Q1. A particle moving in a straight line covers half the distance with speed 6 m/s. The other half is covered in two equal time intervals with speeds 9 m/s and 15 m/s respectively. The average speed of the particle during the motion is : ***09 Apr 2024 (M)***

(1) 10 m/s (2) 8 m/s

(3) 9.2 m/s (4) 8.8 m/s

Q2. Two cars are travelling towards each other at speed of 20 m s^{-1} each. When the cars are 300 m apart, both the drivers apply brakes and the cars retard at the rate of 2 m s^{-2}. The distance between them when they come to rest is : ***09 Apr 2024 (E)***

(1) 200 m (2) 100 m

(3) 50 m (4) 25 m

Q3. A clock has 75 cm, 60 cm long second hand and minute hand respectively. In 30 minutes duration the tip of second hand will travel x distance more than the tip of minute hand. The value of x in meter is nearly (Take $\pi = 3.14$) : ***08 Apr 2024 (M)***

(1) 140.5 (2) 118.9

(3) 139.4 (4) 220.0

Q4. A train starting from rest first accelerates uniformly up to a speed of 80 km/h for time t, then it moves with a constant speed for time $3t$. The average speed of the train for this duration of journey will be (in km/h) : ***06 Apr 2024 (M)***

(1) 40 (2) 80

(3) 30 (4) 70

Q5. A particle moves in a straight line so that its displacement x at any time t is given by $x^2 = 1 + t^2$. Its acceleration at any time t is x^{-n} where n = _____ ***06 Apr 2024 (E)***

Q6. A body projected vertically upwards with a certain speed from the top of a tower reaches the ground in t_1. If it is projected vertically downwards from the same point with the same speed, it reaches the ground in t_2. Time required to reach the ground, if it is dropped from the top of the tower, is : ***06 Apr 2024 (E)***

(1) $\sqrt{t_1 t_2}$ (2) $\sqrt{t_1 + t_2}$

(3) $\sqrt{t_1 - t_2}$ (4) $\sqrt{\frac{t_1}{t_2}}$

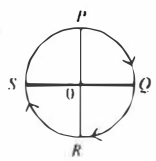
Q7. A body moves on a frictionless plane starting from rest. If S_n is distance moved between $t = n - 1$ and t = n and S_{n-1} is distance moved between t = n − 2 and t = n − 1, then the ratio $\frac{S_{n-1}}{S_n}$ is $\left(1 - \frac{2}{x}\right)$ for n = 10. The value of x is _____. ***05 Apr 2024 (M)***

Q8. A body travels 102.5 m in n^{th} second and 115.0 m in $(n + 2)^{th}$ second. The acceleration is : ***04 Apr 2024 (M)***

(1) 6.25 m/s^2 (2) 12.5 m/s^2

(3) 9 m/s^2 (4) 5 m/s^2

Q9. A cyclist starts from the point P of a circular ground of radius 2 km and travels along its circumference to the point S. The displacement of a cyclist is:



04 Apr 2024 (E)

(1) $\sqrt{8}$ km
(2) 8 km
(3) 6 km
(4) 4 km

Q10. A bus moving along a straight highway with speed of 72 km/h is brought to halt within $4s$ after applying the brakes. The distance travelled by the bus during this time (Assume the retardation is uniform) is _____m.

04 Apr 2024 (E)

Q11. A particle is moving in one dimension (along x axis) under the action of a variable force. It's initial position was 16 m right of origin. The variation of its position (x) with time (t) is given as $x = -3t^3 + 18t^2 + 16t$, where x is in m and t is in s. The velocity of the particle when its acceleration becomes zero is _____ m s^{-1}.

01 Feb 2024 (M)

Q12. A particle initially at rest starts moving from reference point $x = 0$ along x-axis, with velocity v that varies as $v = 4\sqrt{x}\ \text{m s}^{-1}$. The acceleration of the particle is _____ m s^{-2}. ***01 Feb 2024 (E)***

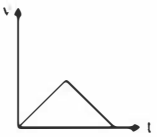
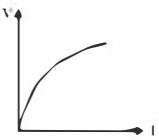
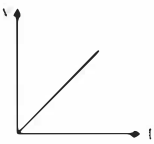
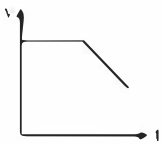
Q13. Train A is moving along two parallel rail tracks towards north with 72 km h^{-1} and train B is moving towards south with speed 108 km h^{-1}. Velocity of train B with respect to A and velocity of ground with respect to B are (in m s^{-1}): ***01 Feb 2024 (E)***

(1) -30 and 50
(2) -50 and -30
(3) -50 and 30
(4) 50 and -30

Q14. The relation between time 't' and distance 'x' is $t = \alpha x^2 + \beta x$, where α and β are constants. The relation between acceleration (a) and velocity (v) is: ***31 Jan 2024 (M)***

(1) $a = -2\alpha v^3$
(2) $a = -5\alpha v^5$
(3) $a = -3\alpha v^2$
(4) $a = -4\alpha v^4$

Q15. A small steel ball is dropped into a long cylinder containing glycerine. Which one of the following is the correct representation of the velocity time graph for the transit of the ball? ***31 Jan 2024 (M)***

(1) 
(2) 
(3) 
(4) 

Q16. The displacement and the increase in the velocity of a moving particle in the time interval of t to $(t + 1)$ s are 125 m and 50 m s^{-1}, respectively. The distance travelled by the particle in $(t + 2)^{\text{th}}$ s is _____ m.

