MENTORS EDUSERV

SCHOLASTIC APTITUDE TEST [ME-SAT]
SAMPLE TEST PAPER

[For Students going to Class 12 in 2021]

[STREAM: ENGINEERING]

Time : 2 hours **Maximum Marks: 180**

DO NOT BREAK THE SEALS ON THIS BOOKLET, AWAIT INSTRUCTIONS FROM THE INVIGILATOR.

INSTRUCTIONS

[A] General :

1. The question paper consists of **THREE** Sections, **A to C** (Physics, Chemistry and Mathematics) having total **60** questions (**20** questions in each Physics, Chemistry and Mathematics).
2. This Question Paper contains **13 pages** including cover page.
3. **Each Section consists of two Parts :**
   - **Part-I** contains **14 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.
   - **Part-II** contains **3 paragraphs** each describing theory, experiment, data etc. There are **6 multiple choice questions** relating to three paragraphs with **2 questions on each paragraph**. Each question of a particular paragraph has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.
4. The Question Paper has blank spaces at the bottom of each page for rough work.No additional sheets will be provided for rough work.
5. Blank papers, clip boards, log tables, slide rule, calculators, cellular phones, pagers and electronic gadgets, in any form, are **NOT** allowed.
6. The **OMR** (Optical Mark Recognition) sheet shall be provided separately.

[B] Answering on the OMR:

7. In **Part-I** & **Part-II** of all 3 Sections, each question has **4 choices** out of which **only one choice is correct**.
8. Fill the bubble with **Ball Pen (Blue or Black) ONLY.**

[C] Filling – Name and Registration No.

9. On the **OMR sheet**, write your Name and Registration No. using ball pen. Also, put your signature in the appropriate box using ball pen.

[D] Marking Scheme:

10. For each question in **Part-I and Part-II**, you will be awarded **3 marks** if you darken the bubble corresponding to the correct answer **ONLY** and **zero (0) marks** if no bubbles are darkened. In all other cases, **minus one (–1) mark** will be awarded in these sections.

SEAL

Name :.....

Registration No.: | | | | | | | | | | | | | | |

SECTION-A : PHYSICS

PART – I

(Single Correct Answer Type)

This part contains **14 multiple choice questions**. Each question has four choices (A), (B), (C) and (D), out of which **ONLY ONE is correct**.

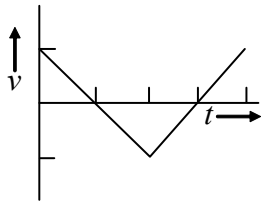
1. Which of the following combinations of three dimensionally different physical quantities P, Q, R can never be a meaningful quantity ?

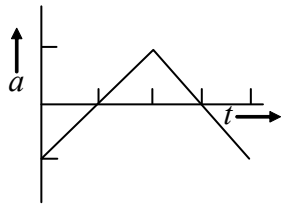
(A) PQ — R (B) PQ / R (C) (P – Q) / R (D) (PR – Q^2) / QR

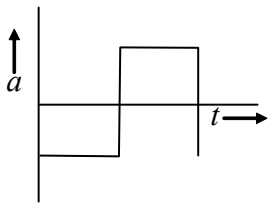
2. A ball thrown upward from the top of tower with speed *v* reaches the ground in t_1 second. If this ball is thrown downward from the top of the same tower with same speed v, it reaches the ground in t_2 second. In what time the ball shall reach the ground if it is allowed to fall freely under gravity from the top of the tower?

(A) $\frac{t_1 + t_2}{2}$ (B) $\frac{t_1 - t_2}{2}$ (C) $\sqrt{t_1 t_2}$ (D) $t_1 + t_2$

3. The graph given shows the velocity *v* versus time *t* for a body. Which of the following graphs shown represents the corresponding acceleration versus time graphs?



