# TEST PAPER KVPY-2019

Date: 03-11-2019 Time Allowed: 3 Hrs. Maximum Marks: 100

# KISHORE VAIGYANIK PROTSAHAN YOJANA STREAM (SA)

#### INSTRUCTIONS FOR MARKING ON ANSWER SHEET

- 1. Immediately fill the particulars on this page of the Test Booklet with Blue / Black Ball Point Pen. Use of pencil is strictly prohibited.
- 2. The Test Booklet consists of 80 questions.
- 3. There are Two parts in the question paper. The distribution of marks subjectwise in each part is as under for each correct response.

#### **MARKING SCHEME:**

#### PART-I

#### **MATHEMATICS**

Question No. 1 to 15 consist of ONE (1) mark for each correct response.

**PHYSICS** 

Question No. 16 to 30 consist of ONE (1) mark for each correct response.

**CHEMISTRY** 

Question No. 31 to 45 consist of ONE (1) mark for each correct response.

**BIOLOGY** 

Question No. 46 to 60 consist of ONE (1) mark for each correct response.

### PART-II

#### **MATHEMATICS**

Question No. 61 to 65 consist of TWO (2) marks for each correct response.

**PHYSICS** 

Question No. 66 to 70 consist of TWO (2) marks for each correct response.

CHEMISTRY

Question No. 71 to 75 consist of TWO (2) marks for each correct response.

#### **BIOLOGY**

Question No. 76 to 80 consist of TWO (2) marks for each correct response.

- 4. Candidates will be awarded marks as stated above in Instructions No. 3 for correct response of each question.for Part-I 0.25 marks will be deducted for indicating incorrect response of each question and for Part-II 0.50 marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the Answer sheet.
- 5. No candidate is allowed to carry any textual material, printed or written, bits of papers, paper, mobile phone, any electronic device, etc., except the Admit Card inside the examination hall/room.
- **6.** Rough work is to be done on the space provided for this purpose in the Test Booklet only. This space is given at the bottom of each page.
- 7. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room/Hall. However, the candidates are allowed to take away this Test Booklet with them.
- 8. Do not fold or make any stray marks on the Answer Sheet.



**HEAD OFFICE** 

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## **PART-I**

# **One Mark Questions**

## **MATHEMATICS**

### Choose the correct $(\checkmark)$ answer:

1. Let ABC be an equilateral triangle with side length a. Let R and r denote the radii of the circumcircle and the incircle of triangle ABC respectively. Then, as a function of a,

the ratio  $\frac{R}{r}$ 

- (1) strictly increases
- (2) strictly decreases
- (3) remains constant
- (4) strictly increases for a < 1 and strictly decreases for a > 1
- Let b be a non-zero real number. Suppose the quadratic

equation  $2x^2 + bx + \frac{1}{b} = 0$  has two distinct real roots. Then

- (1)  $b + \frac{1}{b} > \frac{5}{2}$  (2)  $b + \frac{1}{b} < \frac{5}{2}$
- (3)  $b^2 3b > -2$  (4)  $b^2 + \frac{1}{h^2} < 4$
- 3. Let  $p(x) = x^2 + ax + b$  have two distinct real roots, where  $\frac{1}{2}$  8. a, b are real numbers. Define  $g(x) = p(x^3)$  for all real number x. Then which of the following statements are true?
  - g has exactly two distinct real roots
  - II. g can have more than two distinct real roots
  - **III.** There exists a real number a such that  $g(x) > \alpha$  for all real x
  - (1) Only I
- (2) Only I and III
- (3) Only II
- (4) Only II and III
- **4.** Let  $a_n$ ,  $n \ge 1$ , be an arithmetic progression with first term 2 and common difference 4. Let  $M_n$  be the average of the

first n terms. Then the sum  $\sum_{n=1}^{10} M_n$  is :