30 Jan 2024 (M)

Q17. A particle is moving in a straight line. The variation of position x as a function of time t is given as $x = \left(t^3 - 6t^2 + 20t + 15\right)$ m. The velocity of the body when its acceleration becomes zero is:

29 Jan 2024 (E)

(1) $4\ \text{m s}^{-1}$ (2) $8\ \text{m s}^{-1}$

(3) $10\ \text{m s}^{-1}$ (4) $6\ \text{m s}^{-1}$

Q18. A body starts moving from rest with constant acceleration covers displacement S_1 in first $(p-1)$ seconds and S_2 in first p seconds. The displacement $S_1 + S_2$ will be made in time : ***29 Jan 2024 (M)***

(1) $(2p+1)$ s (2) $\sqrt{(2p^2-2p+1)}$ s

(3) $(2p-1)$ s (4) $\left(2p^2-2p+1\right)$ s

Q19. A body falling under gravity covers two points A and B separated by 80 m in 2 s. The distance of upper point A from the starting point is _____m. Use $\left(g = 10\ \text{m s}^{-2}\right)$

27 Jan 2024 (E)

Q20. Position of an ant (S in metres) moving in $Y-Z$ plane is given by $S = 2t^2\hat{j} + 5\hat{k}$ (where t is in second). The magnitude and direction of velocity of the ant at $t = 1$ s will be :

27 Jan 2024 (M)

(1) $16\ \text{m s}^{-1}$ in y-direction (2) $4\ \text{m s}^{-1}$ in x-direction

(3) $9\ \text{m s}^{-1}$ in z-direction (4) $4\ \text{m s}^{-1}$ in y-direction

Q21. A particle starts from origin at $t = 0$ with a velocity $5\hat{i}\ \text{m s}^{-1}$ and moves in $x-y$ plane under action of a force which produces a constant acceleration of $\left(3\hat{i}+2\hat{j}\right)\ \text{m s}^{-2}$. If the x-coordinate of the particle at that instant is 84 m, then the speed of the particle at this time is $\sqrt{\alpha}\ \text{m s}^{-1}$. The value of α is _____. ***27 Jan 2024 (M)***

Q22. A bullet is fired into a fixed target looses one third of its velocity after travelling 4 cm. It penetrates further $D \times 10^{-3}$ m before coming to rest. The value of D is : ***27 Jan 2024 (E)***

(1) 32 (2) 5

(3) 3 (4) 4

Q23. The position of a particle related to time is given by $x = \left(5t^2 - 4t + 5\right)$ m. The magnitude of velocity of the particle at $t = 2$ s will be : ***15 Apr 2023 (M)***

(1) $06\ \text{m s}^{-1}$ (2) $14\ \text{m s}^{-1}$

(3) $10\ \text{m s}^{-1}$ (4) $16\ \text{m s}^{-1}$

Q24. The distance travelled by an object in time t is given by $s = (2.5)t^2$. The instantaneous speed of the object at $t = 5$ s will be : ***13 Apr 2023 (E)***

(1) $25\ \text{m s}^{-1}$ (2) $5\ \text{m s}^{-1}$

(3) $62.5\ \text{m s}^{-1}$ (4) $12.5\ \text{m s}^{-1}$

Q25. Two trains A and B of length l and $4l$ are travelling into a tunnel of length L in parallel tracks from opposite directions with velocities 108 km h^{-1} and 72 km h^{-1}, respectively. If train A take 35 s less time than train B to cross the tunnel then, length L of tunnel is: (Given $L = 60\ l$)

13 Apr 2023 (M)

(1) 1200 m (2) 900 m

(3) 1800 m (4) 2700 m

Q26. A passenger sitting in a train A moving at 90 km h^{-1} observes another train B moving in the opposite direction for 8 s. If the velocity of the train B is 54 km h^{-1}, then length of train B is: ***13 Apr 2023 (E)***

(1) 120 m (2) 320 m

(3) 80 m (4) 200 m

Q27. A ball is thrown vertically upward with an initial velocity of 150 m s^{-1}. The ratio of velocity after 3 s and 5 s is $\frac{x+1}{x}$. The value of x is _____. {take, $g = 10$ m s^{-2}} ***12 Apr 2023 (M)***

(1) 10 (2) -5

(3) 6 (4) 5

Q28. Given below are two statements:

Statement I : A truck and a car moving with same kinetic energy are brought to rest by applying breaks which provide equal retarding forces. Both come to rest in equal distance.

Statement II : A car moving towards east takes a turn and moves towards north, the speed remains unchanged. The acceleration of the car is zero.

In the light of given statements, choose the most appropriate answer from the options given below

12 Apr 2023 (M)

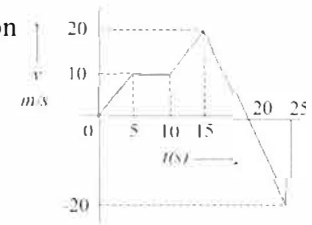
(1) Statement I is correct but statement II is incorrect

(2) Statement I is incorrect but statement II is correct

(3) Both statement I and Statement II are correct

(4) Both statement I and statement II are incorrect

Q29. Form the $v - t$ graph shown, the ratio of distance to displacement in 25 s of motion is:



11 Apr 2023 (M)

(1) 1 (2) $\frac{1}{2}$

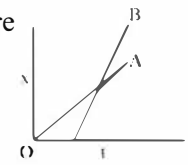
(3) $\frac{5}{3}$ (4) $\frac{3}{5}$

Q30. A person travels x distance with velocity v_1 and then x distance with velocity v_2 in the same direction. The average velocity of the person is v, then the relation between v, v_1 and v_2 will be ***10 Apr 2023 (E)***

(1) $v = \frac{v_1+v_2}{2}$ (2) $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

(3) $v = v_1 + v_2$ (4) $\frac{2}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

Q31. The position-time graphs for two students A and B returning from the school to their homes are shown in figure.



(A) A lives closer to the school (B) B lives closer to the school

(C) A takes lesser time to reach home (D) A travels faster than B

(E) B travels faster than A

Choose the correct answer from the options given below

10 Apr 2023 (M)

(1) (A), (C) and (D) only
(2) (A), (C) and (E) only
(3) (B) and (E) only
(4) (A) and (E) only

Q32. Given below are two statements:

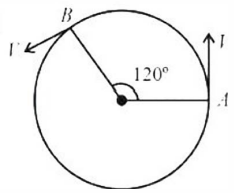
Statement I: Area under velocity-time graph gives the distance travelled by the body in a given time.

Statement II: Area under acceleration-time graph is equal to the change in velocity in the given time.

In the light of given statements, choose the correct answer from the options given below. ***08 Apr 2023 (E)***

(1) Both Statement I and Statement II are true
(2) Both Statement **I** and Statement II are false
(3) Statement I is correct but Statement II is false
(4) Statement I is incorrect but Statement II is true

Q33. As shown in the figure, a particle is moving with constant speed π m s^{-1}. Considering its motion from A to B, the magnitude of the average velocity is:



06 Apr 2023 (E)

(1) $\sqrt{3}$ m s^{-1}
(2) π m s^{-1}
(3) $1.5\sqrt{3}$ m s^{-1}
(4) $2\sqrt{3}$ m s^{-1}

Q34. A particle starts with an initial velocity of 10.0 ms^{-1} along x-direction and accelerates uniformly at the rate of 2.0 m s^{-2}. The time taken by the particle to reach the velocity of 60.0 m s^{-1} is _____.

