

INDIAN ASSOCIATION OF PHYSICS TEACHERS
NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE 2015 -16

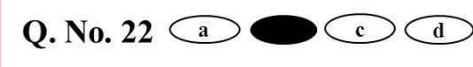
Date of Examination: 22nd November, 2015

Time: 1500 to 1700 Hrs

Q. Paper Code: JS 521

Write the question paper code mentioned above on YOUR answer sheet (in the space provided), otherwise your answer sheet will NOT be assessed. Note that the same Q. P. Code appears on each page of the question paper.

Instructions to Candidates –

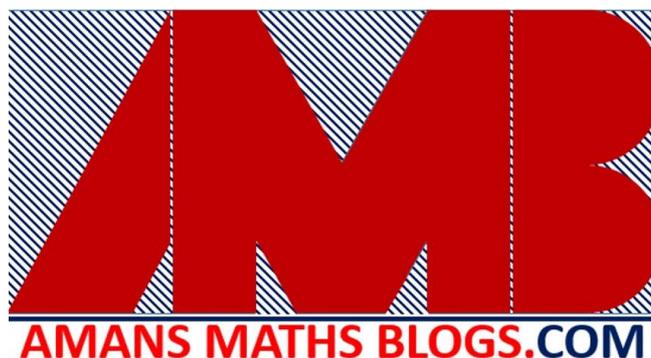
1. Use of mobile phones, smartphones, ipads during examination is **STRICTLY PROHIBITED**.
2. In addition to this question paper, you are given answer sheet along with Candidate's copy.
3. On the answer sheet, make all the entries carefully in the space provided **ONLY** in **BLOCK CAPITALS** as well as by properly darkening the appropriate bubbles. **Incomplete/ incorrect/carelessly filled information may disqualify your candidature.**
4. On the answer sheet, use only **BLUE** or **BLACK BALL POINT PEN** for making entries and filling the bubbles.
5. Question paper has 80 multiple choice questions. Each question has four alternatives, out of which **only one** is correct. Choose the correct alternative and fill the appropriate bubble, as shown.

6. A correct answer carries 3 marks whereas 1 mark will be deducted for each wrong answer.
7. Any rough work should be done only in the space provided.
8. Use of **non-programmable** calculator is allowed.
9. No candidate should leave the examination hall before the completion of the examination.
10. After submitting your answer paper, take away the Candidate's copy for your reference.

Please **DO NOT** make any mark other than filling the appropriate bubbles properly in the space provided on the answer sheet.

Answer sheets are evaluated using machine, hence **CHANGE OF ENTRY IS NOT ALLOWED**.

Scratching or overwriting may result in a wrong score.

DO NOT WRITE ON THE BACK SIDE OF THE ANSWER SHEET.



Instructions to Candidates (continued) –

Read the following instructions after submitting the answer sheet.

11. Comments regarding this question paper, if any, may be sent by email only to iaptpune@gmail.com till 24th November, 2015.
12. The answers/solutions to this question paper will be available on our website – www.iapt.org.in by 2nd December, 2015.
13. **CERTIFICATES and AWARDS –**
Following certificates are awarded by the IAPT to students successful in NSEs
 - (i) Certificates to “Centre Top 10%” students
 - (ii) Merit Certificates to “Statewise Top 1%” students
 - (iii) Merit Certificates and a book prize to “National Top 1%” students
14. Result sheets and the “Centre Top 10%” certificates will be dispatched to the Prof-in-charge of the centre by January, 2016.
15. List of students (with centre number and roll number only) having score above MAS will be displayed on our website (www.iapt.org.in) by 22nd December, 2015. See the **Eligibility Clause** in the Student’s brochure on our website.
16. Students eligible for the INO Examination on the basis of selection criteria mentioned in Student’s brochure will be informed accordingly.