(A)


(B)


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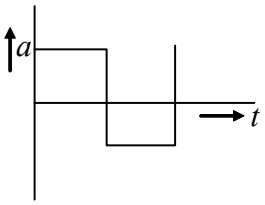

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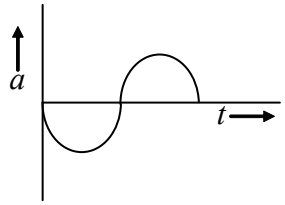
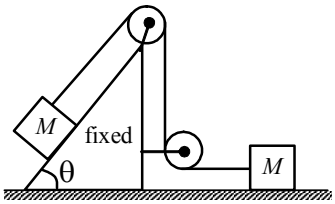


4. A shell fired from the ground is just able to cross in a horizontal direction the top of a wall 90 m away and 45 m high. The direction of projection of the shell is

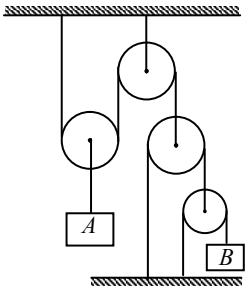
(A) 25° (B) 30° (C) 60° (D) 45°

5. Two blocks, each having a mass *M*, rest on frictionless surface as shown in the figure. If the pulleys are light and frictionless, and *M* on the incline is allowed to move down, then the tension in the string will be



(A) $\frac{2}{3}Mg\sin\theta$ (B) $\frac{3}{2}Mg\sin\theta$ (C) $\frac{Mg\sin\theta}{2}$ (D) 2 *Mg* sin θ

6. Block *A* moves upward with acceleration $\frac{1}{2}m/s^2$. The acceleration of block *B* in downward direction will be



(A) 2 m/s² (B) 3 m/s² (C) 4 m/s² (D) 6 m/s²

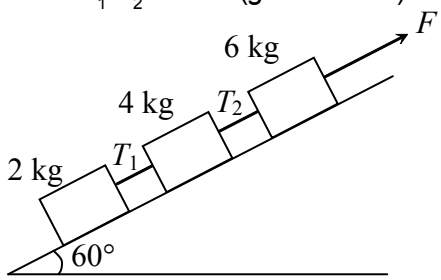
7. The angle which a vector $\hat{i}-\hat{j}+\sqrt{2}\,\hat{k}$ makes with *y*-axis is

(A) 60° (B) 120° (C) 150° (D) $\tan^{-1}(-\frac{1}{2})$

8. If position (in meter) of a particle moving in straight line is given by $x = t^2 - 2t + 1$(where *t* is time in second). The distance travelled by particle in first two second is

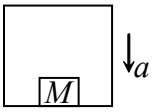
(A) zero (B) 2 m (C) 4 m (D) 3 m

9. Three blocks of masses 2kg, 4kg and 6kg are connected by string and resting on a frictionless incline of 60° as shown. A force of 120N is applied upward along the incline to the 6 kg block. If the strings are ideal, the ratio T_1/T_2 will be (g = 10 ms^{-2})



(A) 1 : 1 (B) 1 : 2 (C) 1 : 3 (D) 1 : 4

10. With what acceleration 'a' should the box of figure descend so that the block of mass M exerts a force $Mg/4$ on the floor of the box?

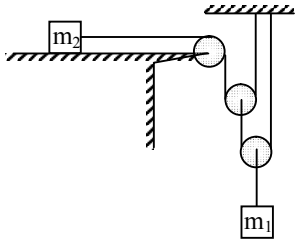


(A) $g/4$ (B) $g/2$ (C) $3g/4$ (D) $4g$

11. A motorboat going downstream overcomes a raft at a point A. After one hour it turns back and meets the raft again at a distance 6 km from A. Find the velocity of river in (km/hr).