06 Apr 2023 (E)

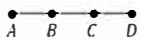
(1) 25 s
(2) 3 s
(3) 6 s
(4) 30 s

Q35. A particle of mass 10 g moves in a straight line with retardation $2x$, where x is the displacement in SI units. Its loss of kinetic energy for above displacement is $\left(\frac{10}{x}\right)^{-n}$J. The value of n will be _____.

06 Apr 2023 (M)

Q36. For a train engine moving with speed of 20 ms^{-1}, the driver must apply brakes at a distance of 500 m before the station for the train to come to rest at the station. If the brakes were applied at half of this distance, the train engine would cross the station with speed $\sqrt{x}$ ms^{-1}. The value of x is _____. (Assuming same retardation is produced by brakes) ***01 Feb 2023 (E)***

Q37. An object moves with speed v_1, v_2 and v_3 along a line segment AB, BC and CD respectively as shown in figure. Where $AB = BC$ and $AD = 3AB$, then average speed of the object will be :



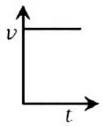
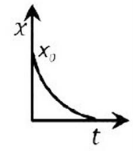
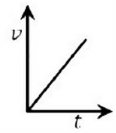
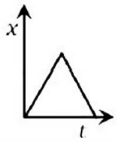
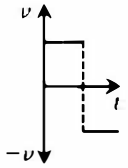
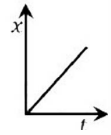
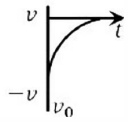
01 Feb 2023 (M)

(1) $\frac{(v_1+v_2+v_3)}{3}$
(2) $\frac{(v_1v_2v_3)}{3(v_1v_2+v_2v_3+v_3v_1)}$
(3) $\frac{3v_1v_2v_3}{v_1v_2+v_2v_3+v_3v_1}$
(4) $\frac{(v_1+v_2+v_3)}{3v_1v_2v_3}$

Q38. A vehicle travels 4 km with speed of 3 km h^{-1} and another 4 km with speed of 5 km h^{-1}, then its average speed is : ***30 Jan 2023 (E)***

(1) 4.25 km h^{-1}
(2) 3.50 km h^{-1}
(3) 4.00 km h^{-1}
(4) 3.75 km h^{-1}

Q39. Match Column-I with Column-II :

Column-I (x-t graphs)		**Column-II (v-t graphs)**	
A		I	
B		II	
C		III	
D		IV	

Choose the correct answer from the options given below:

30 Jan 2023 (M)

(1) A- II B-IV, C-III, D-I
(2) A- I. B-II, C-III, D-IV
(3) A- II B-III, C-IV, D-I
(4) A- I, B-III. C-IV, D-II

Q40. A horse rider covers half the distance with 5 m s^{-1} speed. The remaining part of the distance was travelled with speed 10 m s^{-1} for half the time and with speed 15 m s^{-1} for other half of the time. The mean speed of the rider averaged over the whole time of motion is $\frac{x}{7}$ m s^{-1}. The value of x is _____. ***30 Jan 2023 (M)***

Q41. A tennis ball is dropped on to the floor from a height of 9.8 m. It rebounds to a height 5.0 m. Ball comes in contact with the floor for 0.2 s. Thc average acceleration during contact is _____ m s^{-2}. [Given $g = 10$ m s^{-2}]

29 Jan 2023 (M)

Q42. A car travels a distance of x with speed v_1 and then same distance x with speed v_2 in the same direction. The average speed of the car is: ***25 Jan 2023 (M)***

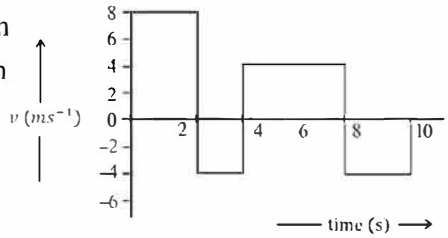
(1) $\frac{v_1 v_2}{2(v_1+v_2)}$
(2) $\frac{v_1+v_2}{2}$
(3) $\frac{2x}{v_1+v_2}$
(4) $\frac{2v_1v_2}{v_1+v_2}$

Q43. The distance travelled by a particle is related to time t as $x = 4t^2$. The velocity of the particle at $t = 5$ s is

25 Jan 2023 (E)

(1) 40 m s^{-1}
(2) 25 m s^{-1}
(3) 20 m s^{-1}
(4) 8 m s^{-1}

Q44. The velocity-time graph of a body moving in a straight line is shown in figure. The ratio of displacement and distance travelled by the body in time 0 to 10 s is



24 Jan 2023 (E)

(1) 1 : 1
(2) 1 : 2
(3) 1 : 3
(4) 1 : 4

Q45. If $t = \sqrt{x} + 4$, then $\left(\frac{dx}{dt}\right)_{t=4}$ is: ***29 Jul 2022 (M)***

(1) 4
(2) Zero
(3) 8
(4) 16

Q46. A ball is thrown up vertically with a certain velocity so that, it reaches a maximum height h. Find the ratio of the times in which it is at height $\frac{h}{3}$ while going up and coming down respectively. ***29 Jul 2022 (M)***

(1) $\frac{\sqrt{2}-1}{\sqrt{2}+1}$
(2) $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$
(3) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$
(4) $\frac{1}{3}$

Q47. A juggler throws balls vertically upwards with same initial velocity in air. When the first ball reaches its highest position, he throws the next ball. Assuming the juggler throws n balls per second, the maximum height the balls can reach is ***29 Jul 2022 (E)***

(1) $\frac{g}{2n}$
(2) $\frac{g}{n}$
(3) $2gn$
(4) $\frac{g}{2n^2}$

Q48. A ball is released from a height h. If t_1 and t_2 be the time required to complete first half and second half of the distance respectively. Then, choose the correct relation between t_1 and t_2. ***29 Jul 2022 (E)***