Indian Association of Physics Teachers

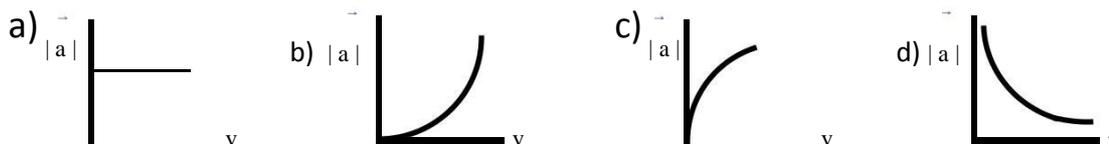
NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE 2015-2016

Total time: 120 minutes

Marks: 240

Only one out of four options is correct

1) Which of the following graphs is correct for a particle moving in a circle of radius r at a speed of v (where ' a ' is magnitude of acceleration) ?



2) Electronic configuration of Na^+ is (2,8) and that of sodium element is (2,8,1). Choose the correct statements.

- i. $\text{Na}^+(\text{g})$ is more stable than $\text{Na}(\text{g})$.
- ii. $\text{Na}^+(\text{g})$ is less stable than $\text{Na}(\text{g})$.
- iii. $\text{Na}^+(\text{aq})$ is more stable than $\text{Na}(\text{aq})$.
- iv. $\text{Na}^+(\text{aq})$ is less stable than $\text{Na}(\text{aq})$.

- a) ii, iii b) i, iii c) ii, iv d) i, iv

3) What will be the remainder if the number 7^{2015} is divided by 25?

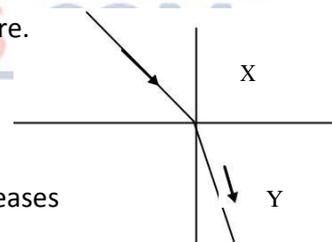
- a) 1 b) 7 c) 18 d) 24

4) In humans, the digestion of carbohydrates happens/takes place in the following parts of the digestive system:

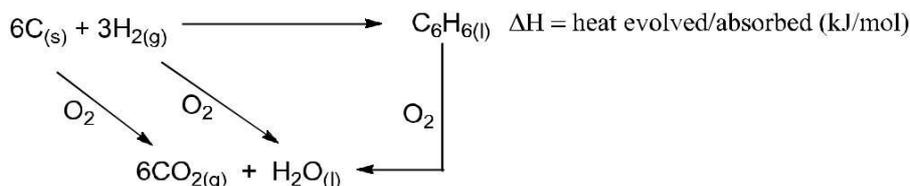
- a) Mouth, stomach and small intestine b) Mouth and small intestine
c) Small intestine alone d) Stomach and small intestine

5) Light travels from medium X to medium Y as shown in the adjacent figure.

- a) both the speed and frequency decrease
b) speed increases and frequency decreases
c) the speed decreases and wavelength decrease
d) the speed decreases and wavelength increases



6) **Hess' Law** states that '*the heat evolved or absorbed in a chemical reaction is the same whether the process takes place in one or in several steps*'



Heat evolved in the combustion of one mole $C_{(s)}$ in excess oxygen is x kJ/mol, and that for the combustion of $H_{2(g)}$ is y kJ/mol and for that of $C_6H_6(l)$ is z kJ/mol. Therefore, the heat change (kJ/mol) involved in the formation one mole of $C_6H_6(l)$ from the given equation is

- a) $x+y+z$ b) $6x+3y-z$ c) $6x+3y+z$ d) $x+y-z/6$
- 7) If $A(p, q + r)$, $B(q, r + p)$ and $C(r, p + q)$ are points then area of triangle ABC
- a) $p^2 + q^2 + r^2$ b) $(p + q + r)^2$ c) $\frac{1}{2}(pq + qr + rp)$ d) zero
- 8) Photosynthesis in plants is carried out in
- a) leaves b) leaves and stems
c) leaves, stems and aerial roots d) stems and roots

9) A particle moves along the x-axis according to the equation $x = 6t^2$ where x is displacement in meters and t is time in seconds. Therefore

- a) the acceleration of the particle is 6 ms^{-2}
b) the particle follows a parabolic path
c) each second the velocity of the particle changes by 9.8 ms^{-1}
d) the velocity of the particle is 6 ms^{-1} at $t = 0.5 \text{ s}$

10) What occurs when $H_2O(l)$ evaporates

- (i) Covalent bonds are broken.
(ii) Only dipole-dipole forces are overcome.
(iii) Heat is absorbed by water from the surroundings.
(iv) It becomes oxygen and hydrogen gas.