- (1) 110
- (2) 335
- (3) 770
- (4) 1100

- 5. In a triangle ABC,  $\angle$  BAC = 90°; AD is the altitude from A on to BC. Draw DE perpendicular to AC and DF perpendicular to AB. Suppose AB = 15 and BC = 25. Then the length of EF is
  - (1) 12
- (2) 10
- (3)  $5\sqrt{3}$
- (4)  $5\sqrt{5}$
- 6. The sides a, b, c of a triangle satisfy the relations  $c^2$  = 2ab and  $a^2 + c^2 = 3b^2$ . Then the measure of  $\angle$  BAC, in degress, is:
  - (1) 30
- (2) 45

(3) 60

- (4) 90
- Let N be the least positive integer such that whenever a non-zero digit c is written after the last digit of N, the resulting number is divisible by c. The sum of the digits of N is:
  - (1) 9

(2) 18

(3) 27

- (4) 36
- Let  $x_1, x_2, ..., x_{11}$  be 11 distinct positive integers. If we replace the largest of these integers by the median of the other 10 integers, then
  - (1) the median remains the same
  - (2) the mean increases
  - (3) the median decreases
  - (4) the mean remains the same
- **9.** The number of cubic polynomials P(x) satisfying P(1) = 2, P(2) = 4, P(3) = 6, P(4) = 8 is:
  - (1) 0
  - (2) 1
  - (3) More than one but finitely many
  - (4) infinitely many

- **10.** A two-digit number ab is called almost prime if one obtains a two-digit prime number by changing at most one of its digits a and b. (For example, 18 is an almost prime number because 13 is a prime number). Then the number of almost prime two-digit numbers is:
  - (1) 56
- (2) 75
- (3) 87

- (4) 90
- and K, L, M, N be the midpoints of AB, BC, CD, DA respectively. If area (PKAN) = 25, area(PLBK) = 36, and area(PMDN) = 41 then area(PLCM) is:
  - (1) 20

(2) 29

(3) 52

- (4) 54
- **12.** The number of non-negative integer solutions of the equations 6x + 4y + z = 200 and x + y + z = 100 is :
  - (1) 3

(2) 5

(3) 7

- (4) Infinite
- **13.** Let  $N_1 = 2^{55} + 1$  and  $N_2 = 165$ . Then
  - (1) N₁ and N₂ are coprime
  - (2) the HCF (Highest Common Factor) of N<sub>1</sub> & N<sub>2</sub> is 55
  - (3) the HCF of N₁ and N₂ is 11
  - (4) the HCF of  $N_1$  and  $N_2$  is 33

- **14.** Let  $\ell > 0$  be a real number, C denote a circle with circumference  $\ell$ , and T denote a triangle with perimeter  $\ell$ . Then
  - (1) given any positive real number  $\alpha$ , we can choose C and T as above such that the ratio  $\frac{\text{Area}(C)}{\text{Area}(T)}$  is greater than  $\alpha$
  - (2) given any positive real number  $\alpha$ , we can choose C and T as above such that the ratio  $\frac{\text{Area}(C)}{\text{Area}(T)}$  is lessthan  $\alpha$
  - (3) given any C and T as above, the ratio  $\frac{\text{Area}(C)}{\text{Area}(T)}$  is independent of C and T
  - (4) there exist real numbers a and b such that for any circle C and triangle T as above, we must have

$$a < \frac{Area(C)}{Area(T)} < b$$

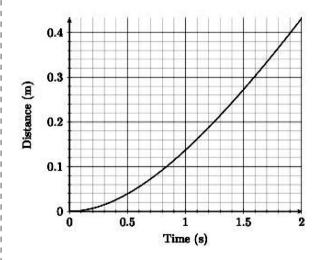
- **15.** The number of three digit numbers abc such that the arithmetic mean of b and c and the square of their geometric mean area equal is:
  - (1) 9

