

# FIITJEE PET – XI (CHAMPIONS\_2<sup>ND</sup> YEAR)

## MAINS

### DATE: 22.09.2018

Time: 3 hours

Maximum Marks: 360

**INSTRUCTIONS:**

### *Instructions to the Candidates*

1. This Test Booklet consists of **90 questions**.  
Use **Blue/Black ball Point Pen only** for writing particulars and bubbling of OMR.
2. For each correct answer **4 Marks** will awarded and for each wrong answer **1 Mark** will be deducted.
3. Attempt all questions.
4. In case you have not darkened any bubble you will be awarded 0 mark for that question.
5. Use of calculator/logarithmic table is not permitted.

**Don't write / mark your answers in this question booklet.**  
**If you mark the answers in question booklet, you will not be allowed to continue the exam.**

NAME:

ENROLLMENT NO.:

1. The maximum number of points into which 4 circles and 4 straight lines intersect is  
 (A) 72 (B) 26 (C) 50 (D) 56
2.  $\sum_{k=m}^n {}^k C_r = a({}^{n+1}C_{r+1} - {}^m C_{r+1})$ , then a is equal to  
 (A) 1 (B) m (C) n (D) none of these
3. The number of positive terms in the sequence  $x_n = \frac{195}{4^n P_n} - \frac{{}^{n+3}P_3}{{}^{n+1}P_{n+1}}$ ,  $n \in \mathbb{N}$  is  
 (A) 2 (B) 3 (C) 4 (D) none of these
4. The number of number that can formed with the help of the digits 1, 2, 3, 4, 3, 2, 1 so that odd digits always occupy odd places is  
 (A) 24 (B) 18 (C) 12 (D) 30
5. The number of numbers, greater than 400,000 that can be formed by using the digits 0, 2, 2, 4, 4, 5 is  
 (A) 30 (B) 48 (C) 50 (D) none of these
6. 7 candidates are to take examination, 2 in mathematics and remaining in different subjects. The number of ways in which they can be seated in a row so that the two examinees in Mathematics may not sit together, is  
 (A) 5400 (B) 4800 (C) 3600 (D) none of these
7. The total number of 8-digit numbers which have all different digits is  
 (A) 3265920 (B) 3265860 (C) 3268620 (D) none of these
8. The sum of the digits in the unit place of all the numbers formed with the help of 3, 4, 5, 6 taken all at a time is  
 (A) 432 (B) 108 (C) 36 (D) 18
9. The number of ways in which a committee of 5 can be chosen from 10 candidates so as to exclude the youngest if it includes the oldest, is  
 (A) 196 (B) 178 (C) 202 (D) none of these
10. In an examination there are three multiple choice questions and each question has 4 choices. Number of ways in which a student can fail to get all answers correct is  
 (A) 11 (B) 12 (C) 27 (D) 63
11. A father with 8 children takes them 3 at a time to the zoological garden, as often as he can without taking the same 3 children together more than once. then which is not true  
 (A) number of times he will go is 56  
 (B) number of times each child will go is 21  
 (C) number of times a particular child will not go is 35  
 (D) number of times two particular child will go is 5

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**Space for rough work**

12. Number of zeros at the end of 300! Is equal to  
 (A) 75 (B) 89 (C) 74 (D) 98
13. Total number of words that can be formed using the alphabets of the word KUBER, so that no alphabet is repeated in any of the formed word, is equal to  
 (A) 325 (B) 320 (C) 240 (D) 365
14. Total number of positive integral solutions of the equation  $x_1 \cdot x_2 \cdot x_3 = 60$ , is equal to  
 (A) 27 (B) 54 (C) 64 (D) none of these
15.  $n_1$  and  $n_2$  are five digits numbers. Total numbers of ways of forming  $n_1$  and  $n_2$  so that these numbers can be added without carrying at any stage, is equal to  
 (A)  $36 \cdot (55)^4$  (B)  $45(55)^4$  (C)  $(55)^6$  (D) none of these
16. Total number of ways in which a person can arrange 8 different things into four distinct boxes, is equal to  
 (No restriction)  
 (A)  ${}^{19}P_8$  (B)  ${}^{11}P_8$  (C)  ${}^{16}P_8$  (D)  ${}^{11}C_8$
17. Total number of times, the digit '3' will be written, when the integers having less than 4 digits are listed, is equal to  
 (A) 300 (B) 310 (C) 302 (D) 306
18.  $f: \{1, 2, 3, 4, 5\} \rightarrow \{x, y, z, t\}$ . Total number of onto functions 'f', is equal to  
 (A) 242 (B) 245 (C) 1024 (D) 240
19. Total number of parallelograms that can be formed, using ' $n_1$ ' parallel lines in one direction and ' $n_2$ ' parallel lines in another direction, is equal to  
 (A)  $({}^{n_1}C_2)({}^{n_2}C_2)$  (B)  ${}^{n_1+n_2}C_2$  (C)  ${}^{n_1+n_2}C_1$  (D) none of these
20. Total number of ways of selecting 2 white squares on a normal chess board, so that they don't belong to the same row or column, is equal to  
 (A) 96 (B) 400 (C) 480 (D) 491
21. The sides AB, BC, CA of a triangle ABC have 3, 4, 5 interior points respectively on them. Total number of triangles that can be formed using these points as vertices, is equal to  
 (A) 135 (B) 145 (C) 178 (D) 205