- a) Only (i) and (iii) occurs
b) Only (ii) and (iii) occurs
c) (i), (iii) and (iv) occurs
d) (i), (ii), (iii) and (iv) take place

11) $\frac{3}{4} + 28\frac{3}{4} + 70\frac{3}{4} + 130\frac{3}{4} + \dots + 9700\frac{3}{4} = ?$

- a) 0.97 b) 0.99 c) 1 d) 1.03

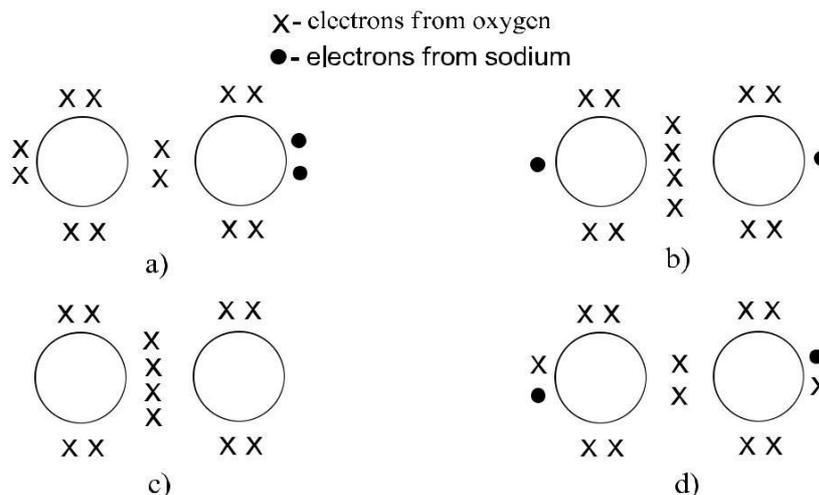
12) The following technique that can be used for deciphering the arrangement of nucleotides in genes.

- a) karyotyping b) nucleic acid sequencing
c) DNA finger printing d) transcription

13) The "reaction" force does not cancel the "action" force because

- a) the action force is greater than the reaction force
b) the reaction force exists only after the action force is removed
c) the reaction force is greater than the action force
d) they act on different bodies

14) Which of the following Lewis dot structures best describes the structure of peroxide ion of sodium peroxide?



15) What is the sum of all three digit even numbers divisible by seventeen?

- a) 18846 b) 18684 c) 14688 d) 16848

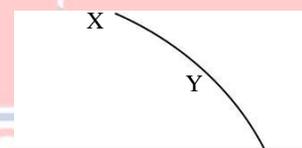
16) When a red blood cell was placed in an animal cell (RBC) in 3 different solutions, the following morphological observations were made under a microscope.

Solution 1	Solution 2	Solution 3
Normal morphology	Swollen and hemolysed	Shrunken or cremated

The above three solutions can be classified in the order of

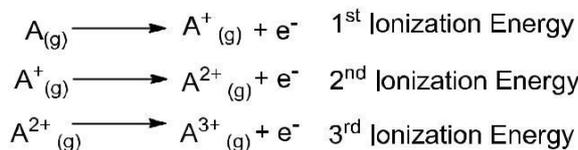
- a) isotonic, hypotonic and hypertonic b) hypotonic, isotonic and hypertonic
c) hypotonic, hypertonic and isotonic d) isotonic, hypertonic and hypotonic

17) A stone is thrown horizontally and follows the XYZ path as shown in the adjacent figure. The direction of the acceleration of the stone at point Y is



- a) ↓ b) → c) ↘ d) ↙

18) Ionization Energy is defined as 'the energy required for removing the most loosely bound electron from an isolated gaseous atom or ion'.



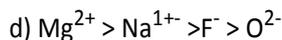
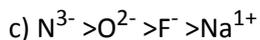
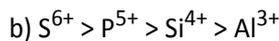
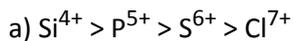
and so on...