(2) 18

- (3) 36
- (4) 54

## **PHYSICS**

- **16.** Various optical processes are involved in the formation of a rainbow. Which of the following provides the correct order in time in which these processes occur?
  - (1) Refraction, total internal reflection, refraction.
  - Total internal reflection, refraction, total internal reflection.
  - (3) Total internal reflection, refraction, refraction.
  - (4) Refraction, total internal reflection, total internal reflection.
- 17. A specially designed Vernier caliper has the main scale least count of 1 mm. On the Vernier scale there are 10 equal divisions and they match with 11 main scale divisions. Then, the least count of the Vernier caliper is:
  - (1) 0.1 mm
- (2) 0.909 mm
- (3) 1.1 mm
- (4) 0.09 mm
- **18.** A steel ball is dropped in viscous liquid. The distance of the steel ball from the top of the liquid is shown below. The terminal velocity of the ball is closest to:



- (1) 0.26 m/s
- (2) 0.33 m/s
- (3) 0.45 m/s
- (4) 0.21 m/s

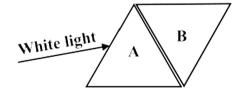
19. A student in a town in India, where the price per unit (1 unit = 1 kW-hr) of electricity is Rs. 5.00, purchases a 1 kVA UPS (uninterrupted power supply) battery. A day before the exam, 10 friends arrive to the student's home with their laptops and all connect their laptops to the UPS. Assume that each laptop has a constant power requirement of 90W. Consider the following statements:

I : All the 10 laptops can be powered by the UPS if connected directly.

II : All the 10 laptops can be powered if connected using an extension box with a 3 A fuse.

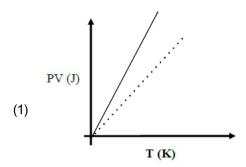
III: If all the 10 friends use the laptop for 5 hours, then the cost of the consumed electricity is about Rs 22.50. Select the correct option with the true statements.

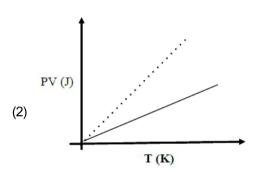
- (1) I only
- (2) I and II only
- (3) I and III only
- (4) II and III only
- **20.** Frosted glass is widely used for translucent windows. The region where a transparent adhesive tape is stuck over the frosted glass becomes transparent. The most reasonable explanation for this is:
  - (1) diffusion of adhesive glue into glass.
  - (2) chemical reaction at adhesive tape-glass interface.
  - (3) refractive index of adhesive glue is close to that of glass.
  - (4) Adhesive tape is more transparent than glass.
- 21. Consider two equivalent triangle hollow prism A and B made of thin glass plates and arranged with negligible spacing as shown in the figure. A beam of white light is incident on prism A from the left. given that the refractive index of water is inversely related to temperature, the beam to the right of prism B would not appear white if:

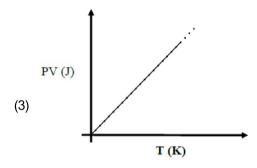


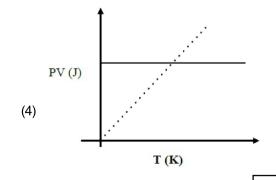
- (1) both prisms are filled with hot water (70°C)
- (2) both prisms are filled with cold water (7°C)
- (3) both prisms are empty.
- (4) prism A is filled with hot water (70°C) and prism B with cold water (7°C)
- **22.** A ball is moving uniformly in a circular path of radius 1m with a time period of 1.5 s. If the ball is suddenly stopped at t = 8.3 s, the magnitude of the displacement of the ball with respect to its position at t = 0 s is closest to:
  - (1) 1 m
- (2) 33m
- (3) 3m
- (4) 2m
- 23. A particle slides from the top of a smooth hemispherical surface of radius R which is fixed on a horizontal surface. If it separates from the hemisphere at a height h from the horizontal surface then the speed of the particle is:
  - (1)  $\sqrt{(2g(R-h))}$
- (2)  $\sqrt{(2g(R+h))}$
- (3)  $\sqrt{2gR}$
- (4)  $\sqrt{2gh}$
- **24.** The nuclear radius is given by  $R = r_0 A^{1/3}$ , where  $r_0$  is constant and A is the atomic mass number. Then,
  - (1) The nuclear mass density of U<sup>238</sup> is twice that of Sn<sup>119</sup>.
  - (2) The nuclear mass density of U<sup>238</sup> is trice that of Sn<sup>119</sup>
  - (3) The nuclear mass density of U<sup>238</sup> is the same as that of Sn<sup>119</sup>
  - (4) The nuclear mass density of U<sup>238</sup> is half that of Sn<sup>119</sup>
- **25.** The electrostatic energy of a nucleus of charge Ze is equal to  $kZ^2e^2/R$ , where k is a constant and R is the nuclear radius. The nucleus divides into two daughter nuclei of charges Ze/2 and equal radii. The change in electrostatic energy in the process when they are far apart is:
  - (1)  $0.375kZ^2e^2/R$
- (2)  $0.125kZ^2e^2/R$
- (3)  $kZ^2e^2/R$
- (4)  $0.5kZ^2e^2/R$
- beam to the right of prism B would not appear white if: | **26.** Two masses  $M_1$  and  $M_2$  carry positive charges  $Q_1$  and  $Q_2$ , respectively. They are dropped to the floor in a laboratory septup from the same height where there is a constant electric field vertically upwards.  $M_1$  hits the floor before  $M_2$ . Then,
  - (1)  $Q_1 > Q_2$
- (2)  $Q_1 < Q_2$
- (3)  $M_1Q_1 > M_2Q_2$
- (4)  $M_1Q_2 > M_2Q_1$

27. Which one of the following schematic graphs best  $\frac{1}{28}$ . Mumbai needs  $1.4 \times 10^{12}$  litres of water annually. Its represents the variation of PV (in Joules) versus T (in Kelvin) of one mole of an ideal gas? (the dotted line represents PV = T









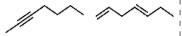
- effective surface area is 600 km<sup>2</sup> and it receives an average rainfall of 2.4 m annually. If 10% of this rain water is conserved it will meet approximately:
  - (1) 1% of Mumbai's water needs
  - (2) 10% of Mumbai's water needs
  - (3) 50% of Mumbai's water needs
  - (4) 100% of Mumbai's water needs
- 29. A Mass M moving with a certain speed V collides elastically with another stationalry mass m. After the collision the masses M and m move with speeds V' and v respectively. All motion is in one dimension. then:
  - (1) V = V' + v
  - (2) V' = V + v
  - (3) V' = (V + v)/2
  - (4) v = V + V'
- 30. Four rays, 1, 2, 3 and 4 are incident normally on the face PQ of an isosceles prism PQR with apex angle ∠ Q = 120°. The refractive indices of the material of the prism for the above rays 1, 2, 3 and 4 are 1.85, 1,95, 2.05 and 2.15, respectively and the surrounding medium is air. Then the rays emerging from the face QR are:
  - (1) 4 only
  - (2) 1 and 2 only.
  - (3) 3 and 4 only
  - (4) 1, 2, 3 and 4

## **CHEMISTRY**

31. The hybridization of N, C and O shown in the following 135. In water-gas shift reaction, hydrocarbon gas is produced

compound N=C=O respectively, are.

- (1)  $sp^2$ , sp,  $sp^2$
- (2)  $sp^2$ ,  $sp^2$ ,  $sp^2$
- (3) sp<sup>2</sup>, sp, sp
- (4) sp, sp, sp<sup>2</sup>
- **32.** The following compounds



are:

- (1) geometrical isomers (2) positional isomers
- (3) optical isomers
- (4) functional group isomers
- 33. The major product of the following reaction

- 34. IUPAC name of the following compound



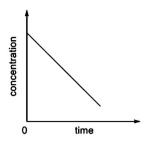
is:

- (1) 1-hydroxycyclohex-4-en-3-one
- (2) 1-hydroxycyclohex-3-en-5-one
- (3) 3-hydroxycyclohex-5-en-1-one
- (4) 5-hydroxycyclohex-2-en-1-one

