



**SIR PADAMPAT SINGHANIA UNIVERSITY  
UDAIPUR**

**Sample Question Paper for B.Tech SPSAT' 17**

**INSTRUCTIONS**

The test is 45 minutes long and consists of 40 multiple choice questions (MCQ) adding up to 40 marks. The distribution of questions is as follows (Mathematics/Biology):

Physics - 10; Chemistry - 10; English – 10; Mathematics - 10 and Biology - 10

**PHYSICS**

1. A motorboat covers a given distance in 6 hours moving downstream on a river. It covers the same distance in 10 hours moving upstream. The time it takes to cover the same distance in still water is \_\_\_\_\_.
- (a) 6.5 hours (b) 8 hours  
(c) 9hours (d) 7.5 hours

2. A body of mass M hits normally a rigid wall with velocity V and bounces back with the same velocity. The impulse experienced by the body is
- (a) Zero (b) MV  
(c) 1.5MV (d) 2 MV

3. A planet moving along an elliptical orbit is closest to the sun at a distance  $r_1$  and farthest away at a distance of  $r_2$ . If  $v_1$  and  $v_2$  are the linear velocities at these points respectively.

Then the ratio  $\frac{v_1}{v_2}$  is

- (a)  $\frac{r_1}{r_2}$  (b)  $\left(\frac{r_1}{r_2}\right)^2$   
(c)  $\frac{r_2}{r_1}$  (d)  $\left(\frac{r_2}{r_1}\right)^2$

4. A charged particle is moving in a magnetic field of strength B perpendicular to the direction of the field. If q and m denote the charge and mass of the particle respectively. Then the frequency of rotation of the particle is

- (a)  $f = \frac{2\pi m}{qB}$  (b)  $f = \frac{2\pi^2 m}{qB}$   
(c)  $f = \frac{qB}{2\pi m^2}$  (d)  $f = \frac{qB}{2\pi m}$

5. A cylinder of radius  $r$  and length  $l$  is placed in an uniform electric field  $E$  parallel to the axis of the cylinder. The total flux for the surface of the cylinder is given by \_\_\_\_\_.
- (a)  $\pi r^2 E$  (b)  $(\pi r^2 + \pi l^2)E$   
 (c) zero (d)  $2V r^2 E$
6. A mass of 10 kg is suspended from a spring balance. It is pulled aside by a horizontal string so that it makes an angle of  $60^\circ$  with the vertical. The new reading of the balance is
- (a) 20 kg.wt (b) 10 kg.wt  
 (c)  $10\sqrt{3}$  kg.wt (d)  $20\sqrt{3}$  kg.wt
7. A horizontal metal wire is carrying an electric current from the north to the south. Using a uniform magnetic field, it is to be prevented from falling under gravity. The direction of this magnetic field should be towards the \_\_\_\_\_.
- (a) east (b) west  
 (c) north (d) south
8. A count rate meter shows a count of 240 per minute from a given radioactive source. One hour later the meter shows a count rate of 30 per minute. The half-life of the source is \_\_\_\_\_.
- (a) 20 min (b) 30 min  
 (c) 80 min (d) 120 min
9. A nucleus  ${}^m_x X$  emits one  $\alpha$ -particle and two  $\beta$ -particles. The resulting nucleus is
- (a)  ${}^{m-4}_{n-2} Y$  (b)  ${}^{m-6}_{n-4} Z$   
 (c)  ${}^{m-6}_n Z$  (d)  ${}^{m-4}_n X$
10. A convex lens of focal length 30 cm produces 5 times magnified real image of an object. What is the object distance?
- (a) 36cm (b) 25cm  
 (c) 30cm (d) 150 cm

## BIOLOGY

11. Pollen grains of a plant whose  $2n = 28$  are cultured to get callus by tissue culture method. What would be the number of chromosomes in the cells of the callus?
- (a) 21 (b) 14  
 (c) 56 (d) 28
12. Populations are said to be allopatric when \_\_\_\_\_.
- (a) they are physically isolated by natural barriers  
 (b) they live together and breed freely to produce viable offspring  
 (c) they are isolated but often come together for breeding  
 (d) none of the above
13. Osteomalacia is a deficiency disease of