(1) $t_1 = \left(\sqrt{2}\right)t_2$
(2) $t_1 = \left(\sqrt{2}-1\right)t_2$
(3) $t_2 = \left(\sqrt{2}+1\right)t_1$
(4) $t_2 = \left(\sqrt{2}-1\right)t_1$

Q49. A NCC parade is going at a uniform speed of 9 km h^{-1} under a mango tree on which a monkey is sitting at a height of 19.6 m. At any particular instant, the monkey drops a mango. A cadet will receive the mango whose distance from the tree at time of drop is :
(Given $g = 9.8\ m\ s^{-2}$) ***28 Jul 2022 (M)***

(1) 5 m
(2) 10 m
(3) 19.8 m
(4) 24.5 m

Q50. A ball is thrown vertically upwards with a velocity of 19.6 m s^{-1} from the top of a tower. The ball strikes the ground after 6 s. The height from the ground up to which the ball can rise will be $\left(\frac{k}{5}\right)$ m. The value of k is _____ (use $g = 9.8\ m\ s^{-2}$) ***28 Jul 2022 (E)***

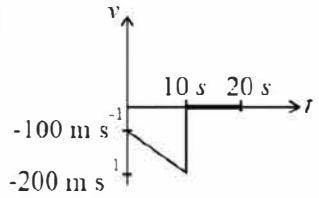
Q51. The velocity of the bullet becomes one third after it penetrates 4 cm in a wooden block. Assuming that bullet is facing a constant resistance during its motion in the block. The bullet stops completely after travelling at $(4 + x)$ cm inside the block. The value of x is ***27 Jul 2022 (E)***

(1) 2.0 (2) 1.0

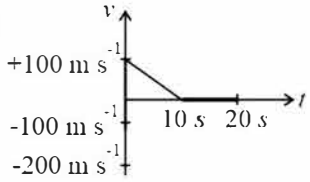
(3) 0.5 (4) 1.5

Q52. A bullet is shot vertically downwards with an initial velocity of 100 m s^{-1} from a certain height. Within 10 s, the bullet reaches the ground and instantaneously comes to rest due to the perfectly inelastic collision. The velocity-time curve for total time t = 20 s will be : (Take $g = 10$ m s^{-2}) ***27 Jul 2022 (M)***

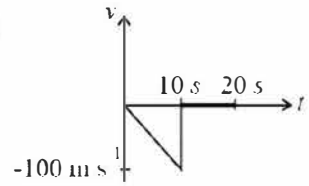
(1)



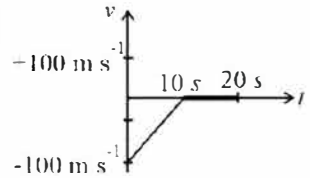
(2)



(3)



(4)



Q53. A car is moving with speed of 150 km h^{-1} and after applying the brake it will move 27 m before it stops. If the same car is moving with a speed of one third the reported speed then it will stop after travelling _____ m distance. ***25 Jul 2022 (M)***

Q54. A particle is moving in a straight line such that its velocity is increasing at 5 m s^{-1} per meter. The acceleration of the particle is _____ m s^{-2} at a point where its velocity is 20 m s^{-1}. ***25 Jul 2022 (E)***

Q55. A small toy starts moving from the position of rest under a constant acceleration. If it travels a distance of 10 m in t s, the distance travelled by the toy in the next t s will be: ***29 Jun 2022 (E)***

(1) 10 m (2) 20 m

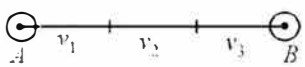
(3) 30 m (4) 40 m

Q56. Two balls A and B are placed at the top of 180 m tall tower. Ball A is released from the top at $t = 0$ s. Ball B is thrown vertically down with an initial velocity u at $t = 2$ s. After a certain time, both balls meet 100 m above the ground. Find the value of u in m s^{-1}. [use $g = 10$ m s^{-2}] ***29 Jun 2022 (M)***

(1) 10 (2) 15

(3) 20 (4) 30

Q57. A car covers AB distance with first one-third at velocity v_1 m s^{-1}, second one-third at v_2 m s^{-1} and last one-third at v_3 m s^{-1}. If $v_3 = 3v_1, v_2 = 2v_1$ and $v_1 = 11$ m s^{-1}, then the average velocity of the car is _____ m s^{-1}.



28 Jun 2022 (E)

Q58. Velocity (v) and acceleration (a) in two systems of units 1 and 2 are related as $v_2 = \frac{n}{m^2}v_1$ and $a_2 = \frac{a_1}{mn}$ respectively. Here m and n are constants. The relations for distance and time in two systems respectively are

28 Jun 2022 (E)

(1) $\frac{n^3}{m^3} L_1 = L_2$ and $\frac{n^2}{m} T_1 = T_2$
(2) $L_1 = \frac{n^4}{m^2} L_2$ and $T_1 = \frac{n^2}{m} T_2$
(3) $L_1 = \frac{n^2}{m} L_2$ and $T_1 = \frac{n^4}{m^2} T_2$
(4) $\frac{n^2}{m} L_1 = L_2$ and $\frac{n^4}{m^2} T_1 = T_2$

Q59. When a ball is dropped into a lake from a height 4.9 m above the water level, it hits the water with a velocity v and then sinks to the bottom with the constant velocity v. It reaches the bottom of the lake 4.0 s after it is dropped. The approximate depth of the lake is ***27 Jun 2022 (E)***

(1) 39.2 m
(2) 19.6 m
(3) 73.5 m
(4) 29.4 m

Q60. A ball of mass 0.5 kg is dropped from the height of 10 m. The height, at which the magnitude of velocity becomes equal to the magnitude of acceleration due to gravity, is _____ m. [Use $g = 10\ \text{m s}^{-2}$]
26 Jun 2022 (M)

Q61. An object is thrown vertically upwards. At its maximum height, which of the following quantity becomes zero ? ***26 Jun 2022 (M)***

(1) Momentum
(2) Potential energy
(3) Acceleration
(4) Force

Q62. A person is standing in an elevator. In which situation, he experiences weight loss ? ***26 Jun 2022 (M)***

(1) When the elevator moves upward with constant acceleration
(2) When the elevator moves downward with constant acceleration
(3) When the elevator moves upward with uniform velocity
(4) When the elevator moves downward with uniform velocity