- from the reaction of steam with
  - (1) methane
- (2) coke
- (3) carbon monoxide
- (4) carbon dioxide
- 36. Treatment with lime can remove hardness of water caused by
  - (1) CaCl<sub>2</sub>
- (2) CaSO<sub>4</sub>
- (3) Ca(HCO<sub>3</sub>)<sub>2</sub>
- (4) CaCO<sub>3</sub>
- 37. The most polarizable ion among the following is
  - (1) F

- (2) T
- (3) Na<sup>+</sup>
- (4) CI
- 38. For a multi-electron atom, the highest energy level among the following is
  - (1) n = 5, l = 0, m = 0,  $s = +\frac{1}{2}$
  - (2) n = 4, l = 2, m = 0,  $s = +\frac{1}{2}$
  - (3) n = 4, l = 1, m = 0,  $s = +\frac{1}{2}$
  - (4) n = 5, l = 1, m = 0,  $s = +\frac{1}{2}$
- 39. The oxide which is neither acidic nor basic is:
  - (1)  $As_2O_3$
  - (2) Sb<sub>4</sub>O<sub>10</sub>
  - (3) N<sub>2</sub>O
  - (4) Na<sub>2</sub>O
- 40. The element whose salts cannot be detected by flame test is
  - (1) Mg
- (2) Na
- (3) Cu
- (4) Sr

41. The plot of concentration of a reactant vs. time for a 43. The number of moles of water present in a spherical water chemical reaction is shown below:



The order of this reaction with respect to the reactant is

- (1) 0
- (2) 1
- (3) 2
- (4) not possible to determine from this plot
- **42.** During the free expansion of an ideal gas in an isolated chamber,
  - (1) Internal energy remains constant
  - (2) Internal energy decreases
  - (3) Work done on the system is negative
  - (4) Temperature increases

droplet of radius 1.0 cm is:

[Given: density of water in the droplet =  $1.0 \text{ g cm}^{-3}$ ]

- (3)  $24\pi$
- 44. Among the following, the correct statement about cathode ray discharge tube is
  - (1) the electrical discharge can only be observed at high pressure and at low voltages
  - (2) in the absence of external electrical or magnetic field, cathode rays travel in straight lines
  - (3) the characteristics of cathode rays depend upon the material of electrodes
  - (4) the characteristics of cathode rays depend upon the gas present in the cathode ray tube
- 45. For a spontaneous process
  - (1) enthalpy change of the system must be negative
  - (2) entropy change of the system must be positive
  - (3) entropy change of the surrounding must be positive
  - (4) entropy change of the system plus surrounding must be positive

### **BIOLOGY**

- **46.** Which one of the following is a CORRECT statement 48. Removal of the pancreas impairs the breakdown of about primate evolution?
  - (1) Chimpanzees and gorillas evolved from macaques
  - (2) Humans and chimpanzees evolved from gorillas
  - (3) Humans, chimpanzees and gorillas evolved from a common ancestor
  - (4) Humans and gorillas evolved from chimpanzees
- 47. The crypts of Lieberktihn are found in which one of the following parts of the human digestive tract?
  - (1) Oesophagus
- (2) Small intestine
- (3) Stomach
- (4) Rectum

- - (1) lipids and carbohydrates only
  - (2) lipids and proteins only
  - (3) lipids, proteins and carbohydrates
  - (4) proteins and carbohydrates only
- **49.** Microscopic examination of a blood smear reveals an abnormal increase in the number of granular with multiple nuclear lobes. Which one of the following cell types has increased in number?
  - (1) Lymphocytes
- (2) Monocytes
- (3) Neutrophils
- (4) Thrombocytes

