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## Indian Association of Physics Teachers

### NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE 2012-2013

Date of Examination 24th November 2012

Time: 15.00 to 17.00 Hrs

Q.P code No.	5	7	8
	Five	Seven	Eight

#### INSTRUCTIONS TO CANDIDATES

1. On the answer sheet, fill up all the entries carefully in the space provided, **ONLY IN BLOCK CAPITALS**. Use only **BLUE** or **BLACK BALL PEN** for making entries and marking answers. Incomplete / incorrect / carelessly filled information may disqualify your candidature.
2. Write the Q. P. Code No. mentioned above on YOUR answer sheet ( in the space provided). Otherwise your answer sheet will NOT be examined.
3. The question paper has 80 multiple choice questions. Each question has 4 options, out of which only one is correct. Choose the correct answer and mark a cross in the corresponding box on the answer sheet as shown below:

Q.	a	b	c	d
22			X	

4. A correct answer carries 3 marks and 1 mark will be deducted for each wrong answers.
5. All rough work may be done on the blank sheet provided at the end of the question paper.
6. **PLEASE DO NOT MAKE ANY MARKS OTHER THAN (X) IN THE SPACE PROVIDED ON THE ANSWER SHEET.** Answer sheets are evaluated with the help of a machine. Due to this, **CHANGE OF ENTRY IS NOT ALLOWED.**
7. Scratching or overwriting may result in wrong score. **DO NOT WRITE ANYTHING ON THE BACK OF ANSWER SHEET.**
8. Use of a nonprogrammable calculator is allowed.
9. **The answers / solutions to this question paper will be available on our website - [www.iapt.org.in](http://www.iapt.org.in) by 30th November 2012.**

#### CERTIFICATES & AWARDS

- i) Certificates to top 10% students of each centre.
  - ii) Merit certificates to statewise Top 1% students.
  - iii) Merit certificate to Nationwide Top 1% students.
10. **Result sheets** and the **"centre top 10%"** certificates of NSEJS are dispatched to the Professor in charge of the centre. Thus you will get your marks from the Professor in charge of your centre by January 2013 end.
  11. 300 (or so) students are called for the next examination - Indian National Junior Science Olympiads (INJSO). Individual letters are sent to these students ONLY.
  12. No queries will be entertained in this regard.

## Indian Association of Physics Teachers

### NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE 2012-2013

Total time: 120 minutes

Marks: 240

Only one out of four options is correct

- 1) Charring of sugar in concentrated sulphuric acid is due to
  - a) Oxidation of sugar
  - b) Reduction of sugar
  - c) Hydrolysis of sugar
  - d) Dehydration of sugar
- 2) Two wires made of same material have length  $l$  and  $2l$ . If the masses of the wires are same, the ratio of the resistance of shorter wire to that of longer wire is
  - a)  $1/2$
  - b) 2
  - c)  $1/4$
  - d) 4
- 3) Find  $x^2 + y^2 + z^2$  if  $x^2 + xy + xz = 135$ ,  $y^2 + yz + yx = 351$  and  $z^2 + zx + zy = 243$ 
  - a) 225
  - b) 250
  - c) 275
  - d) 300
- 4) Current passing through a wire increases by 20%. Due to Joule heating the resistance increases by 20%. The percentage increase in the power is
  - a) 72.8%
  - b) 44%
  - c) 33%
  - d) 40%
- 5) In a certain number system  $363 + 1056 = 1452$ . Find the value of  $(654 - 456)$  in the same number system
  - a) 156
  - b) 165
  - c) 178
  - d) 198
- 6) A radioactive element  ${}_{90}\text{R}^{232}$  emits one alpha ( $\alpha$ ) particle and then two beta ( $\beta$ ) particles. The daughter element will have
  - a) Atomic no 90, Mass No. 228
  - b) Atomic no. 90, Mass no. 232
  - c) Atomic no. 88, Mass No. 228
  - d) Atomic no. 88, Mass no. 232
- 7) Dwarfness is a desirable agronomic character since such cereals:
  - a) Produce grains faster
  - b) Produce grains of better quality
  - c) Prove easier to harvest
  - d) Require lesser nutrients and water



- 8) The combination of the following structures possessing a single set of genome is:
- i. ovary      ii. anther      iii. egg      iv. Zygote      v. sepal  
vi. petal      vii. Pollen

- a) i, ii, iv, v and vi      b) ii, iii, iv and vii      c) only iii and vii      d) only ii, iii and vii