Molar Ionization Energy for Element 'A'	1 st	2 nd	3 rd	4 th	5 th	6 th
(kJ/mol)	1086.5	2352.6	4620.5	6222.7	37831	47277

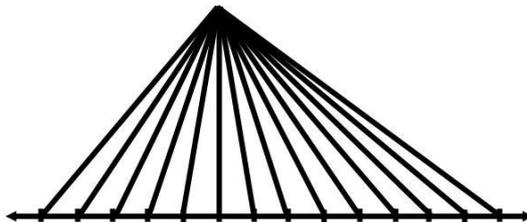
Identify element A.

- a) Nitrogen b) Oxygen c) Carbon d) Fluorine

34) Ionic radii of following species are



35) How many triangles are there in this figure?



a) 50

b) 70

c) 84

d) 91

36) Raju Sharma, a 10th standard student participated in 100 meter sprint. During running he developed painful muscle contraction and fell down. The physical education teacher rushed to him and gave a hot water massage. Raju Sharma slowly recovered from the cramp. The teacher explained the physiology behind the cramp and the subsequent relief.

Identify the right explanation.

a) Because of the quick movement, the muscles loses its elasticity and are stressed. The inflammation developed during this process causes cramp. After hot water massage the inflammation subsides and the pain gets relieved.

b) During vigorous physical activity, aerobic respiration in the muscles increases which leads to the accumulation of more CO₂ in the muscles. This causes cramps. Later CO₂ was relieved upon hot water massage resulting in pain relief.

c) During vigorous physical activity, lactic acid accumulates in the muscles due to anaerobic respiration. This causes the cramps. Hot water massage improves the circulation of blood and O₂ in the muscles. As a result lactic acid is converted into CO₂ and water. Thus the pain gets relieved.

d) During quick movements, the nerves will not co-operate with the muscles. There is a stimulus which is taken to spinal cord and the effector function was done by motor neurons which cause cramp. On hot water massage the stimulus was subsided. Thus the pain gets relieved.

37) If a force acting is conservative only when

a) work done by this force is zero when the particle moves once around any closed path

b) it obeys Newton's third law

c) its work is the change in the K.E of the particle

d) it is not a frictional force

38) Sati was studying neutralisation reaction. She accidentally dropped 'x' grams of a sodium carbonate monohydrate into a 100 mL solution of HCl whose concentration was 0.25 M. 10mL from this final solution was taken and titrated against 0.05M NaOH solution to yield a titre value of 20mL. What is the value of 'x'.

a) 186mg

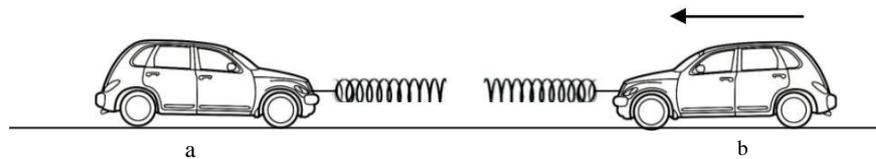
b) 93mg

c) 1860mg

d) 930mg

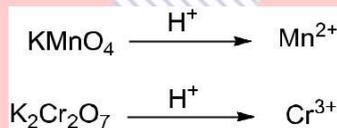
- 44) The testes of men lie in a small muscular pouch called scrotum located outside the abdominal cavity; choose the correct reason.
- Sperm formation in testes requires a higher temperature than the normal body temperature.
 - Seminal vesicles requires lower temperature to produce nutrients for sperm.
 - Sperm formation in testes requires a lower temperature than the normal body temperature.
 - Sperm produced in scrotum is easily released out without going into abdominal cavity.