8					KVPY-SA-2019	
<b>50</b> .	Which one of the following genetic phenomena is	55.	• , , ,			
	represented by the blood group AB?	l I	CORRECT taxonomical	hierar	chy?	
	(1) Codominance (2) Dominance	 	(1) Species, genus, fam	ily, or	der	
	(3) Overdominance (4) Semidoninance	I I	(2) Order, genus, family	, spec	cies	
51.	The mode of speciation mediated by graphical isolation	 	(3) Species, order, genu	ıs fam	nily	
	is referred to as	,   	(4) Species, genus, orde	er, far	nily	
	(1) adaptive radiation (2) allopatric speciation	56.	Which one of the followi	ng or	gans is NOT a site for the	
	(3) parapatric speciation (4) symspatric speciation	!   	production of white blood	d cells	s?	
<b>52</b> .	Which one of the following metabolic conversion requires	 	(1) Bone marrow	(2)	Kidney	
	oxygen?	1   	(3) Liver	(4)	Spleen	
	(1) Glucose to pyruvate	57.	Which one of the following anatomical structures			
	(2) Glucose to CO <sub>2</sub> and ethanol	I I I	involved in guttation?			
	(3) Glucose to lactate	 	(1) Cuticle	(2)	Hydathodes	
	(4) Glucose to CO <sub>2</sub> and H <sub>2</sub> O	   	(3) Lenticels	(4)	Stomata	
53.	3. Where are the proximal and distal convoluted tubules		8. Which one of the following parts of the eye is affected			
	located within the human body?	!   	cataract?			
	(1) Adrenal cortex (2) Adrenal medulla	 	(1) Cornea	(2)	Conjunctiva	
	(3) Renal cortex (4) Renal medulla	! !	(3) Retina	(4)	Lens	
54.	. In a diploid organism, when the locus X is inactivated,		Which one of the following organism is a bryophyte?			
	transcription of the locus $\boldsymbol{Y}$ is triggered. Based on	triggered. Based on	(1) Liverwort	(2)	Volvox	
	observation. Which one of the following statements is	 	(3) Chlamydomonas	(4)	Fem	
	CORRECT?  (1) X is dominant over Y (2) X is epistatic to Y		During oogenesis in mammals, the second meiotic			
			division occurs			
	(3) Y is dominant over X (4) Y is epistatic to X	! 	(1) Before fertilization	(2)	After implantation	
		 	(3) Before ovulation	(4)	After fertilization	
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## **PART-II**

# **Two Mark Questions**

## **MATHEMATICS**

- **61.** Let a, b, c, d be distinct real numbers such that a, b are roots of  $x^2 5cx 6d = 0$ , and c, d are roots of  $x^2 5ax 6b = 0$ . Then b + d is:
  - (1) 180
- (2) 162
- (3) 144
- (4) 126
- **62.** Let S =  $\{1, 2, 3, \dots, 100\}$ . Suppose b and c are chosen at random from the set S. The probability that  $4x^2 + bx + c$  has equal roots is :
  - (1) 0.001
- (2) 0.004
- (3) 0.007
- (4) 0.01
- **63.** Let N be the set positive integers. For all  $n \in N$ , let  $\int_{0}^{1} f_n = (n + 1)^{1/3} n^{1/3}$  and

$$A = \left\{ n \in N : f_{n+1} < \frac{1}{3(n+1)^{2/3}} + f_n \right\}$$

Then

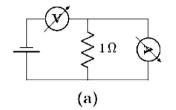
- (1) A = N
- (2) A is a finite set
- (3) the complement of A in N is nonempty but finite
- (4) A and its complement in N are both infinite
- **64.** A prime number p is called special if there exist primes  $p_1$ ,  $p_2$ ,  $p_3$ ,  $p_4$  such that  $p = p_1 + p_2 = p_3 p_4$ The number of special primes is :
  - (1) 0
  - (2) 1
  - (3) more than one but finite
  - (4) infinite
- **65.** Let ABC be a triangle in which AB = BC. Let X be a point on AB such that AX : XB = AB : AX. If AC = AX, then the measure of ∠ ABC equals
  - (1) 18°
- (2) 36°
- (3) 54°
- (4) 72°

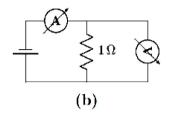
# PHYSICS

- water tank rotates about a horizontal axis passing through its center of mass in a vertical plane as shown in the figure. The time period of rotation is 60s. Assuming the water to be still and no reflections from the surface of the tank, the duration for which the light beam escapes the tank in one time period is close to (Refractive index of water = 1.33)
  - 40 cm 30 cm 30 cm