- 9) The equilibrium constant for the gaseous reaction  $N_2 + O_2 \rightarrow 2NO$  is  $K$ . The equilibrium constant for the formation of one mole of  $NO$  will be

- a)  $K/2$       b)  $K$       c)  $2K$       d)  $\sqrt{K}$

- 10) A bar magnet is placed on a table. There are  $n$  number of field lines connecting North pole to South pole of the magnet. Another identical magnet is placed on the first magnet with North Pole on North Pole and South Pole on South Pole. The number of field lines are now

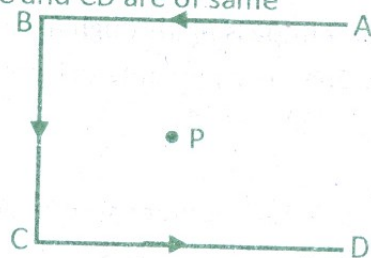
- a)  $n$       b)  $n^2$       c)  $n/2$       d)  $2n$

- 11) What is the radius of the circumcircle of a triangle whose sides are 30cm, 36cm and 30cm in length

- a) 18cm      b) 18.25cm      c) 18.50cm      d) 18.75cm

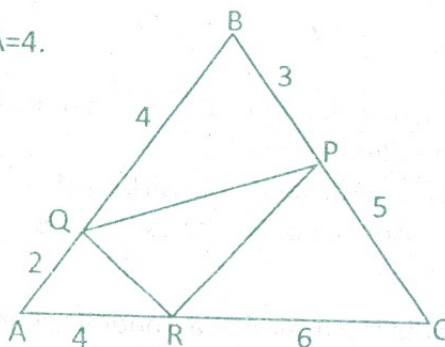
- 12) A conducting wire shown in the figure carries current  $I$ . Segments  $AB$ ,  $BC$  and  $CD$  are of same length. The direction of the magnetic field at point  $P$  is given by

- a) into the plane of the paper  
b) out of the plane of the paper  
c) towards right  
d) towards left



- 13) In the adjoining figure  $AQ=2$ ,  $QB=4$ ,  $BP=3$ ,  $PC=5$ ,  $CR=6$  and  $RA=4$ . Find the area of triangle  $PQR$ .

- a) 4.8      b) 5.2  
c) 5.8      d) 6.2



- 14) The solubility of a salt  $B_2D_3$  is  $X \text{ mol L}^{-1}$ . Its solubility product is

- a)  $X^5$       b)  $6X^5$       c)  $36X^5$       d)  $108X^5$

- 15) If and when proteins are oxidized during respiration the energy yield is lesser than when carbohydrates or lipids are oxidized. This is primarily due to the fact that they have:

- a) relatively more oxygen      b) relatively less carbon  
c) nitrogen that is not oxidized      d) relatively less hydrogen

- 16) 8 Grams of oxygen at NTP contain



- a)  $1.5 \times 10^{23}$  molecules  
c)  $6.023 \times 10^{23}$  molecules

- b)  $3.0 \times 10^{23}$  molecules  
d)  $1.5 \times 10^{22}$  molecules

- 17) In a nuclear reactor the fission process of each  $^{235}\text{U}$ -atom gives out an energy of 200MeV. According to Einstein's equation the amount of mass getting converted to energy in this process is
- a)  $3.55 \times 10^{-30}\text{Kg}$       b)  $3.55 \times 10^{-38}\text{Kg}$       c)  $3.55 \times 10^{-28}\text{Kg}$       d)  $3.55 \times 10^{-27}\text{Kg}$
- 18) If  $\sin x + \sin y = a$  and  $\cos x - \cos y = b$ . Then find the value of  $\frac{1}{2}(2 - a^2 - b^2)$
- a)  $\cos(x+y)$       b)  $\cos(x-y)$       c)  $\sin(x+y)$       d)  $\sin(x-y)$
- 19) A ball is projected at an angle of  $45^\circ$  with horizontal. In the absence of air resistance, the ball follows
- a) Elliptical orbit      b) sinusoidal path  
c) parabolic path      d) linear path
- 20) A circle is inscribed in an isosceles trapezium ABCD in which AB is parallel DC. If AB=10 and DC=30. Find the area of the circle.
- a)  $45\pi$       b)  $50\pi$       c)  $60\pi$       d)  $75\pi$
- 21) When 1g of  $\text{CaCO}_3$  reacts with 50 mL of 0.1 M HCl, the volume of  $\text{CO}_2$  produced is
- a) 11.2 mL      b) 22.4 mL      c) 112 mL      d) 224 mL
- 22) Neoteny or larva becoming large and developing into adult retaining larval features is common in amphibians since they are adapted to survive:
- a) in fresh water bodies where temperature and/ or iodine content is less  
b) on insects that fail to supply enough nutrients  
c) on a high protein diet that induces early maturation  
d) in dark places and lack of light induces early sexual maturation
- 23) Cheese is a colloidal system of
- a) Gas in solid      b) Gas in liquid      c) Liquid in gas      d) Liquid in solid
- 24) 60g of ice at  $0^\circ\text{C}$  is added to 20g of water at  $40^\circ$ . The final temperature attained by the mixture is (given latent heat of melting of ice = 80 cal/g and specific heat of water is 1cal/g/ $^\circ\text{C}$ )
- a)  $0^\circ\text{C}$       b)  $20^\circ\text{C}$       c)  $10^\circ\text{C}$       d)  $5^\circ\text{C}$
- 25) y varies inversely as x. If x is increased by 25%, then the value of percentage change to y is
- a) 80%      b) 75%      c) 60%      d) 62.5%
- 26) Wavelength is