- (a) Infants due to protein energy malnutrition  
 (b) Adults due to protein energy malnutrition  
 (c) Adults due to Vitamin D deficiency  
 (d) Infants due to Vitamin K deficiency
14. Populations are said to be sympatric when \_\_\_\_\_.
- (a) two populations are physically isolated by natural barriers.  
 (b) two populations live together and freely interbreed to produce sterile offspring.  
 (c) two populations share the same environment but cannot interbreed.  
 (d) two populations are isolated but occasionally come together to interbreed.
15. *Nosema bombycis* which causes pebrine in silk worms is a
- (a) Virus (b) Bacterium  
 (c) Protozoan (d) Fungus
16. Ovule integument gets transformed into
- (a) seed (b) fruit wall  
 (c) seed coat (d) cotyledons
17. Polyploid derived from two different species is called
- (a) Autopolyploid (b) Triploid  
 (c) Allopolyploid (d) Monoploid
18. Palaeontologists unearthed a human skull during excavation. A small fragment of the scalp tissue was still attached to it. Only little DNA could be extracted from it. If the genes of the ancient man need to be analysed, the best way of getting sufficient amount of DNA from this extract is
- (a) Subjecting the DNA to polymerase chain reaction  
 (b) Subjecting the DNA to gel electrophoresis  
 (c) Treating the DNA with restriction endonucleases  
 (d) Hybridising the DNA with a DNA probe
19. *Pinus* belongs to the class \_\_\_\_\_.
- (a) *Gentopsida* (b) *Cycadopsida*  
 (c) *Coniferopsida* (d) *Sphenopsida*
20. Pieces of plant tissue used in tissue culture is called
- (a) Explant (b) Somaclone  
 (c) Inoculant (d) Clone

## CHEMISTRY

21. In qualitative analysis when  $\text{H}_2\text{S}$  is passed through an aqueous solution of salt acidified with dil.  $\text{HCl}$ , a black precipitate is obtained. On boiling the precipitate with dil.  $\text{HNO}_3$ , it forms a solution of blue colour. Addition of excess of aqueous solution of ammonia to this solution gives \_\_\_\_\_.
- (a) deep blue precipitate of  $\text{Cu}(\text{OH})_2$   
 (b) deep blue solution of  $[\text{Cu}(\text{NH}_3)_4]^{2+}$   
 (c) deep blue solution of  $\text{Cu}(\text{NO}_3)_2$   
 (d) deep blue solution of  $\text{Cu}(\text{OH})_2 \cdot \text{Cu}(\text{NO}_3)_2$

22. On addition of conc.  $\text{H}_2\text{SO}_4$  to a chloride salt, colourless fumes are evolved but in case of iodide salt, violet fumes come out. This is because

- (a)  $\text{H}_2\text{SO}_4$  reduces HI to  $\text{I}_2$  (b) HI is of violet colour  
(c) HI gets oxidised to  $\text{I}_2$  (d) HI changes to  $\text{HIO}_3$

23. Bond dissociation enthalpy of E—H (E = element) bonds is given below. Which of the compounds will act as strongest reducing agent?

Compound	$\text{NH}_3$	$\text{PH}_3$	$\text{AsH}_3$	$\text{SbH}_3$
$\Delta_{\text{diss}}(\text{E—H})/\text{kJ mol}^{-1}$	389	322	297	255

- (a)  $\text{NH}_3$  (b)  $\text{PH}_3$   
(c)  $\text{AsH}_3$  (d)  $\text{SbH}_3$

24. On heating with concentrated NaOH solution in an inert atmosphere of  $\text{CO}_2$ , white phosphorus gives a gas. Which of the following statement is incorrect about the gas?

- (a) It is highly poisonous and has smell like rotten fish.  
(b) It's solution in water decomposes in the presence of light.  
(c) It is more basic than  $\text{NH}_3$ .  
(d) It is less basic than  $\text{NH}_3$ .

25. Which of the following acids forms three series of salts?

- (a)  $\text{H}_3\text{PO}_2$  (b)  $\text{H}_3\text{BO}_3$   
(c)  $\text{H}_3\text{PO}_4$  (d)  $\text{H}_3\text{PO}_3$

26. Strong reducing behaviour of  $\text{H}_3\text{PO}_2$  is due to

- (a) Low oxidation state of phosphorus  
(b) Presence of two  $-\text{OH}$  groups and one P—H bond  
(c) Presence of one  $-\text{OH}$  group and two P—H bonds  
(d) High electron gain enthalpy of phosphorus

27. Which of the following pairs of ions are isoelectronic and isostructural?

- (a)  $\text{CO}_3^{2-}$ ,  $\text{NO}_3^-$  (b)  $\text{ClO}_3^-$ ,  $\text{CO}_3^{2-}$   
(c)  $\text{SO}_3^{2-}$ ,  $\text{NO}_3^-$  (d)  $\text{ClO}_3^-$ ,  $\text{SO}_3^{2-}$

28. In a cyclotrimetaphosphoric acid molecule, how many single and double bonds are present?

- (a) 3 double bonds; 9 single bonds (b) 6 double bonds; 6 single bonds  
(c) 3 double bonds; 12 single bonds (d) Zero double bonds; 12 single bonds

29. Which of the following elements can be involved in  $p\pi-d\pi$  bonding?

- (a) Carbon (b) Nitrogen  
(c) Phosphorus (d) Boron

30. Affinity for hydrogen decreases in the group from fluorine to iodine. Which of the halogen acids should have highest bond dissociation enthalpy?