- (1) 8.13 s
- (2) 14.05 s
- (3) 16.27 s
- (4) 23.86 s
- 67. In an hour–glass approximately 100 grains of sand fall per second (starting from rest), and it takes 2 sec. for each sand particle to reach the bottom of the hour–glass. If the average mass of each sand particle is 0.2 g then the average force exerted by the falling sand on the bottom of the hour–glass is close to:
  - (1) 0.4 N
  - (2) 0.8 N
  - (3) 1.2 N
  - (4) 1.6 N

**68.** A student uses the resistance of a known resistor  $(1\Omega)$  **69.** A hot air balloon with a payload rises in the air. Assume to calibrate a voltmeter and an ammeter using the circuits shown below. The student measures the ratio of the voltage to current to be 1 ×  $10^3 \Omega$  in circuit (a) and 0.999  $\Omega$  in circuit (b). From these measurements, the resistances (in  $\Omega$ ) of the voltmeter and ammeter are found to be close to:





- (1)  $10^2$  and  $10^{-2}$
- (2)  $10^3$  and  $10^{-3}$
- (3)  $10^{-2}$  and  $10^{2}$
- (4)  $10^{-3}$  and  $10^{3}$

- that the balloon is spherical in shape with diameter of 11.7 m and the mass of the balloon and the payload (without the hot air inside) is 210 kg. Temperature and pressure of outside air are 27° C and 1 atm = 10<sup>5</sup> N/m<sup>2</sup> respectively. Molar mass of dry air is 30 g. The temperature of the hot air inside is close to, [The gas constant R = 8.31 J/K/mol]
  - (1) 27°C
- (2) 52°C
- (3) 105°C
- (4) 171°C
- 70. A healthy adult of height 1.7 m has an average blood pressure (BP) of 100 mm of Hg. The heart is typically at a height of 1.3 m from the foot. Take the density of blood to be 10<sup>3</sup> kg/m<sup>3</sup> and note that 100 mm of Hg is equivalent to 13.3 kPa (kilo Pascals). The ratio of BP in the foot region to that in the head region is close to:
  - (1) one
- (2) two
- (3) three
- (4) four

## **CHEMISTRY**

- **71.** PbO<sub>2</sub> is obtained from
  - (1) the reaction of PbO with HCI
  - (2) thermal decomposition of Pb(NO<sub>3</sub>)<sub>2</sub> at 200°C
  - (3) the reaction of Pb<sub>3</sub>O<sub>4</sub> with HNO<sub>3</sub>
  - (4) the reaction of Pb with air at room temperature
- 72. For one mole of van der Waals gas, the compressibility

factor  $Z = \left(\frac{PV}{RT}\right)$  at a fixed volume will certainly

decreases if

[Given: "a", "b" are standard parameters for van der Waals gas]

- (1) "b" increases and "a" decreases at constant temperature
- (2) "b" decreases and "a" increases at constant temperature
- (3) temperature increases at constant "a" and "b" values
- (4) "b" increases at constant "a" and temperature

- 73. The correct statement among the following
  - (i)  $E_{2s}(H) > E_{2s}(Li) > E_{2s}(Na) > E_{2s}(K)$
  - (ii) The maximum number of electrons in the shell with principal quantum number n is equal to 2n<sup>2</sup>
  - (iii) Extra stability of half-filled subshell is due to smaller exchange energy
  - (iv) Only two electrons, irrespective of their spin, may exist in the same orbital are
  - (1) (i) and (ii)
- (2) (ii) and (iii)
- (3) (iii) and (iv)
- (4) (i) and (iv)
- 74. An organic compound contains 46.78% of a halogen X. When 2.00 g of this compound is heated with fuming HNO<sub>3</sub> in the presence of AgNO<sub>3</sub>, 2.21 g AgX was formed. The halogen X is