- (i) The distance traveled by the wave in one period of oscillation of particles in the medium.
- (ii) The distance between two particles, which are in the same phase.
- (iii) Half of the distance between two particles, which are in the same phase.

The correct definitions are

- a) (i) and (iii)
- b) (i) and (ii)
- c) (i), (ii) and (iii)
- d) (ii) and (iii)

27) Find the value  $\frac{2}{15} + \frac{2}{35} + \frac{2}{63} + \frac{2}{99} + \dots + \frac{2}{9999}$

- a) 8/33
- b) 2/11
- c) 98/303
- d) 222/909

28) When a dilute solution of sulphuric acid is electrolysed using platinum electrodes the gas evolved at the positive electrode is

- a) SO<sub>2</sub>
- b) SO<sub>3</sub>
- c) H<sub>2</sub>
- d) O<sub>2</sub>

29) To avoid damage to electricity cables trees are often trimmed before monsoon. Excessive trimming leaving only trunk often leads to death of a tree. The most probable reason is that:

- a) no food can be synthesized
- b) no buds are left to grow into new shoot/s
- c) no auxins (growth promoters) can be synthesized
- d) they succumb to the excessive trauma of wounds

30) If equal weights of oxygen and nitrogen are kept in separate containers at the same temperature then.

- a) Both the containers have the same number of molecules.
- b) More molecules are present in the oxygen container.
- c) The pressure of the nitrogen container is greater than that of the oxygen container.
- d) The pressure of the oxygen container is greater than that of the nitrogen container.

31) A boy is standing on a truck which is moving with constant speed along a straight road. On a day when wind is negligible, the boy throws a ball vertically up with some velocity. The ball comes back and falls

- a) into boy's hand
- b) Behind the boy
- c) In Front of the boy
- d) Behind or in front of the boy depending on the speed of the truck and ball.



32) If  $\sqrt[3]{75} = \sqrt[4]{45} = \sqrt[5]{15} = 0$ , then which of the statement is true

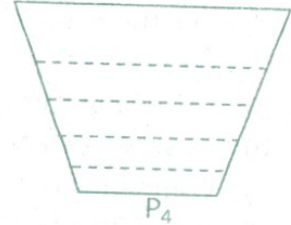
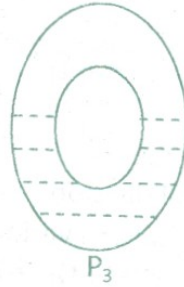
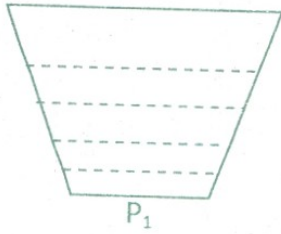
a)  $x + y = 2z$

b)  $x + y = 3z$

c)  $x - y = 2z$

d)  $x - y = 3z$

33) The pressure at the bottom of the four vessels filled with water to the same level is  $P_1, P_2, P_3$  and  $P_4$  respectively. Then which of the following conclusion is correct.