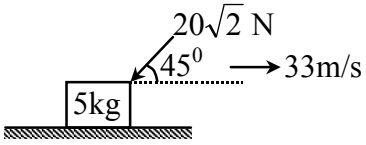
(A) 1 (B) 2 (C) 3 (D) 4

12. Pulleys are ideal and string are massless. The masses of blocks are m_1 = 4 kg and m_2 = 1 kg as shown. If all surfaces are smooth then the acceleration of m_2 in m/s^2 is (g = 10 m/s^2)



(A) 2 (B) 4 (C) 6 (D) 8

13. A block of mass 5 kg is kept on a rough horizontal floor. It is given velocity 33 m/s towards right. A force of $20\sqrt{2}$ N continuously acts on the block as shown. If the coefficient of friction between block and floor is 0.5, find the velocity of the block after 5 seconds. (g = 10 m/s^2)



(A) 0 (B) 1 (C) 2 (D) 3

14. A balloon rises from rest on the ground with constant acceleration $\frac{g}{8}$. A stone is dropped when the balloon has risen to a height of *H* m. The time taken by the stone to reach the ground is $\sqrt{\frac{nH}{g}}$. Find n.

(A) 2 (B) 4 (C) 5 (D) 6

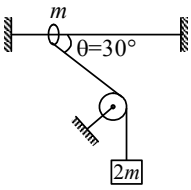
PART – II

(Paragraph Type)

This part contains **6 multiple choice questions** relating to three paragraphs with **two questions on each paragraph**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

Paragraph for Questions 15 and 16

A smooth ring of mass *m* can slide on a fixed horizontal rod. A massless string tied to the ring passes over a fixed smooth pulley of mass *m* and carries a block of mass 2*m* as shown in figure. At an instant the string between ring and pulley makes an angle $\theta = 30°$ with the horizontal.



15. Acceleration of block is

(A) $\frac{3}{5}g$ (B) $\frac{g}{3}$ (C) $\frac{2\sqrt{3}}{5}g$ (D) none of these

16. Acceleration of ring is

(A) $\frac{3}{5}g$ (B) $\frac{g}{3}$ (C) $\frac{2\sqrt{3}}{5}g$ (D) none of these

Paragraph for Questions 17 and 18

The velocity *v* of a body moving along a straight line is varying with time *t* as $v = t^2 - 4t$, where *v* is in m/s and *t* is in seconds.

17. The magnitude of initial acceleration is

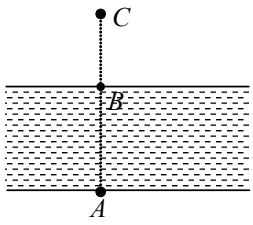
(A) zero (B) 2 m/s^2 (C) 4 m/s^2 (D) 6 m/s^2

18. The magnitude of displacement of particle in first three seconds is

(A) zero (B) 9 m (C) 18 m (D) 27 m

Paragraph for Questions 19 and 20

A river of width *d* is flowing with uniform velocity *u*. A boat starts moving from point *A* (one bank of river) with speed *u* relative to the river. The direction of resultant velocity is always perpendicular to line joining boat and fixed point *C* (see figure). Point *B* is on the opposite side of the river and *A*, *B*, *C* are in straight line. If *AB* = *BC* = *d*



19. The path of boat is

(A) straight line (B) parabolic

(C) circular (D) curve but not parabolic or circular

20. The distance from *B* where the boat will reach the other bank of river is

(A) *d* (B) $d\sqrt{2}$ (C) $\frac{d}{2}$ (D) $d\sqrt{3}$

SECTION-B : CHEMISTRY

PART – I

(Single Correct Answer Type)

This part contains **14 multiple choice questions**. Each question has four choices (A), (B), (C) and (D), out of which **ONLY ONE is correct**.

21. Which of the following statement is correct in relation to the hydrogen atom?

(A) 3s–orbital is lower in energy than 3p–orbital.

(B) 3p–orbital is lower in energy than 3d–orbital.

(C) 3s and 3p–orbitals are of lower energy than 3d–orbitals.

(D) 3s, 3p and 3d–orbitals all have same energy.

22. How many electrons will have m (magnetic quantum number) = 0 in Fe^{3+} ion?

(A) 12 (B) 13 (C) 11 (D) 14

23. Equal weights of ethane and hydrogen are mixed in an empty container at 25°C. The fraction of total pressure exerted by hydrogen is?