Q63. A ball is projected vertically upward with an initial velocity of $50\ \text{m s}^{-1}$ at $t = 0$ s. At $t = 2$ s, another ball is projected vertically upward with same velocity. At $t =$____s, second ball will meet the first ball $\left(\text{g} = 10\ \text{m s}^{-2}\right)$. ***26 Jun 2022 (E)***

Q64. Two buses P and Q start from a point at the same time and move in a straight line and their positions are represented by $x_P(t) = \alpha t + \beta t^2$ and $x_Q(t) = ft - t^2$. At what time, both the buses have same velocity ?
25 Jun 2022 (E)

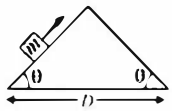
(1) $\frac{\alpha - f}{1+\beta}$
(2) $\frac{\alpha + f}{2(\beta - 1)}$
(3) $\frac{\alpha + f}{2(1+\beta)}$
(4) $\frac{f - \alpha}{2(1+\beta)}$

Q65. From the top of a tower, a ball is thrown vertically upward which reaches the ground in 6 s. A second ball thrown vertically downward from the same position with the same speed reaches the ground in 1.5 s. A third ball released, from the rest from the same location, will reach the ground in _____ s. ***24 Jun 2022 (M)***

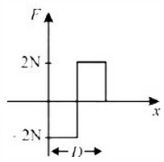
Q66. An object of mass 5 kg is thrown vertically upwards from the ground. The air resistance produces a constant retarding force of 10 N throughout the motion. The ratio of time of ascent to the time of descent will be equal to : [Use $g = 10\ \text{m s}^{-2}$]. ***24 Jun 2022 (E)***

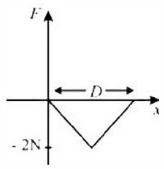
(1) $1 : 1$
(2) $\sqrt{2} : \sqrt{3}$
(3) $\sqrt{3} : \sqrt{2}$
(4) $2 : 3$

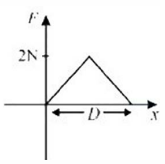
Q67. An object of mass m is being moved with a constant velocity under the action of an applied force of 2 N along a frictionless surface with following surface profile. The correct applied force vs distance graph will be :

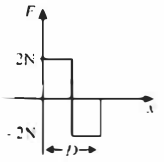


01 Sep 2021 (E)

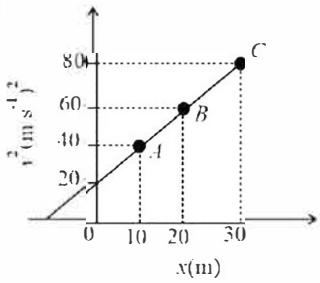
(1) 

(2) 

(3) 

(4) 

Q68. A particle is moving with constant acceleration a. Following graph shows v^2 versus x (displacement) plot. The acceleration of the particle is _____ m s^{-2}.



31 Aug 2021 (E)

Q69. If the velocity of a body related to displacement x is given by $v = \sqrt{5000 + 24x}$ m s^{-1}, then the acceleration of the body is _____ m s^{-2}.

27 Aug 2021 (M)

Q70. Water drops are falling from a nozzle of a shower onto the floor from a height of 9.8 m. The drops fall at a regular interval of time. When the first drop strikes the floor, at that instant, the third drop begins to fall. Locate the position of second drop from the floor when the first drop strikes the floor.

27 Aug 2021 (E)

(1) 2.94 m (2) 4.18 m

(3) 2.45 m (4) 7.35 m

Q71. Two spherical balls having equal masses with radius of 5 cm each are thrown upwards along the same vertical direction at an interval of 3 s with the same initial velocity of 35 m s^{-1}, then these balls collide at a height of _____m, (take g = 10 m s^{-2})

26 Aug 2021 (M)

Q72. A particle of mass M originally at rest is subjected to a force whose direction is constant but magnitude varies with time according to the relation $F = F_0\left[1 - \left(\frac{t-T}{T}\right)^2\right]$ where F_0 and T are constants. The force acts only for the time interval 2 T. The velocity v of the particle after time 2 T is:

27 Jul 2021 (E)

(1) $\frac{2F_0T}{M}$ (2) $\frac{F_0T}{2M}$

(3) $\frac{4F_0T}{3M}$ (4) $\frac{F_0T}{3M}$

Q73. A ball is thrown up with a certain velocity so that it reaches a height h. Find the ratio of the two different times of the ball reaching $\frac{h}{3}$ in both the directions.

27 Jul 2021 (M)

(1) $\frac{\sqrt{2}-1}{\sqrt{2}+1}$ (2) $\frac{1}{3}$

(3) $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$ (4) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$

Q74. The relation between time t and distance x for a moving body is given as $t = mx^2 + nx$, where m and n are constants. The retardation of the motion is: (When v stands for velocity) ***25 Jul 2021 (E)***

(1) $2mv^3$ (2) $2mnv^3$

(3) $2nv^3$ (4) $2n^2v^3$

Q75. The instantaneous velocity of a particle moving in a straight line is given as $v = \alpha t + \beta t^2$, where α and β are constants. The distance travelled by the particle between 1 s and 2 s is: ***25 Jul 2021 (E)***

(1) $3\alpha + 7\beta$ (2) $\frac{3}{2}\alpha + \frac{7}{3}\beta$

(3) $\frac{\alpha}{2} + \frac{\beta}{3}$ (4) $\frac{3}{2}\alpha + \frac{7}{2}\beta$

Q76. Water droplets are coming from an open tap at a particular rate. The spacing between a droplet observed at 4^{th} second after its fall to the next droplet is 34. 3 m. At what rate the droplets are coming from the tap ? (Take $g = 9.8\ \text{m s}^{-2}$) ***25 Jul 2021 (M)***

(1) 3 drops/2 seconds (2) 2 drops/second

(3) 1 drop/second (4) 1 drop/7 seconds

Q77. A balloon was moving upwards with a uniform velocity of $10\ \text{m s}^{-1}$. An object of finite mass is dropped from the balloon when it was at a height of 75 m from the ground level. The height of the balloon from the ground when object strikes the ground was around: (takes the value of g as $10\ \text{m s}^{-2}$) ***25 Jul 2021 (E)***