a)  $P_1 > P_2 > P_3 > P_4$

b)  $P_1 < P_2 < P_3 < P_4$

c)  $P_1 = P_4 = P_2 > P_3$

d)  $P_1 = P_2 = P_3 = P_4$

34) If  $x + y + z = 1; x \neq y \neq z; x, y, z$  are real numbers and  $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = m$ . How many of the following values of  $m$  are always possible.

i)  $m=6,$

ii)  $m=8,$

iii)  $m=10$

and iv)  $m=12$

a) 1

b) 2

c) 3

d) all

35) Two liters of oxygen gas diffused through a membrane in 600 seconds. 0.6 liter of an unknown gas diffused through the same membrane in half the time required for oxygen to diffuse. The molecular weight of the unknown gas is

a) 16

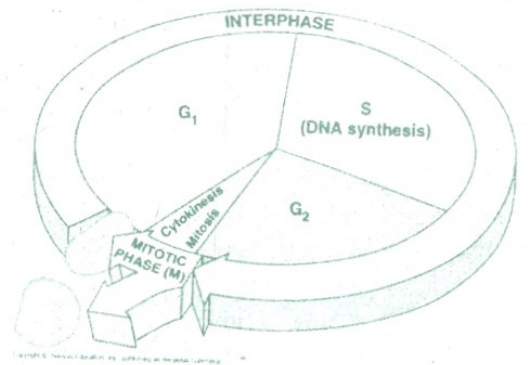
b) 44

c) 89

d) 64

Read the following carefully and answer the questions from 36 to 39

A student treats some onion root tips with colchicine that is responsible for arresting cell division at the metaphase stage (by dissolving spindle fibers) and further prepared a slide of the root tip staining with orcein (stains chromatin) and observed under high power of compound microscope. He is well aware of the cell cycle given alongside.



36) Which of the following is not true about his observation?

a) Most cells are in Interphase

b) Most cells are in the metaphase

c) No cells are in anaphase or telophase

d) Chromosomes could be observed better than a slide prepared without colchicine treatment.



37) Why did the student choose root tips of onion

- a) Roots grow fast and considerable length of tips can be used.
- b) Root tips are easy to smear and stain.
- c) Root tips have meristematic tissue.
- d) Cell division occurs only at the root tips in plants

38) What might be the purpose of the student?

- a) Observing chromosomes
- b) Observing stages of cell division
- c) Comparing number of cells in various stages of cell division
- d) Preventing further growth of the root tips.

39) Considering the action of colchicine, it may be considered for the treatment of:

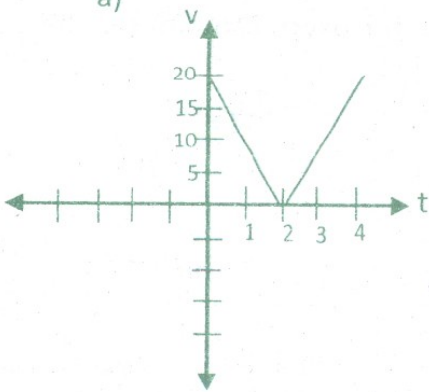
- a) Hairfall
- b) Anemia
- c) Cancer
- d) Bacterial infection

40) The element with electronic configuration  $1s^2 2s^2 2p^6 3s^2$  is a/an

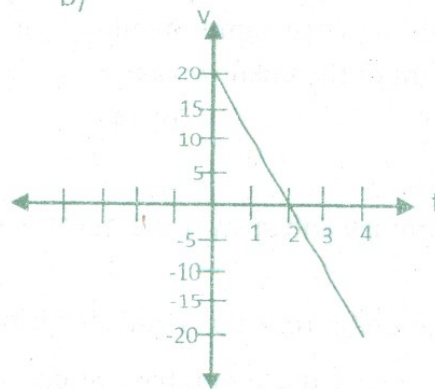
- a) Metal
- b) Non-metal
- c) Metalloid
- d) Inert gas

41) A ball is thrown up vertically in still air with a velocity of  $20\text{ms}^{-1}$ . It comes back to ground. The velocity-time graph is ( $g=10\text{ms}^{-2}$ ).