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**Space for rough work**

22. Six papers are set in examination, 2 of them in Mathematics. The number of different orders be given so that two mathematics papers are not successive is  
(all papers are different)  
(A) 720 (B) 480 (C) 240 (D) 120
23. A family consisting of an old man, 6 adults and 4 children, is to be seated in a row for dinner. The children wish to occupy the two seats at each end and the old man refuses to have a child on either side of him. The number of ways that the seated arrangements can be made for the dinner is  
(A) 85,410 (B) 85,405 (C) 85,400 (D) 86,400
24. The letters of word VICTORY are permuted in all possible ways and the words thus formed are arranged as in a dictionary. The rank of the word VICTORY is  
(A) 2896 (B) 3733 (C) 2597 (D) 3452
25. Let  $T_n$  be the number of all possible triangles formed by joining vertices of an n-sided regular polygon. If  $T_{n+1} - T_n = 10$ , then the value of n is  
(A) 10 (B) 8 (C) 7 (D) 5
26. The number of 5 digit numbers of different digits can be formed with 2 even and 3 odd digits is  
(A)  ${}^5C_2 \cdot {}^5C_3 \cdot 5!$  (B)  ${}^4C_2 \cdot {}^5C_3 \cdot 5!$   
(C)  ${}^4C_1 \cdot {}^5C_3 \cdot 4(4!)$  (D)  ${}^4C_2 \cdot {}^5C_3 \cdot 5! + {}^4C_1 \cdot {}^5C_3 \cdot 4(4!)$
27. There are 6 Indians, 6 Americans and 8 Germans. Of them a committee of 3 Indians, 4 Americans and 5 Germans is to be formed always including a particular Indian, a particular German and excluding a particular American  
(A) 350 (B) 1750 (C) 3500 (D) none of these
28. The number of ways in which 5 boys and 3 girls can sit in a line so that all the girls do not come together is  
(A) 4210 (B) 4320 (C) (50) (6!) (D) none of these
29. An n-digit number is a positive number with exactly n digits. Nine hundred distinct n-digit numbers are to be formed using only digits 2, 5 and 7. The smallest value of n for which this is possible is  
(A) 6 (B) 7 (C) 8 (D) 9
30. The number of odd numbers between 1000 and 10,000 can be formed with the digits 1, 2, 3, 4, 5, 6, 7, 8, 9 is  
(A) 1280 (B) 1836 (C) 2572 (D) 1680