(1) 300 m (2) 200 m

(3) 125 m (4) 250 m

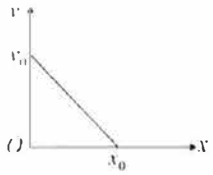
Q78. A body at rest is moved along a horizontal straight line by a machine delivering a constant power. The distance moved by the body in time t is proportional to:

20 Jul 2021 (E)

(1) $t^{\frac{3}{2}}$ (2) $t^{\frac{1}{2}}$

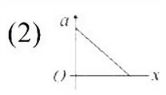
(3) $t^{\frac{1}{4}}$ (4) $t^{\frac{3}{4}}$

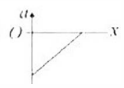
Q79. The velocity-displacement graph of a particle is shown in the figure. The acceleration-displacement graph of the same particle is represented by :

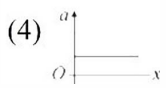


18 Mar 2021 (E)

(1) 

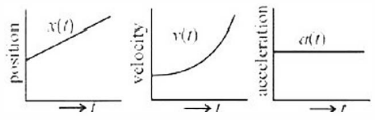
(2) 

(3) 

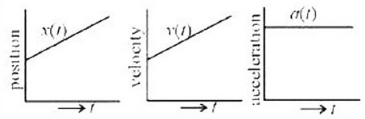
(4) 

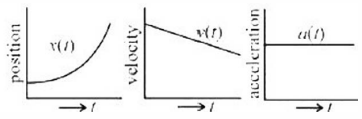
Q80. The position, velocity and acceleration of a particle moving with a constant acceleration can be represented by :

18 Mar 2021 (M)

(1) 

(2) 

(3) 

(4) 

Q81. The velocity of a particle is $v = \left(v_0 + gt + Ft^2\right)$ m s^{-1}. Its position is $x = 0$ at $t = 0$; then its displacement after time $(t = 1$ s$)$ is : ***17 Mar 2021 (E)***

(1) $v_0 + g + F$

(2) $v_0 + \frac{g}{2} + \frac{F}{3}$

(3) $v_0 + \frac{g}{2} + F$

(4) $v_0 + 2\text{g} + 3\text{F}$

Q82. A car accelerates from rest at a constant rate α for some time after which it decelerates at a constant rate β to come to rest. If the total time elapsed is t seconds, the total distance travelled is: ***17 Mar 2021 (M)***

(1) $\frac{4\alpha\beta}{(\alpha+\beta)}\text{t}^2$

(2) $\frac{2\alpha\beta}{(\alpha+\beta)}t^2$

(3) $\frac{\alpha\beta}{2(\alpha+\beta)}\text{t}^2$

(4) $\frac{\alpha\beta}{4(\alpha+\beta)}\text{t}^2$

Q83. A mosquito is moving with a velocity $\vec{v} = 0.5t^2\hat{\text{i}} + 3t\hat{\text{j}} + 9\hat{\text{k}}$ m s^{-1} and accelerating in uniform conditions. What will be the direction of mosquitoes after 2 s ?

16 Mar 2021 (E)

(1) $\tan^{-1}\left(\frac{2}{3}\right)$ from x-axis

(2) $\tan^{-1}\left(\frac{\sqrt{85}}{6}\right)$ from y-axis

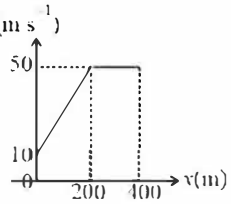
(3) $\tan^{-1}\left(\frac{5}{2}\right)$ from y-axis

(4) $\tan^{-1}\left(\frac{5}{2}\right)$ from x-axis

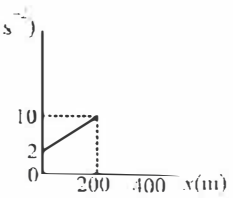
Q84. A body of mass 2 kg moves under a force of $\left(2\hat{\text{i}} + 3\hat{\text{j}} + 5\hat{\text{k}}\right)$ N It starts from rest and was at the origin initially. After 4 s, its new coordinates are $(8, b, 20)$. The value of b is _____.
(Round off to the Nearest Integer)

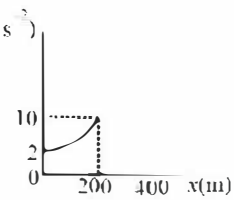
16 Mar 2021 (E)

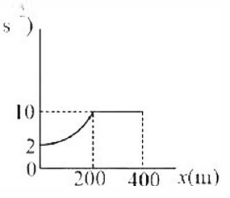
Q85. The velocity-displacement graph describing the motion of a bicycle is shown in the figure. The acceleration-displacement graph of the bicycle's motion is best described by :

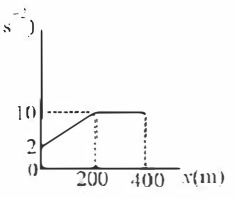


16 Mar 2021 (M)

(1) 

(2) 

(3) 

(4) 

Q86. A boy pushes a box of mass 2 kg with a force $\vec{F} = \left(20\hat{i} + 10\hat{j}\right)$ N on a frictionless surface. If the box was initially at rest, then _____ m is displacement along the x-axis after 10 s ***26 Feb 2021 (M)***

Q87. A scooter accelerates from rest for time t_1 at constant rate a_1 and then retards at constant rate a_2 for time t_2 and comes to rest. The correct value of $\frac{t_1}{t_2}$ will be : ***26 Feb 2021 (E)***

(1) $\frac{a_2}{a_1}$ (2) $\frac{a_1}{a_2}$

(3) $\frac{a_1+a_2}{a_1}$ (4) $\frac{a_1+a_2}{a_2}$

Q88. An engine of a train, moving with uniform acceleration, passes the signal-post with velocity u and the last compartment with velocity v. The velocity with which middle point of the train passes the signal post is : ***25 Feb 2021 (M)***

(1) $\frac{u+v}{2}$ (2) $\sqrt{\frac{v^2+u^2}{2}}$

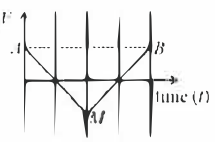
(3) $\frac{v-u}{2}$ (4) $\sqrt{\frac{v^2-u^2}{2}}$

Q89. A stone is dropped from the top of a building. When it crosses a point 5 m below the top, another stone starts to fall from a point 25 m below the top. Both stones reach the bottom of building simultaneously. The height of the building is : ***25 Feb 2021 (E)***

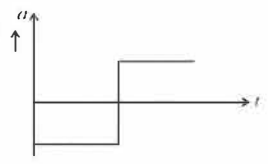
(1) 25 m (2) 45 m

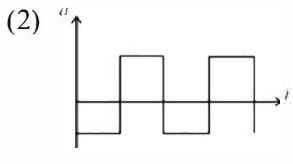
(3) 35 m (4) 50 m

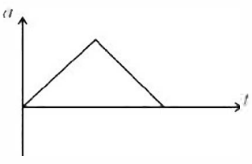
Q90. If the velocity-time graph has the shape AMB, what would be the shape of the corresponding acceleration-time graph?