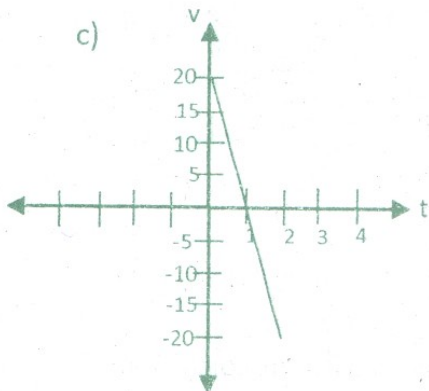
a)



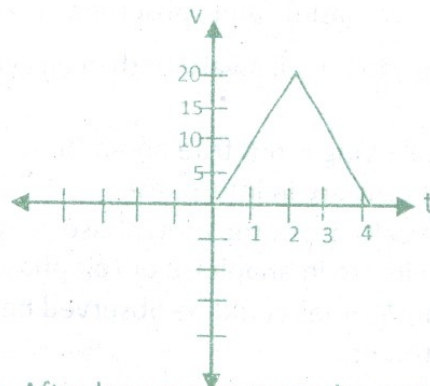
b)



c)



d)



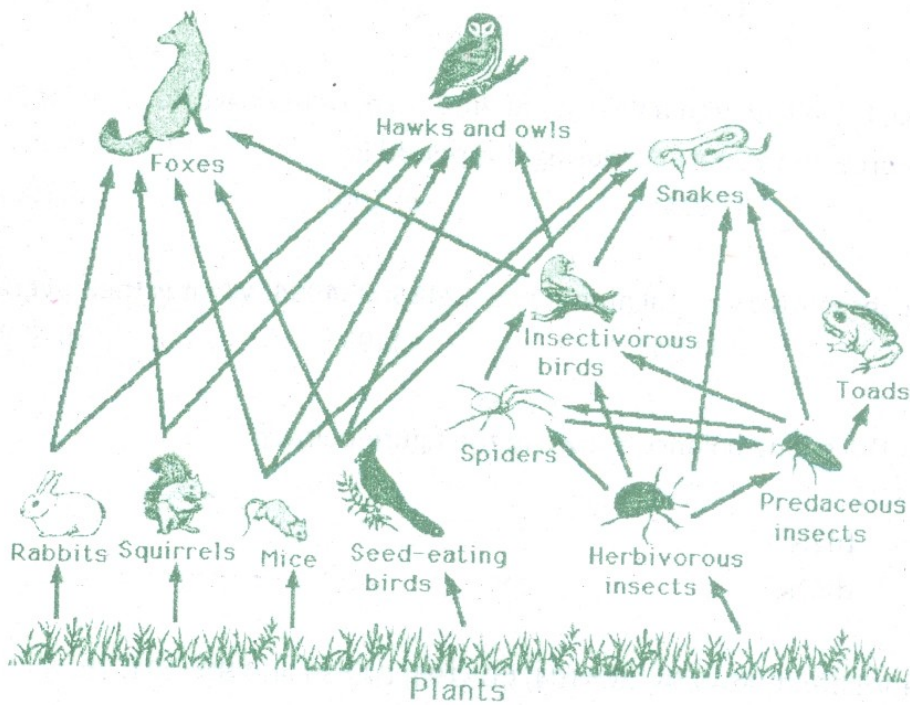
42) The sixty sixth Independence Day was on Wednesday. After how many years the next Independence Day will be on Wednesday?

- a) 6years
- b) 7years
- c) 11 years
- d) 28 years

- 43) Sound waves traveling in air enters water at an angle  $i$  with the normal. It gets refracted at angle  $r$  with
- a)  $i > r$       b)  $r > i$       c)  $i = r$       d) Sound waves do not get refracted
- 44) What will be the remainder if the number  $7^{2012}$  is divided by 25?
- a) 24      b) 18      c) 7      d) 1
- 45) The last electron of the element of atomic number 31 will have the following quantum numbers


	n	l	m	s
a)	3	0	0	-1/2
b)	3	1	1	+1/2
c)	4	1	-1	-1/2
d)	4	0	0	+1/2

Study the following diagram and answer the questions 46 to 50



- 46) Which of the following are tertiary consumers?
- a) Snake, toads and spiders      b) Foxes, Hawks and Snakes  
 c) Rabbit, Squirrels and Mice      d) Spiders, Predacious insects and herbivorous insects.
- 47) The shortest and the longest food chains have \_\_\_\_\_ and \_\_\_\_\_ number of organisms respectively.
- a) 2 and 6      b) 2 and 5      c) 3 and 5      d) 3 and 6