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***Space for rough work***

31. A source is moving with constant speed  $v_s = 20\text{m/s}$  towards a stationary observer due east of the source. Wind is blowing at the speed of  $20\text{ m/s}$  at  $60^\circ$  north of east. The source has frequency  $500\text{ Hz}$ . Speed of sound =  $300\text{ m/s}$ . The frequency registered by the observer is approximately.  
 (A)  $541\text{ Hz}$  (B)  $552\text{ Hz}$  (C)  $534\text{ Hz}$  (D)  $517\text{ Hz}$
32. An observer moves towards a stationary source of sound with a speed  $(1/5)$ th of the speed of sound. The wavelength and frequency of the source emitted are  $\lambda$  and  $f$  respectively. The apparent frequency and wavelength recorded by the observer are respectively  
 (A)  $1.2 f$  and  $\lambda$  (B)  $f$  and  $\lambda$  (C)  $0.8 f$  and  $0.8 \lambda$  (D)  $1.2 f$  and  $1.2 \lambda$
33. In the experiment to determine the speed of sound using a resonance column,  
 (A) prongs of the tuning fork are kept in a vertical plane  
 (B) prongs of the tuning fork are kept in a horizontal plane  
 (C) in one of the two resonances observed, the length of the resonating air column is close to the wavelength of sound in air  
 (D) in one of the two resonances observed, the length of the resonating air column is close to half of the wavelength of sound in air
34. A tuning fork A of frequency  $320\text{ Hz}$  when sounded together with another tuning fork B produces  $5$  beats/sec. One of the prongs of the tuning fork B is loaded with wax. Tuning forks A and B now produce  $6$  beats/sec, the frequency of B is  
 (A)  $320\text{ Hz}$  (B)  $315\text{ Hz}$  (C)  $326\text{ Hz}$  (D)  $314\text{ Hz}$
35. A car with a horn of frequency  $620\text{ Hz}$  travels towards a large wall at a speed of  $20\text{ ms}^{-1}$ . If velocity of sound is  $330\text{ ms}^{-1}$ , the frequency of echo of sound as heard by the driver is  
 (A)  $700\text{ Hz}$  (B)  $660\text{ Hz}$  (C)  $620\text{ Hz}$  (D)  $580\text{ Hz}$
36. If a vibrating tuning fork of frequency  $255\text{ Hz}$  is moving with a velocity  $4\text{ ms}^{-1}$  perpendicular to a wall, the number of beats produced per second is (speed of sound in air =  $340\text{ ms}^{-1}$ )  
 (A)  $3$  (B)  $4$  (C)  $5$  (D)  $6$
37. A blast gives a sound of intensity  $0.8\text{ W/m}^2$  and frequency  $1\text{ kHz}$ . If the density of air is  $1.3\text{ kg/m}^3$  and speed of sound in air is  $330\text{ m/sec}$ , the amplitude of the sound wave is approximately  
 (A)  $5 \times 10^{-6}\text{ m}$  (B)  $9.7 \times 10^{-6}\text{ m}$  (C)  $15 \times 10^{-6}\text{ m}$  (D)  $20 \times 10^{-6}\text{ m}$

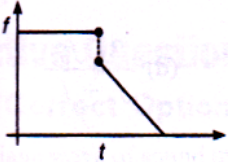
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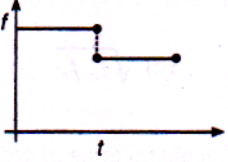
38. When two tuning forks of nearly the same frequency are sounded together they produce beats; the velocity of the propagation of beats  
 (A) is greater than velocity of sound (B) is smaller than velocity of sound  
 (C) depends on the relative frequencies (D) same as the speed of sound
39. A train has just completed a U-curve in a track which is a semi-circle. The engine is at the forward end of the semicircular part of the track while the last carriage is at the rear end of the semi circular track. The driver blows a whistle of frequency 200 Hz. Velocity of sound is 340 m/s. Then, the apparent frequency as observed by a passenger in the middle of the train, when the speed of the train is 30 m/s, is  
 (A) 219 Hz (B) 188 Hz (C) 200 Hz (D) 181 Hz
40. Sound from two identical sources  $S_1$  and  $S_2$  reach a point P. When the sound reach directly and in the same phase, the intensity at P is  $I_0$ . The power of  $S_1$  is now reduced by 64% and the phase difference between  $S_1$  and  $S_2$  varied continuously. The maximum and minimum intensities recorded at P are now  $I_{max}$  and  $I_{min}$ . be:  
 (A)  $I_{max} = 0.64 I_0$  (B)  $I_{min} = 0.36 I_0$  (C)  $I_{max} / I_{min} = 16$  (D)  $I_{max} / I_{min} = 1.64 / 0.36$
41. Sound with intensity larger than 120 dB appears painful to person. A small speaker delivers 2.0 W of audio output. How close can the person get to the speaker without hurting his ears?  
 (A) 20 cm (B) 40 cm (C) 60 cm (D) 80 cm
42. When sound wave is refracted from air to water, which of the following will remain unchanged?  
 (A) Wave number (B) Wavelength (C) Wave velocity (D) Frequency
43. The sound level at a point 5.0 m away from a point source is 40 dB. What will be the level at a point 50 m away from the source?  
 (A) 20 dB (B) 25 dB (C) 30 dB (D) 40 Db
44. If the intensity of sound is doubled, by how many decibels does the sound level increase?  
 (A) 10 dB (B) 2 dB (C) 3 dB (D) 5 dB
45. A vehicle, with a horn of frequency  $n$  is moving with a velocity of 30 m/s in a direction perpendicular to the straight line joining the observer and the vehicle. The observer perceives the sound to have a frequency  $(n + n_1)$ . If the sound velocity in air is 300 m/s, then  
 (A)  $n_1 = 10n$  (B)  $n_1 = 0$  (C)  $n_1 = 0.1n$  (D)  $n_1 = -0.1n$