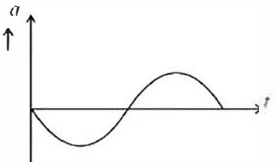


24 Feb 2021 (M)

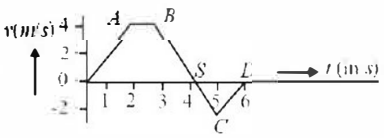
(1) 

(2) 

(3) 

(4) 

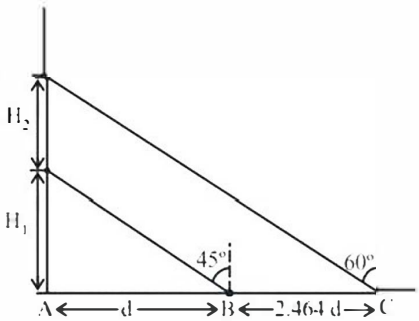
Q91. The velocity (v) and time (t) graph of a body in a straight line motion is shown in the figure. The point S is at 4.333 seconds. The total distance covered by the body in 6 s is :



05 Sep 2020 (E)

(1) $\frac{37}{3}$m
(2) 12m
(3) 11m
(4) $\frac{49}{4}$m

Q92. A balloon is moving up in air vertically above a point A on the ground. When it is a height h_1, a girl standing at a distance d (point B) from A (see figure) sees it at an angle 45° with respect to the vertical. When the balloon climbs up a further height h_2, it is seen at an angle 60° with respect to the vertical if the girl moves further by a distance 2.464 d (point C). Then the height h_2 is (given $\tan 30^\circ = 0.5774$):



05 Sep 2020 (M)

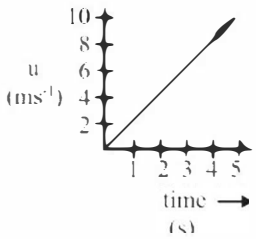
(1) 1.464 d
(2) 0.732 d
(3) 0 .464 d
(4) d

Q93. A helicopter rises from rest on the ground vertically upwards with a constant acceleration g. A food packet is dropped from the helicopter when it is at a height h. The time taken by the packet to reach the ground is close to [g is the acceleration due to gravity]:

05 Sep 2020 (M)

(1) $t = \frac{2}{3}\sqrt{\left(\frac{h}{g}\right)}$
(2) $t = 1.8\sqrt{\left(\frac{h}{g}\right)}$
(3) $t = 3.4\sqrt{\left(\frac{h}{g}\right)}$
(4) $t = \sqrt{\frac{2h}{3g}}$

Q94. The speed verses time graph for a particle is shown in the figure. The distance travelled (in m) by the particle during the time interval t = 0 to t = 5 s will be _____



04 Sep 2020 (E)

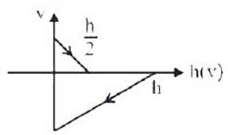
Q95. Starting from the origin at time t = 0, with initial velocity $5\,\hat{j}$ ms^{-1}, a particle moves in the x-y plane with a constant acceleration of $\left(10\hat{i} + 4\hat{j}\right) ms^{-2}$. At time t, its coordinates are (20 m, y_0 m). The values of t and y_0 are, respectively:

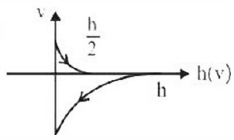
04 Sep 2020 (M)

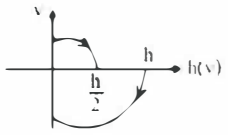
(1) 2 s and 18 m
(2) 4 s and 52 m
(3) 2 s and 24 m
(4) 5 s and 25 m

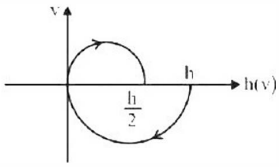
Q96. A tennis ball is released from a height h and after freely falling on a wooden floor it rebounds and reaches height h/2. The velocity versus height of the ball during its motion may be represented graphically by: (graphs are drawn schematically and on not to scale)

04 Sep 2020 (M)

(1) 

(2) 

(3) 

(4) 

Q97. A small ball of mass m is thrown upward with velocity u from the ground. The ball experiences a resistive force mkv^2 where v is it speed. The maximum height attained by the ball is : ***04 Sep 2020 (E)***

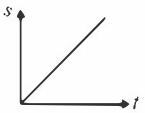
(1) $\frac{1}{2k}\tan^{-1}\frac{ku^2}{g}$

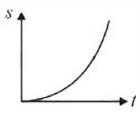
(2) $\frac{1}{k}\ln\left(1+\frac{ku^2}{2g}\right)$

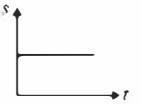
(3) $\frac{1}{k}\tan^{-1}\frac{ku^2}{2g}$

(4) $\frac{1}{2k}\ln\left(1+\frac{ku^2}{g}\right)$

Q98. A particle is moving unidirectional on a horizontal plane under the action of a constant power supplying energy source. The displacement (s) – time (t) graph that describes the motion of the particle is (graphs are drawn schematically and are not to scale): ***03 Sep 2020 (E)***

(1) 

(2) 

(3) 

(4) 

Q99. Train A and train B are running on parallel tracks in the opposite directions with speed of 36 km hour^{-1} and 72 km hour^{-1}, respectively. A person is walking in train A in the direction opposite to its motion with a speed of 1.8 km hour^{-1}. Speed $\left(\text{in m s}^{-1}\right)$ of this person as observed from train B will be close to: (take the distance between the tracks as negligible) ***02 Sep 2020 (M)***