- 48) An insecticide is sprayed to protect the plants. Which of the following statements is true?
- Toads and insectivorous birds will prosper as they will get ample supply of dead insects.
  - Herbivores will be greatly affected, plants will be safe and carnivores will move to other areas and will not be affected greatly.
  - Some insects will die, some will become resistant and prolifer more and top carnivore will be affected most.
  - Some insects will die, but there will be no long term effects as the pesticides will get washed away.
- 49) What should be the preferred food of snakes to ensure minimum loss of solar energy.
- Mice
  - Toads
  - Insectivorous birds
  - Foxes
- 50) Organisms having low chances of survival produce larger number of offsprings to ensure their survival. Which of the following can be a characteristic feature of such organisms.
- Short lifecycle
  - Better defense strategies
  - Large body size
  - Good parental care
- 51) The compound which contains both ionic and covalent bonds is
- KCl
  - CS<sub>2</sub>
  - C<sub>2</sub>H<sub>6</sub>
  - KCN
- 52) A particle of mass 0.5kg travelling with a velocity of 2ms<sup>-1</sup> experiences acceleration of 2m<sup>-2</sup> for 9s. The workdone by the force on the particle during this period is
- 99J
  - 101J
  - 190J
  - 396J
- 53) The product of three consecutive natural numbers is 124850054994. What is their average?
- 4993
  - 4994
  - 4997
  - 4998
- 54) What is the reading of the spring balance shown in the figure below?
- 0
  - 2N
  - 4N
  - 6N
- 
- 55) If ABCD is a cyclic quadrilateral. AB=204, BC=104, CD=195, DA=85 and BD=221. Then find AC
- 205
  - 210
  - 220
  - 225
- 56) Molality of a solution is the number of
- moles of the solute per 1000 mL of the solution.
  - moles of the solute per 1000 mL of the solvent.
  - moles of the solute per 1000 g of the solvent.
  - moles of the solute per 100g of the solvent.

57) A scientist wanted to check the effect of a certain hair straightening procedure on the tensile strength of hair. The scientist could take only 20 samples. Which of the following sampling pattern should she use to ensure that maximum parameters are controlled and the results reflect the effect of the straightening process alone.

- a) 10 girls and 10 boys of age 18 before and after the straightening procedure.
- b) 10 girls and 10 boys one each of age 15, 16, 17, and so on upto 25 before and after the procedure.
- c) 10 girls and 10 boys of age 18 after the straightening procedure and another similar set of sample group who did not undergo the procedure.
- d) 10 girls and 10 boys one each of age 15, 16, 17, and so on upto 25 after the procedure and another similar set of sample group who did not undergo the procedure.

58) A lady has 4 kids with blood group AB and 1 kid with blood group O. If the father of these kids have blood group B, what is the possible genotype of the lady?

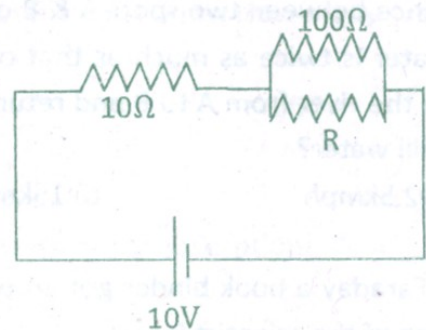
- a)  $I^A I^B$
- b)  $I^A I^O$
- c)  $I^A I^A$
- d)  $I^B I^B$

59) The pH of blood is maintained within the range 7.36 - 7.42 by

- a)  $\text{CH}_3\text{COONH}_4$
- b)  $\text{CH}_3\text{COONa}/\text{CH}_3\text{COOH}$
- c)  $\text{HCO}_3^- / \text{CO}_3^{2-}$
- d)  $\text{CH}_3\text{COOH}$

60) An ideal cell of emf 10V is connected across the network of resistors as shown in the figure. The value of the resistance  $R$  for which the power dissipated by the parallel combination is same as that in  $10\Omega$  resistance is.

- a)  $20\Omega$
- b)  $30\Omega$
- c)  $22.22\Omega$
- d)  $11.11\Omega$



61) If one of the roots of the equation  $x^2 - px + q = 0$  is  $m$  times the other root then  $m/(1+m^2)$  is equal to

- a)  $\frac{q}{p^2 - 2q}$
- b)  $\frac{p}{q^2 - 2p}$
- c)  $\frac{q}{q^2 - 2p}$
- d)  $\frac{p}{p^2 - 2q}$

62) Three particles each of mass  $m$  are placed at the vertices of a triangle of sides  $r$ . The force experienced by each mass is