- 45) Two toy cars (a and b) fixed with spring at front, collide as shown in the figure below. 'a' has a mass of 200 g and is initially moving to the right. Car 'b' has a mass of 300 g and is initially at rest. When the separation between the cars is minimum,



- car b is at rest
- car a has come to rest
- both cars have the same kinetic energy (K.E)
- the K.E of the system is at a minimum

- 46) What is the ratio of number of electrons gained by acidified KMnO_4 and acidified $\text{K}_2\text{Cr}_2\text{O}_7$ in the reaction given below



- 5:6
 - 6:5
 - 3:5
 - 5:3
- 47) If $\sqrt{338} - \sqrt{288} = m$ then $m = ?$
- $\sqrt{50}$
 - $\sqrt[3]{2}$
 - $\sqrt{8}$
 - $\sqrt[3]{8}$
- 48) Which of the following is NOT produced by microbial activity?
- Yoghurt
 - Bread
 - Vinegar
 - Antiseptics

- 49) A concave spherical mirror has a focal length of 12 cm. if an object is placed 6 cm in front of it, the position of the image is
- 4 cm behind the mirror
 - 4 cm in front of the mirror
 - 12 cm behind the mirror
 - 12 cm in front of the mirror

- 50) Methylcyclobutane is a saturated alkane. What is its molecular formula?
- C_5H_{10}
 - C_5H_8
 - C_5H_{12}
 - C_5H_6

- 51) 5901AB04 is an eight digit number divisible by 792. Find $A + B = ?$
- 6
 - 7
 - 8
 - 9

- 52) Among the following, which is not true about vaccines?
- Vaccines contain dead microbial cells or their parts.
 - Vaccines contain antibiotics to prevent diseases.

- c) Vaccine contain special proteins which evoke immune system against disease.
- d) Vaccines contain inactivated micro-organisms.

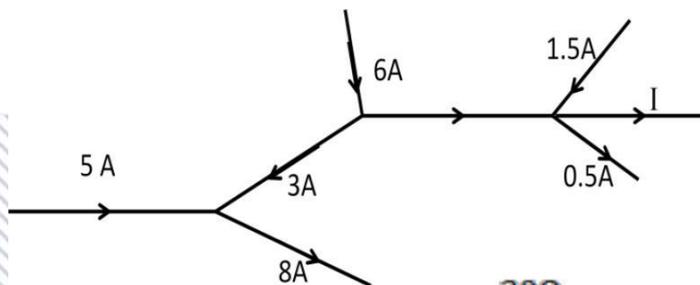
In the following passage some concepts about electrical circuit analysis is discussed. Based on this answer questions 53 to 56.

- (i) When two or more conductors meet at a point it is called a junction. At junctions there should not be any accumulation of charges. This implies that the net current entering the junction should be equal to net current leaving a junction.
- (ii) In a closed circuit having resistors and batteries, the sum of voltages across the resistors will be equal to net electromotive force (emf). This follows from the principle of conservation of energy.

With the help of above two concepts the current and voltage across different circuit elements can be determined.

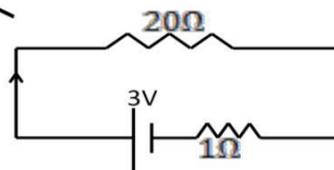
53) The current I in the branch shown in the adjacent figure is

- a) 3.0A
- b) 2.5A
- c) 4.0A
- d) 4.5A



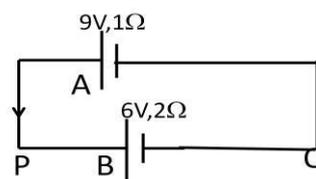
54) A closed circuit shown in the adjacent figure includes a resistor of resistance and battery of emf 3.0V and internal resistance of . The internal resistance of the battery can be considered in series with it. The voltage drop across the resistor of resistance is

- a) 2.857 V
- b) 3.000 V
- c) 2.500 V
- d) 1.567 V



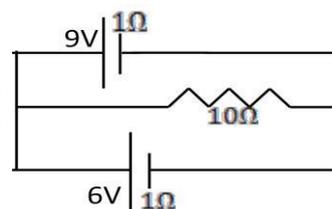
55) A circuit which is used for charging a battery is shown in the adjacent figure. The battery 'B' has emf 6V and internal resistance of . The charging battery 'A' has an emf of 9V and internal resistance of . The voltage across the points P and Q

- a) 8V
- b) 7V
- c) 4V
- d) 4.2V



56) The circuit shown in adjacent figure consists of an external resistance of connected across two batteries of emfs 6.0V and 9.0V with internal resistance of each. Find the power dissipated by the resistor.