(A) 1 : 2 (B) 1 : 1 (C) 1 : 16 (D) 15 : 16

24. If 'V' is the volume of one molecule of a gas under given condition, then vander Waal's constant 'b' is

(A) 4V (B) $\frac{4V}{N_o}$ (C) $\frac{N_o}{4V}$ (D) $4VN_o$

25. 4.0 g of argon in a bulb at a temperature of T K has a pressure P atm. When the bulb was placed in water bath at a temperature 50°C more than the first one, 0.8 g of gas had to be removed to get the original pressure. T is equal to

(A) 510 K (B) 200 K (C) 100 K (D) 73 K

26. Which of the following has the highest first ionization energy?

(A) Sulphur (B) Oxygen (C) Nitrogen (D) Phosphorus

27. Cl^- and K^+ are isoelectronic then

(A) their sizes are same

(B) Cl^- ion is relatively bigger than K^+ ion

(C) K^+ ion is bigger than Cl^- ion

(D) their sizes depend on other cation and anion

28. Which of the following is definitely true for elements A and B which occur in the same group of the periodic table and B occurs below A?

(A) Atomic number of B > atomic number of A.

(B) Atomic size of B > atomic size of A.

(C) Ionisation energy of A > ionisation energy of B.

(D) Electron affinity of A > electron affinity of B.

29. How many moles of magnesium phosphate will contain 0.25 mole of oxygen atoms?

(A) 3.125×10^{-2} (B) 1.25×10^{-2} (C) 2.5×10^{-2} (D) 0.02

30. Density of a 2.05 M solution of acetic acid in water is 1.02 g/ml. The molality of the solution is (Atomic mass: H = 1, C = 12, O = 16)

(A) 3.28 mol kg^{-1} (B) 2.28 mol kg^{-1} (C) 0.44 mol kg^{-1} (D) 1.14 mol kg^{-1}

31. A photon of 19.6 eV energy strikes a H-atom (in its ground state). Find de-Broglie wavelength of electron ejected from H-atom (in Å).

(A) 1 (B) 3 (C) 5 (D) 7

32. What is the volume of water in ml of 3.011×10^{23} molecule of water ? (d = 1g/ml)

(A) 3 (B) 6 (C) 9 (D) 12

33. A V dm^3 flask contains gas A and another flask of 2V dm^3 contains gas B at the same temperature. If density of gas A is 3.0 g dm^{-3} and that of gas B is 1.5 g dm^{-3} and mol. wt. of A = 1/2 mol. wt. of B, then what will be the ratio of partial pressure of gas A to that of gas B ?

(A) 1 (B) 2 (C) 3 (D) 4

34. If 4 g of oxygen diffuse through a very narrow hole, how much hydrogen (in gm) will diffuse under identical conditions?

(A) 1 (B) 2 (C) 3 (D) 4

PART – II

(Paragraph Type)

This part contains **6 multiple choice questions** relating to three paragraphs with **two questions on each paragraph**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

Paragraph for Questions 35 and 36

Molarity, molality, mole fraction are used in these days for stoichiometric calculations. It is necessary to write balanced chemical equation when calculations are done in terms of molarity.

35. 38% HCl has density equal to 1.20 g ml^{-1}. The molality and molarity respectively are –

(A) 12.4, 16.7 (B) 16.7, 12.4

(C) 12.4, 12.2 (D) 16.7, 16.7

36. 10 ml of 1M $BaCl_2$ solution, 5 ml of 0.5 M K_2SO_4 is added $BaSO_4$ is precipitated out. The amount of $BaSO_4$ ppt. will be -

(A) 0.0025 moles (B) 0.025 moles

(C) 0.00025 moles (D) 0.0050 moles

Paragraph for Questions 37 and 38

The first (IE_1) & second (IE_2) ionisation enthalpies (KJ/mole) of three elements, A, B, C are given below :

	A	B	C
$I.E_1$	403	750	1142
$I.E_2$	2640	1500	2080

In an experiment 1/12 mole of B atom in vapour phase absorb 100KJ of energy so that it forms a mixture of B^+ & B^{2+} ions.