- (a) HF (b) HCl  
(c) HBr (d) HI

## MATHEMATICS

31. The probability that at least one of A and B occurs is 0.6. If A and B occur simultaneously with probability 0.3, then  $P(A') + P(B')$  is
- (a) 0.9 (b) 0.15  
(c) 1.1 (d) 1.2
32. Geometric mean (G.M.) and harmonic mean (H.M.) of two numbers are 10 and 8 respectively. The numbers are
- (a) 5, 20 (b) 4, 25  
(c) 2, 50 (d) 1, 100
33. If  $y = \tan^{-1} \frac{\sqrt{1+x^2}-1}{x}$ , then  $y'(1) =$
- (a) 0.25 (b) 0.5  
(c) -0.25 (d) -0.5
34. If the three points A (1,6), B (3,-4) and C (x, y) are collinear then the equation satisfying by x and y is
- (a)  $5x + y - 11 = 0$  (b)  $5x + 13y + 5 = 0$   
(c)  $5x - 13y + 5 = 0$  (d)  $13x - 5y + 5 = 0$
35. The value of  $f(0)$  so that the function  $f(x) = \frac{1 - \cos(1 - \cos x)}{x^4}$  is continuous everywhere is
- (a)  $\frac{1}{2}$  (b)  $\frac{1}{4}$   
(c)  $\frac{1}{6}$  (d)  $\frac{1}{8}$
36. The solution of  $\frac{dy}{dx} = \frac{y}{x} + \tan \frac{y}{x}$  is
- (a)  $x = c \sin(y/x)$  (b)  $x = c \sin(xy)$   
(c)  $y = c \sin(y/x)$  (d)  $xy = c \sin(x/y)$
37. The value of  $\frac{\cot x - \tan x}{\cot 2x}$  is
- (a) 1 (b) 2  
(c) -1 (d) 4
38. The locus of the middle points of all chords of the parabola  $y^2 = 4ax$  passing through the vertex is
- (a) A straight line (b) an ellipse  
(c) a parabola (d) a circle.
39. If the coordinates of one end of a diameter of the circle  $x^2 + y^2 + 4x - 8y + 5 = 0$  is (2, 1), the coordinates of the other end is
- (a) (-6, -7) (b) (6, 7)

(c) (-6,7) (d) (7,-6)

40. The number of permutations by taking all letters and keeping the vowels of the word COMBINE in the odd places is
- (a) 96 (b) 144  
(c) 512 (d) 576

## ENGLISH

41. Choose the most appropriate one word substitute out of the four choices -  
Tendency to quarrel or fight
- (a) pugnacity (b) rebellious  
(c) oasis (d) narcotic
42. Fill in the blank with the correct word -  
The priest addressed the \_\_\_ for more than an hour and was listened to with rapt attention.
- (a) staff (b) audience  
(c) congregation (d) crew
43. Choose the correct phrasal verb -  
I would like to go to New Zealand, but I am \_\_\_\_\_ by the long flight.
- (a) put down (b) put off  
(c) put out (d) put up
44. Choose the correct synonym of the given word - Yearn
- (a) Tathe (b) Fear  
(c) Crave (d) Release
45. Fill in the blank space with the most appropriate preposition -  
There was no heir \_\_\_ the throne.
- (a) to (b) in  
(c) on (d) over
46. Choose the correct option -  
I will never forget being \_\_\_\_\_ by my teacher for the mispronunciation of a word.
- (a) castigated (b) conjugated  
(c) coruscated (d) cast away
47. Choose the word opposite or nearly so of the given word - Malevolent
- (a) kindly (b) vacuous  
(c) ambivalent (d) primitive
48. Choose the option which can be substituted for the given words -  
Opposed to great or sudden change
- (a) static (b) revolutionary  
(c) conservative (d) evolutionary

49. Below the sentence are given three possible substitutions for the italicized part. If one of them (a), (b), (c) or (d) is better than the italicized part, indicate your response against the corresponding letter

He decided to *quickly leave the house*.

- |                                |                             |
|--------------------------------|-----------------------------|
| (a) Quickly to leave the house | (b) Quickly leaves house    |
| (c) Leave the house quickly    | (d) Leave quickly the house |
| (e) None                       |                             |

50. Fill in the blanks with the correct word -

The industrial workers \_\_\_\_\_ a fair \_\_\_\_\_ for their work

- |                    |                    |
|--------------------|--------------------|
| (a) request, price | (b) sought, salary |
| (c) demanded, wage | (d) asked, pay     |