- a) 6.5W
- b) 5.1W
- c) 3.5W
- d) 5.5W



57) Choose the correct sets which represent the oxides as acidic:basic:neutral:amphoteric respectively

- (i) CO_2 : MgO : N_2O : H_2O
- (ii) SO_2 : NO : CO : Al_2O_3
- (iii) P_2O_5 : ZnO : NO : Al_2O_3
- (iv) SO_3 : CaO : N_2O : PbO

- a) i & ii b) ii & iii c) iii & iv d) iv & i

58) What is the smallest natural number when multiplied by 15 and divided by 63 gives remainder 21?

- a) 13 b) 14 c) 17 d) 20

59) Gram positive bacteria will have one of the specific characters. Identify it.

- a) They have more peptidoglycon in their cell walls.
 b) They show red colour on gram staining.
 c) Flagella found all over the body.
 d) They will have mesosomes as the extension of cell membrane.

60) A silver article turns black when kept open in air for few days. The article when rubbed with toothpaste again starts shining because

- a) Hydrogen peroxide present in the toothpaste reacts to give silver sulphate.
 b) Hydrated silica present in the toothpaste reacts to give silver oxide.
 c) Aluminium hydroxide present in the toothpaste reacts to give silver hydroxide.
 d) Calcium carbonate present in the toothpaste reacts to give silver carbonate.

61) The sum of first four terms of an A.P is 56. The sum of last four terms of same A.P is 112. The first term of the A.P is 11. Find the number of terms in that A.P.

- a) 7 b) 8 c) 11 d) 13

62) Mitochondrial equivalent in prokaryotic bacterial cell is

- a) ribosomes b) thylakoid
 c) cytoplasmic plasma membrane d) cyanosomes

63) A compound 'A' when treated with a dilute mineral acid gives a gas which when passed through a solution of B regenerates A. Further, a gas (C) that is obtained from the addition of Concentrated HCl to KMnO₄ crystals is used to react with B to give D. Identify A, B, C and D.

- a) Na₂CO₃, NaOH, O₂, Na₂O. b) MgCO₃, Mg(OH)₂, OCl₂, Mg(OCl)₂
 c) CaCO₃, Ca(OH)₂, Cl₂, CaOCl₂ d) Al₂(CO₃)₃, Al(OH)₃, Cl₂, Al₂O₃.

64) If $a : b = c : d$ then how many of the following statements are true?

- (i) $c(a + b) = a(c + d)$ (ii) $d(a - b) = b(c - d)$
 (iii) $(a^2 + b^2)(ac - bd) = (a^2 - b^2)(ac + bd)$ (iv) $\left(\frac{a^2}{b} + \frac{c^2}{d}\right) = \left(\frac{2ac}{bd}\right)$
 a) 1 b) 2 c) 3 d) All

65) Endemic species refers to

- a) threatened wild animals and plants which belong to different areas.
 b) species which are capable of inter breeding.
 c) those species of flora and fauna which are found exclusively in a particular area.
 d) all the plants and animals mentioned in the red data book.

66) 5 g of a gas at 27 °C occupied the same volume as 0.250 g of dihydrogen at 17 °C at the same pressure. Find out molecular weight of the gas.

- a) 41.37 b) 20.68 c) 25.80 d) 39.87

67) Select any three distinct digits. Form a three digit number. Form the another number by reversing the digits. Find the difference of these two numbers. What is the G.C.D of all such differences?

- a) 9 b) 11 c) 33 d) 99

68) Which of the following option is not true about the viruses?

- a) Viruses have either DNA or RNA as these genetic material.
 b) Viruses will not infect bacteria, fungi and algae.
 c) Viruses use host machinery to produce their own proteins.
 d) Viruses are useful in the preparation of vaccines.

69) The coefficient of linear thermal expansion of steel is $11 \times 10^{-6}/^{\circ}\text{C}$. The percentage change in the length of the rod when temperature changes by 70°C .