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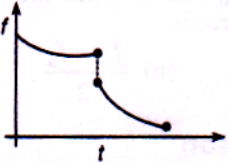
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46. A sound source emits frequency of 180 Hz when moving towards a rigid wall with speed 5 m/s and an observer is moving away from wall with speed 5 m/s. Both source and observer moves on a straight line which is perpendicular to the wall. The number of beats per second heard by the observer will be (speed of sound = 355 m/s)  
 (A) 5 beats /s                      (B) 10 beats /s                      (C) 6 beats /s                      (D) 8 beats /s
47. A train is moving towards a stationary observer. Which of the following curve best represent the frequency received by observer  $f$  as a function of time ?
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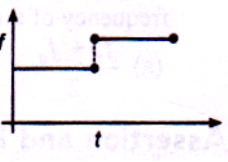
(A)



(B)



(C)



(D)
48. One train is approaching an observer at rest another train is receding from him with the same velocity 4 m/s. Both trains blow whistles of same frequency of 243 Hz. The beat frequency in Hz as heard by the observer is (speed of sound in air = 320 m/s)  
 (A) 10                      (B) 6                      (C) 4                      (D) 1
49. Two persons A and B, each carrying a source of frequency 300 Hz, are standing a few metre apart. A starts moving towards B with velocity 30m/s. If the speed of sound is 300 m/s, which of the following is true ?  
 (A) Number of beats heard by A is higher than that heard by B  
 (B) The number of beats heard by B are 30 Hz  
 (C) Both A and B are correct  
 (D) Both A and B are wrong
50. A fixed source of sound emitting a certain frequency appears as  $f_a$  when the observer is approaching the square with speed  $v_0$  and  $f_r$  when the observer recedes from the source with the same speed . The frequency of the source is  
 (A)  $\frac{f_r + f_a}{2}$                       (B)  $\frac{f_r - f_a}{2}$                       (C)  $\sqrt{f_a f_r}$                       (D)  $\frac{2f_r f_a}{f_r + f_a}$

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**Space for rough work**

**Assertion and Reason (Question 51-53)**

**Directions:** Choose the correct option

**(A) If both Assertion and Reason are true and the Reason is correct explanation of the Assertion**

**(B) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion**

**(C) If Assertion is true, but the Reason is false**

**(D) If Assertion is false but the Reason is true.**

51. **Assertion** : A train is approaching towards a hill. The driver of the train will hear beats  
**Reason** : Apparent frequency of reflected sound observed by driver will be more than the frequency of direct sound observed by him.
52. **Assertion** : Fundamental frequency of this pipe is 150 Hz  
**Reason** : According to Laplace end correction if radius of pipe is less, frequency should be more
53. **Assertion** : In the experiment of finding speed of sound by resonance tube method, as the level of water is lowered, wavelength increases.  
**Reason** : By lowering the water level number of loops increases
54. A closed organ pipe has length L. The air in it is vibrating in third overtone with maximum amplitude a. The amplitude at distance  $\frac{L}{7}$  from closed end of the pipe is  
 (A) 0 (B) a (C)  $\frac{a}{2}$  (D) Data insufficient
55. A car traveling towards a hill at 10 m/s sounds its horn which has a frequency 500 Hz. This is heard in a second car traveling behind the first car in the same direction with speed 20 m/s. The sound can also be heard in the second car by reflection of sound from the hill. The beat frequency heard by the driver of the second car will be (speed of sound in air = 340 m/s)  
 (A) 31 Hz (B) 24 Hz (C) 21 Hz (d) 34 Hz
56. Two sounding bodies are producing progressive waves given by  $y_1 = 2\sin(400\pi t)$  and  $y_2 = \sin(404\pi t)$  where t is in second, which superpose near the ears of a person. The person will hear  
 (A) 2 beats / with intensity ratio 9/4 between maxima and minima  
 (B) 2 beats / with intensity ratio 9 between maxima and minima  
 (C) 4 beats / with intensity ratio 16 between maxima and minima  
 (D) 4 beats / with intensity ratio 16/9 between maxima and minima

