  
**Answer: D**

**Q126.**  
**Answer: A**

**Q127.**  
**Answer: B**

**Q128.**  
**Answer: A**

**Q129.**  
**Answer: B**

**Q130.**  
**Answer: B**

**Q131.**  
**Answer: A**

**Q132.**  
**Answer: B**

**Q133.**  
**Answer: A**

**Q134.**  
**Answer: C**

**Q135.**  
**Answer: B**

**Q136.**  
**Answer: D**

**Q137.**  
**Answer: C**

**Q138.**  
**Answer: A**

**Q139.**  
**Answer: A**

**Q140.**  
**Answer: C**

**Q141.**  
**Answer: A**

**Q142.**  
**Answer: B**

**Q143.**  
**Answer: C**

**Q144.**  
**Answer: C**

**Q145.**  
**Answer: A**

**Q146.**  
**Answer: B**

**Q147.**  
**Answer: A**

**Q148.**  
**Answer: A**

**Q149.**  
**Answer: B**

**Q150.**  
**Answer: D**

**Q151.**  
**Answer: B**

**Q152.**  
**Answer: A**

**Q153.**  
**Answer: C**

**Q154.**

**Answer: A**

**Q155.**

**Answer: C**

**Q156.**

**Answer: C**

**Q157.**

**Answer: A**

**Q158.**

**Answer: A**

**Q159.**

**Answer: A**

**Q160.**

**Answer: A**

**Q161.**

**Answer: C**

**Q162.**

**Answer: C**

**Q163.**

**Answer: A**

**Q164.**

**Answer: A**

**Q165.**

**Answer: B**

**Q166.**

**Answer: B**

**Q167.**

**Answer: D**

**Q168.**

**Answer: D**

**Q169.**

**Answer: C**

**Q170.**

**Answer: B**

**Q171.**

**Answer: C**

**Q172.**

**Answer: B**

**Q173.**

**Answer: D**

**Q174.**

**Answer: A**

**Q175.**

**Answer: D**

**Q176.**

**Answer: A**

**Q177.**

**Answer: D**

**Q178.**

**Answer: A**

**Q179.**

**Answer: A**

**Q180.**

**Answer: B**