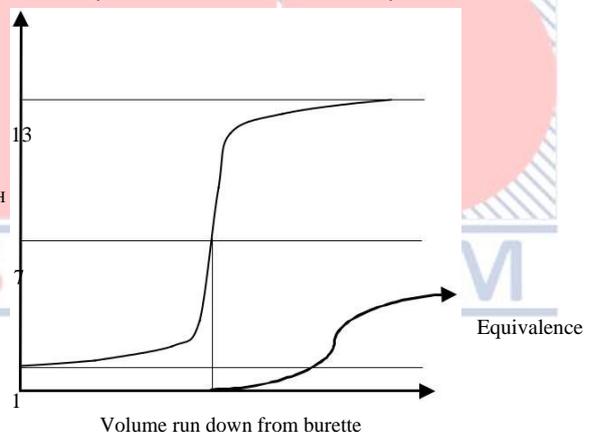
- a) 0.077% b) 0.085% c) 0.0576% d) 0.00077%

70) An acid-base titration is a technique where a solution of known concentration of acid/base is used to determine the concentration of an unknown solution of acid/base. These titrations typically use a pH indicator solution to denote the end point of the reaction. A pH indicator is a compound added in small quantities to

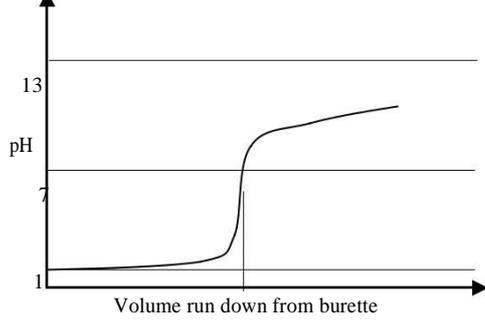
a solution to indicate the pH visually (generally by appearance/disappearance or change in colour). A typical procedure is as follows: A certain volume ' V_1 ' of unknown concentration ' M_1 ' of HCl is

taken in a conical flask, to which a few drops of phenolphthalein indicator solution is added. The solution remains colourless. From a burette (a graduated dropper) a solution of NaOH, whose concentration is known, ' M_2 ', is added dropwise into the conical flask until a pale

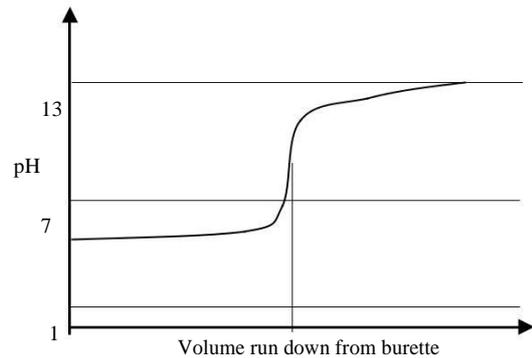
pink colour is obtained and is termed as the end point. The amount of solution dispensed from the burette to obtain the end point is noted as ' V_2 '. Phenolphthalein indicator changes its colour to pink only when the pH of the solution is above 9.5. Similarly, another indicator, methyl orange, is red in colour below pH 3.7 and yellow above. Given below is a graph of pH of the solution in the conical flask and the reading of the burette in the course of the titration. The equivalent point is theoretically defined as the point in the graph where the number of moles HCl in the conical flask becomes equal to the number of moles of NaOH run down the burette. Note the difference between end point and equivalence point.



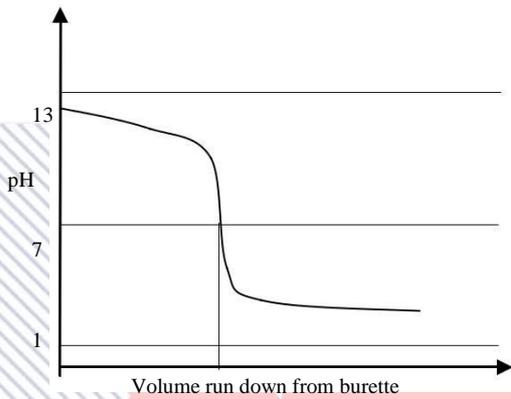
Which is the correct graph that represents the titration of NH_4OH (from burette) with HCl ?