- a)  $\sqrt{3} \left( \frac{Gm^2}{r^2} \right)$
- b)  $\sqrt{2} \left( \frac{Gm^2}{r^2} \right)$
- c)  $\frac{Gm^2}{r^2}$
- d)  $2 \frac{Gm^2}{r^2}$



63) If  $a+b+c=1$ ,  $a^2 + b^2 + c^2 = 12$  and  $abc=8$  then find the value of  $(1-a)(1-b)(1-c)$

a) -10

b)-18

c)-24

d)-30

64) An alkaline solution of  $K_2HgI_4$  is called

a) Fehling's reagent

b) Benedict's reagent

c) Nessler's reagent

d) Tollen's reagent

65) A film of oil on every water surface arrests the growth in mosquito population since:

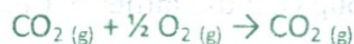
a) it blocks sunlight and mosquito larvae cannot get food

b) mosquito larvae suffocate

c) mosquito eggs cannot float on oil

d) mosquitoes fail to mate if water surface is not available

66) At constant temperature and pressure which of the following statements is true for the reaction.



a)  $\Delta E = \Delta H$

b)  $\Delta E > \Delta H$

c)  $\Delta E < \Delta H$

d)  $\Delta H$  and  $\Delta E$  are independent of each other

67) When a car turns on a curved road, you are pushed against one of the doors of the car because of

a) inertia

b) the centripetal force

c) the centrifugal force

d) the frictional force

68) The distance between two spots A & B on the same bank of the river is 75km. Speed of the boat in still water is twice as much as that of the speed of the water current of the river. The boat travels in the river from A to B and returns back to the spot in 16 hour. What is the speed of the boat in still water?

a) 12.5kmph

b) 15kmph

c) 16kmph

d) 18kmph

69) Michael Faraday a book binder got an opportunity to work with a scientist and later succeeded him. Name of the scientist is

a) Hans Christian Oersted

b) Humphrey Davy

c) Heinrich Lenz

d) James Clerk Maxwell

70) Find the equation of the line parallel to  $4x + 3y = 5$  and having x-intercept (-3)

a)  $3x + 4y + 12 = 0$

b)  $3x + 4y = 12$

c)  $4x + 3y - 12 = 0$

d)  $4x + 3y + 12 = 0$

71) The green coloured substance produced during the burning of ammonium dichromate in fireworks is

a)  $CrO_3$

b)  $Cr_2O_3$

c)  $CrO(O_2)_2$

d)  $Cr(OH)_3$

- 72) Mud flats with mangrove plants export a lot of organic matter to waters in contact. This is primarily because:
- there are fewer consumers in mangrove community
  - excreta of animals in mangrove community is richer in fibers
  - detritivores are lacking in mangrove community
  - aerobic decomposers cannot survive in waterlogged mud
- 73) The oxidation number of chlorine in  $\text{CaOCl}_2$  is
- 0
  - 1
  - +1
  - +3
- 74) The real image of an extended object placed in front of a concave mirror is formed at a distance of 40 cm from the object. If the image is 3 times bigger than the object, the magnitude of focal length of the mirror is.
- 15cm
  - 10cm
  - 20cm
  - 5cm
- 75) If  $\cot^2\theta(1-3\sec\theta+2\sec^2\theta)=1$  and  $\theta>90^\circ$ , then  $\theta$  is equal to
- $120^\circ$
  - $210^\circ$
  - $300^\circ$
  - $330^\circ$
- 76) A person suffering from short sight is advised to wear spectacles having concave lens of power -1.25D. What is the farthest distance he can see clearly without spectacles?
- 60cm
  - 100cm
  - 120cm
  - 80cm
- 77) Consider triangles having integer sides such that no side is greater than 4 units. How many such triangles are possible?
- 13
  - 17
  - 24
  - 64
- 78) Green house effect is related to
- Ozone layer depletion
  - Carbon dioxide emission and absorption
  - Nitrogen radiation
  - Oxygen radiation
- 79) What is the major difference between Bacteria and Virus
- Viruses are precursors to bacteria
  - Viruses lack proteins that are present in viruses
  - Viruses use host machinery to reproduce unlike bacteria
  - Viruses have proteins whereas bacteria do not.
- 80) Of the following the combination of processes related to sexual reproduction are:
- Conjugation
  - Fragmentation
  - Gamete formation
  - Zygote
- i, iii and iv
  - i, ii and iv
  - ii, iii and iv
  - only iii and iv