37. Most suitable outer most configuration of element 'A' is–

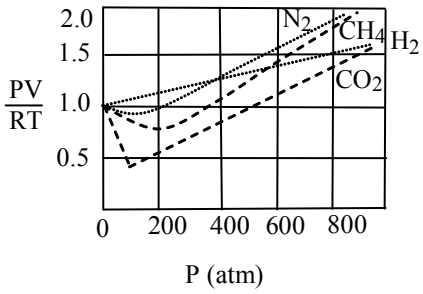
(A) ns^1 (B) ns^2 (C) ns^2np^1 (D) $ns^2.np^2$

38. Energy utilized to form B^{+2} from B^+ in experiment is –

(A) 1500 KJ (B) 750 KJ (C) 62.5 KJ (D) 37.5 KJ

Paragraph for Questions 39 and 40

The graph represents Z versus P for 1 mole of several gases at 300 K.



39. The deviation of CO_2 from ideal behaviour at 100 atm is best explained by-

(A) Intermolecular attractions (B) Molecular volume

(C) Molecular shape (D) Temperature

40. The greatest contributing factor for all gases to deviate from ideal behaviour at extremely high pressure is

(A) Intermolecular attractions (B) Molecular volume

(C) Molecular shape (D) Temperature

SECTION-C : MATHEMATICS

PART – I

(Single Correct Answer Type)

This part contains **14 multiple choice questions**. Each question has four choices (A), (B), (C) and (D), out of which **ONLY ONE is correct**.

41. In a triangle ABC, if A is (1, 2) and equations of the medians through B and C are x + y = 5 and x = 4 respectively, then B must be the point

(A) (1, 4) (B) (7, –2) (C) (4, 1) (D) (–2, 7)

42. The value of $\sin\left(\frac{\pi}{4}-A\right)\cos\left(\frac{\pi}{4}+B\right)+\cos\left(\frac{\pi}{4}-A\right)\sin\left(\frac{\pi}{4}+B\right)$ is

(A) sin (A – B) (B) sin (B – A) (C) cos (A – B) (D) $\frac{1}{2}$

43. In any G.P. the first term is 2 and last term is 512 and common ratio is 2, then 5^{th} term from end is-

(A) 16 (B) 32 (C) 64 (D) None of these

44. In a certain A.P., 5 times the 5th term is equal to 8 times the 8th term, then the 13th term is equal to

(A) – 13 (B) – 12 (C) – 1 (D) None of these

45. If $\tan\theta = a \neq 0$, $\tan 2\theta = b \neq 0$ and $\tan\theta + \tan 2\theta = \tan 3\theta$ then

(A) a = b (B) ab = 1 (C) a + b = 0 (D) b = 2a

46. Solve $\left||x-2|-1\right| \geq 3$

(A) $(-\infty,-2]\cup[6,\infty)$ (B) $(-\infty, 2)\cup(6,\infty)$

(C) $(-\infty, 2)\cup[6,\infty)$ (D) none of these

47. The solution set of the inequation $\frac{x-1}{x-2} > 2$, is

(A) (2, 3) (B) [2, 3]