[Given: atomic weight of Ag = 108, F = 19, Cl = 35.5, Br = 80, I = 127

(1) F

(2) CI

- (3) Br
- (4) I

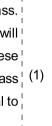
**75.** An organic compound X with molecular formula C<sub>6</sub>H<sub>10</sub>, when treated with HBr, forms a gem dibromide. The compound X upon warming with HgSO<sub>4</sub> and dil. H<sub>2</sub>SO<sub>4</sub>, produces a ketone which gives a positive iodoform test. The compound X is:

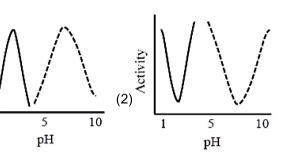




## **BIOLOGY**

76. A cell weighing 1 mg grows to double its initial mass before dividing into two daughter cells of equal mass. Assuming no death, at the end of 100 divisions what will be the ratio of the mass of the entire population of these cells to that of the mass of the Earth? Assume that mass (1) of the Earth is  $10^{24}$  kg and  $2^{10}$  is approximately equal to 1000.

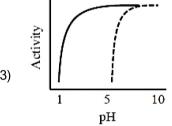


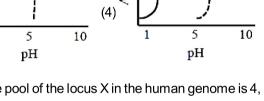


- $(1) 10^{-28}$
- $(2) 10^{-3}$

(3) 1

- $(4) 10^3$
- 77. Papaya is a dioecious species with XY sexual genotype for male and XX for female. What will be the genotype of the embryos and endosperm nuclei after double fertilization?





- (1) 50% ovules would have XXX endosperm and XY embryo, while the other 50% wouldhave XXY endosperm and XX embryo
- (2) 100% ovules would have XXX endosperm and XY embryo
- (3) 100% ovules would have XXY endosperm and XX embryo
- (4) 50% ovules would have XXX endosperm and XX embryo, while the other 50% ovules would have XXY endosperm and XY embryo
- 78. Solid and dotted lines represent the activities of pepsin and salivary amylase enzymes of the digestive tract, respectively. Which of the following graphs best represents their activity vs pH?

- 79. If the gene pool of the locus X in the human genome is 4, then what would be the highest possible number of genotypes in a large population?
  - (1) 6
- (2)8
- (3) 10
- (4) 16
- 80. Match the plant hormones in Column I with their primary function in column II:

# Column I Abscisic acid

- Column II Promotes disease
- Ethylene
- resistance Maintains seed
- Cytokinin
- dormancv Promotes seed
- Gibberellin
- germination Promotes fruit ripening
- Inhibits leaf senescence
- (1) P-iii, Q-iv, R-i, S-ii
- (2) P-ii, Q-iv, R-v S-iii
- (3) P-v, Q-iii, R-ii, S-i
- (4) P-iv, Q-ii, R-iii, S-v

12					KVPY-SA-2019
				ANSWERS KVPY-SA-2019	
1.	(3)	14. (1)	27. (1)	40. (1) 53. (3)	66. (3) 79. (3)
2.	(3)	15. (2)	28. (2)	41. (1) 54. (4)	67. (1) 80. (2)
3.	(2)	   16. (1) 	29. (4)	42. (1) 55. (1)	68. (2)
4.	(1)	i 17. (1)	30. (3)	43. (2) 56. (2)	69. (3)
5.	(1)	18. (2)	31. (1)	44. (2) 57. (2)	70. (3)
6.	(2)	   19. (3) 	32. (4)	45. (4) 58. (4)	71. (3)
7.	(1)	20. (3)	33. (1)	46. (3) 59. (1)	72. (2)
8.	(3)	   21. (4)	34. (4)	47. (2) 60. (4)	73. (1)
9.	(1)	   22. (4)	35. (3)	48. (3) 61. (3)	74. (3)
10.	(4)	23. (1)	36. (3)	49. (3) 62. (1)	75. (4)
11.	(3)	   24. (3)	37. (2)	50. (1) 63. (1)	76. (3)
12.	(3)	   25. (1)	38. (4)	51. (2) 64. (2)	77. (4)
13.	(4)	26. (4)	39. (3)	52. (4) 65. (2)	78. (1)