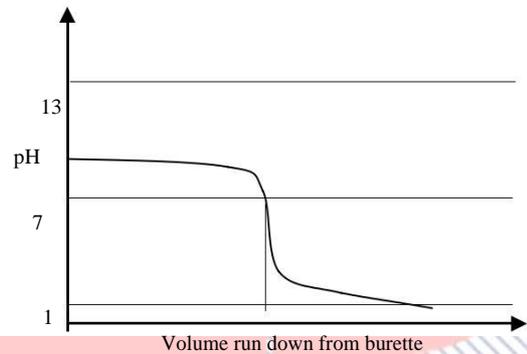
a)



b)



c)



d)

71) There are ten numbers in a certain A.P. The sum of first three terms is 321. The sum of last three numbers is 405. Find the sum of all the ten numbers.

- a) 1165 b) 1210 c) 1221 d) 1252

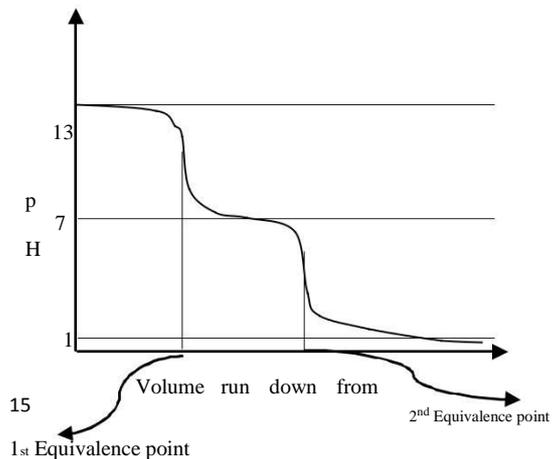
72) Regeneration in animal kingdom is observed in which of the following animals?

- a) Frog b) Planaria (C) Birds (D) Snakes

73) A cube of side 4 cm made of wood is floating in water of density 1.00gcm^{-3} . When a small steel ball is embedded in the cube it just immerses in water. If density of wood is 0.76gcm^{-3} , then mass of the steel ball is

- a) 12.65g b) 3.84g c) 15.36g d) 22.98g

74) Given below is the pH vs volume curve for titration of Na_2CO_3 (in conical flask) with HCl .



Choose the correct statement based on the above graph

- a) 1st equivalence point represents NaHCO_3 getting protonated to H_2CO_3 .
- b) 2nd equivalence point represents NaHCO_3 getting protonated to H_2CO_3 .
- c) 1st equivalence point represents deprotonation of HCl by NaHCO_3 alone.
- d) 2nd equivalence point represents deprotonation of HCl by Na_2CO_3 alone.

75) How many three digit numbers are divisible by 13 and having middle digit 5?

- a) 5
- b) 7
- c) 10
- d) 13

76) In biology, Polymerase Chain Reaction (PCR) refers to which of the following option?

- a) In vitro multiplication of nucleic acids molecules.
- b) In vivo multiplication of nucleic acids molecules.
- c) Continuous protein synthesis from peptide.
- d) Synthesis of mRNA from DNA *in vitro*.

77) A swing playing with small amplitude can be considered as a simple pendulum. Such a swing is set to oscillate with an amplitude a and frequency f . When it is at its mean position, a box of same mass as that of the seat of the swing is dropped on it and it starts moving with the swing. Choose the correct statement

- a) Amplitude is reduced to half its initial value and frequency is doubled
- b) Amplitude is reduced to half its initial value and frequency is unchanged
- c) Amplitude doubles and frequency is unchanged
- d) Amplitude remains same and frequency is half its initial value

78) The pH of the 10^{-8} M HCl solution is

- a) Greater than 7 and less than 8
- b) Exactly 8
- c) Exactly 6
- d) Greater than 6 less than 7

79) Two parallel chords 96 cm and 28 cm long are on the opposite side of the centre of the circle with radius 50 cm. Find the area of the quadrilateral whose vertices are the end points of the chords.

- a) 3488
- b) 3848
- c) 3844
- d) 3484

80) Each chromosome contains

- a) one long DNA molecule
- b) one long RNA molecule d)
- c) one long sequence of amino acids
- a single gene for a protein