(C) $(-\infty, 2) \cup (3, \infty)$ (D) None of these

48. If $\log_3 y = x$ and $\log_2 z = x$, then 72^x is equal to

(A) yz^3 (B) y^2z^3 (C) y^3z^2 (D) y^3z^3

49. If $A = \{x / x \in I, x^2 < 150\}$ and $B = \{x / x \in N, x^3 < 1500\}$ then $|n(B) - n(A)|$ is

(A) 13 (B) 1 (C) 12 (D) 14

50. The equation of a straight line having equal intercepts and passing through (3, 5) is

(A) $x + y - 2 = 0$ (B) $x - y - 4 = 0$ (C) $x + y = 8$ (D) $x + 2y - 1 = 0$

51. If $\sin\theta + \text{cosec}\theta = 2$ then $\sin^2\theta + \text{cosec}^2\theta$ is

(A) 1 (B) 2 (C) 3 (D) 4

52. The number of integer lies between the solution set of $\log_{\frac{1}{2}}(x^2 - 5x + 7) > 0$ is

(A) 0 (B) 1 (C) 2 (D) 3

53. If P(1, 2), Q(4, 6), R(5, 7) and S(a, b) are consecutive vertices of a parallelogram PQRS, then a + b is

(A) 1 (B) 3 (C) 5 (D) 7

54. If $\frac{a^n + b^n}{a^{n-1} + b^{n-1}}$ is the HM between a and b then n is

(A) 0 (B) 1 (C) 2 (D) 3

PART – II

(Paragraph Type)

This part contains **6 multiple choice questions** relating to three paragraphs with **two questions on each paragraph**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

Paragraph for Questions 55 and 56

A triangle is formed by the lines y = x, y + x = 2, y – 2x = 4. The orthocentre H of triangle is joined with two points P and Q on the circumcircle of the triangle so that area of triangle HPQ is maximum.

55. The area of triangle HPQ is

(A) 37π sq.units (B) $\frac{37\sqrt{3}}{4}$ sq. units (C) $\frac{\sqrt{3}}{4}$ sq. units (D) none of these

56. In radius of triangle HPQ is

(A) $\sqrt{37}$ (B) $\frac{\sqrt{37}}{2}$ (C) $2\sqrt{37}$ (D) $\frac{5\sqrt{5}}{6}$

Paragraph for Questions 57 and 58

Four different integers form an increasing A.P. One of these numbers is equal to the sum of the squares of the other three numbers. Then

57. The smallest number is :

(A) – 2 (B) 0 (C) – 1 (D) 2

58. The common difference of the four numbers is

(A) 2 (B) 1 (C) 3 (D) 4

Paragraph for Questions 59 and 60

Consider the following relations: $x\cos\theta + y\sin\theta = x\cos\phi + y\sin\phi = 2a$, and $2\sin\frac{\theta}{2}\sin\frac{\phi}{2} = 1$.

59. The value of $\cos\theta + \cos\phi$ will be

(A) $\frac{4ax}{x^2 - y^2}$ (B) $-\frac{4ax}{x^2 + y^2}$ (C) $\frac{4ax}{x^2 + y^2}$ (D) $-\frac{4ax}{(x^2 - y^2)}$

60. The relation between x and y after eliminating both θ and ϕ will be

(A) $y^2 = 4a(a - x)$ (B) $y^2 = 4a(a + x)$

(C) $x^2 = 4a(a - y)$ (D) $x^2 = 4a(a + y)$

MENTORS EDUSERV

SCHOLASTIC APTITUDE TEST [ME-SAT]
SAMPLE TEST PAPER

[For Students going to Class 12 in 2021]

[STREAM: ENGINEERING]

Time : 2 hours **Maximum Marks: 180**

SECTION-A : PHYSICS

1.	(C)	2.	(C)	3.	(B)	4.	(D)	5.	(C)
6.	(C)	7.	(B)	8.	(B)	9.	(C)	10.	(C)
11.	(C)	12.	(D)	13.	(A)	14.	(B)	15.	(A)
16.	(C)	17.	(C)	18.	(B)	19.	(C)	20.	(D)

SECTION-B : CHEMISTRY

21.	(D)	22.	(C)	23.	(D)	24.	(D)	25.	(B)
26.	(C)	27.	(B)	28.	(A)	29.	(A)	30.	(B)
31.	(C)	32.	(C)	33.	(D)	34.	(A)	35.	(B)
36.	(A)	37.	(A)	38.	(D)	39.	(A)	40.	(B)

SECTION-C : MATHEMATICS

41.	(B)	42.	(C)	43.	(B)	44.	(D)	45.	(C)
46.	(A)	47.	(A)	48.	(B)	49.	(D)	50.	(C)
51.	(B)	52.	(A)	53.	(C)	54.	(A)	55.	(D)
56.	(D)	57.	(C)	58.	(B)	59.	(C)	60.	(A)