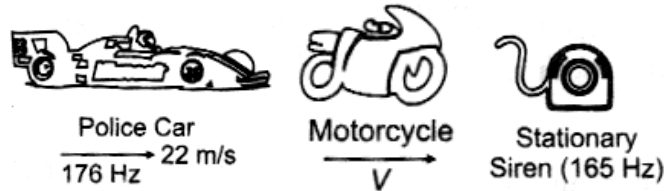
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***Space for rough work***



57. The air in a closed tube 34 cm long is vibrating with two nodes and two antinodes and its temperature is  $51^{\circ}\text{C}$ . What is the wavelength of the waves produced in air outside the tube, when the temperature of air is  $16^{\circ}\text{C}$  ?  
 (A) 42.8 cm                      (B) 68 cm                      (C) 17 cm                      (D) 102 cm

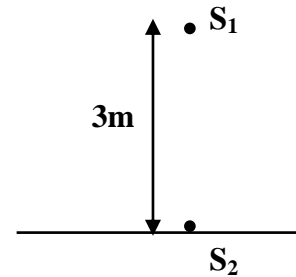
58. A police car moving at 22 m/s, chase a motorcyclist. The police man sounds his horn at 176 Hz, while both of them move towards a stationary siren of frequency 165 Hz. Calculate the speed of the motorcyclist, if he does not observe any beats. (velocity of sound in air = 330 m/s)



- (A) 33 m/s                      (B) 22 m/s                      (C) zero                      (D) 11 m/s

59. A closed organ pipe resonates in its fundamental mode at a frequency of 200 Hz with  $\text{O}_2$  in the pipe at a certain temperature. If the pipe now contains 2 moles of  $\text{O}_2$  and 3 moles of ozone, then what will be the fundamental frequency of same pipe at same temperature ?  
 (A) 268.23 Hz                      (B) 175.4 Hz                      (C) 149.45 Hz                      (D) None of these

60.  $S_1$  and  $S_2$  are two coherent sources of sound having no initial phase difference. The velocity of sound is 330 m/s. No maxima will be formed on the line passing through  $S_2$  and perpendicular to the line joining  $S_1$  and  $S_2$ , If the frequency of both the source is  
 (A) 330 Hz                      (B) 120 Hz  
 (C) 100 Hz                      (D) 220 Hz



**Space for rough work**

# FIITJEE PET – XI (CHAMPIONS\_2<sup>ND</sup> YEAR)

## MAINS\_ANSWERS

### DATE: 22.09.2018

#### MATHEMATICS

- |            |       |       |       |
|------------|-------|-------|-------|
| 1. C       | 2. A  | 3. C  | 4. B  |
| 5. D       | 6. C  | 7. D  | 8. B  |
| 9. A       | 10. D | 11. D | 12. C |
| 13. A or B | 14. B | 15. A | 16. B |
| 17. A      | 18. D | 19. A | 20. B |
| 21. D      | 22. B | 23. D | 24. B |
| 25. D      | 26. D | 27. B | 28. C |
| 29. B      | 30. D |       |       |

#### PHYSICS

- |       |            |       |       |
|-------|------------|-------|-------|
| 31. C | 32. A      | 33. A | 34. B |
| 35. A | 36. D      | 37. B | 38. D |
| 39. C | 40. A or C | 41. B | 42. D |
| 43. A | 44. C      | 45. B | 46. A |
| 47. B | 48. B      | 49. D | 50. A |
| 51. A | 52. BONUS  | 53. D | 54. B |
| 55. A | 56. BONUS  | 57. A | 58. B |
| 59. B | 60. C      |       |       |

#### CHEMISTRY

- |           |       |       |       |
|-----------|-------|-------|-------|
| 61. B     | 62. B | 63. D | 64. A |
| 65. D     | 66. C | 67. D | 68. B |
| 69. C     | 70. A | 71. C | 72. C |
| 73. C     | 74. B | 75. C | 76. B |
| 77. Bonus | 78. B | 79. A | 80. B |
| 81. B     | 82. A | 83. A | 84. A |
| 85. C     | 86. D | 87. C | 88. B |
| 89. D     | 90. A |       |       |