(1) 29.5 m s^{-1}

(2) 28.5 m s^{-1}

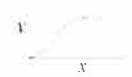
(3) 31.5 m s^{-1}

(4) 30.5 m s^{-1}

Q100. The distance x covered by a paritcle in one dimensional motion varies with time t as $x^2 = at^2 + 2bt + c$. If the acceleration of the particle depends on x as x^{-n}, where n is an integer, the value of n is _____

09 Jan 2020 (M)

Q101. A particle of mass m and charge q is released from rest in a uniform electric field. If there is no other force on the particle, the dependence of its speed v on the distance x travelled by it is correctly given by (graphs are schematic and not drawn to scale) ***08 Jan 2020 (E)***

(1) 

(2) 

(3) 

(4) 

Q102. A particle is moving along the x -axis with its coordinate with time t given by $x(t) = 10 + 8t - 3t^2$. Another particle is moving along the y -axis with its coordinate as a function of time given by $y(t) = 5 - 8t^3$. At $t = 1$ s, the speed of the second particle as measured in the frame of the first particle is given as $\sqrt{v}$. Then $v\left(\text{in m s}^{-1}\right)$ is _____. ***08 Jan 2020 (M)***

Q103. A ball is dropped from the top of a 100 m high tower on a planet. In the last $\frac{1}{2}$ s before hitting the ground, it covers a distance of 19 m. Acceleration due to gravity (in m s^{-2}) near the surface on that planet is_____ ***08 Jan 2020 (E)***

Q104. An elevator in a building can carry a maximum of 10 persons, with the average mass of each person being 68 kg . The mass of the elevator itself is 920 kg and it moves with a constant speed of 3 m/s . The frictional force opposing the motion is 6000 N . If the elevator is moving up with its full capacity, the power delivered by the motor to the elevator $\left(g = 10 m/s^2\right)$ must be at least: ***07 Jan 2020 (E)***

(1) 56300W (2) 62360W

(3) 48000W (4) 66000W

Q105. A particle is moving with speed $v = b\sqrt{x}$ along positive $x-$ axis. Calculate the speed of the particle at time $t = \tau$ (assume that the particle is at origin at $t = 0$) ***12 Apr 2019 (E)***

(1) $b^2\tau$ (2) $\frac{b^2\tau}{\sqrt{2}}$

(3) $\frac{b^2\tau}{2}$ (4) $\frac{b^2\tau}{4}$

Q106. A bullet of mass 20 g has an initial speed of 1 m s^{-1}, just before it starts penetrating a mud wall of thickness 20 cm. If the wall offers a mean resistance of 2.5×10^{-2} N, the speed of the bullet after emerging from the other side of the wall is close to: ***10 Apr 2019 (E)***

(1) 0.7 m s^{-1} (2) 0.3 m s^{-1}

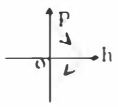
(3) 0.1 m s^{-1} (4) 0.4 m s^{-1}

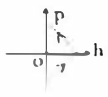
Q107. The position vector of a particle changes with time according to the relation $\vec{r}(t) = 15t^2\hat{i} + \left(4 - 20t^2\right)\hat{j}$. What is the magnitude of the acceleration at $t = 1$? ***09 Apr 2019 (E)***

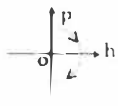
(1) 40 (2) 25

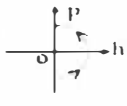
(3) 100 (4) 50

Q108. A ball is thrown vertically up (taken as $+z -$ axis) from the ground. The correct momentum-height (p – h) diagram is: ***09 Apr 2019 (M)***

(1) 

(2) 

(3) 

(4) 

Q109. The position of a particle as a function of time t, is given by $x(t) = at + bt^2 - ct^3$ where a, b and c are constants. When the particles zero acceleration, then its velocity will be: ***09 Apr 2019 (E)***

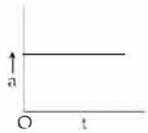
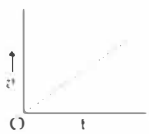
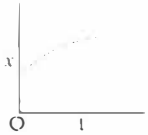
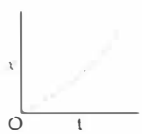
(1) $a + \frac{b^2}{3c}$ (2) $a + \frac{b^2}{2c}$

(3) $a + \frac{b^2}{c}$ (4) $a + \frac{b^2}{4c}$

Q110. A particle starts from origin O from rest and moves with a uniform acceleration along the positive $x-$ axis. Identify all figures that correctly represent the motion qualitatively.

(a = acceleration, v = velocity, x = dispalcement, t = time)

08 Apr 2019 (E)

(A)  (B)  (C)  (D) 

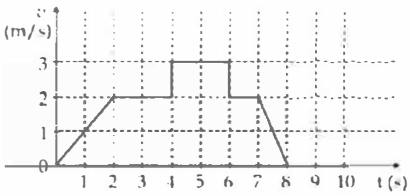
(1) (A), (B), (D)

(2) (A), (B), (C)

(3) (B), (C)

(4) (A)

Q111. A particle starts from the origin at time $t = 0$ and moves along the positive x-axis. The graph of velocity with respect to time is shown in figure. What is the position of the particle at time $t = 5s$?



10 Jan 2019 (E)

(1) 10 m

(2) 9 m

(3) 6m

(4) 3m

Q112. The position co-ordinates of a particle moving in a $3D$ coordinate system is given by $x = a\cos\omega t$, $y = a\sin\omega t$ and $z = a\omega t$. The speed of the particle is:

09 Jan 2019 (E)

(1) $\sqrt{2}\,a\omega$

(2) $a\omega$

(3) $2a\omega$

(4) $\sqrt{3}\,a\omega$

ANSWER KEYS

1. (2)	**2.** (2)	**3.** (3)	**4.** (4)	**5.** (3)	**6.** (1)	**7.** (19)	**8.** (1)
9. (1)	**10.** (40)	**11.** (52)	**12.** (8)	**13.** (3)	**14.** (1)	**15.** (2)	**16.** (175)
17. (2)	**18.** (2)	**19.** (45)	**20.** (4)	**21.** (673)	**22.** (1)	**23.** (4)	**24.** (1)
25. (3)	**26.** (2)	**27.** (4)	**28.** (1)	**29.** (3)	**30.** (4)	**31.** (4)	**32.** (4)
33. (3)	**34.** (1)	**35.** (2)	**36.** (200)	**37.** (3)	**38.** (4)	**39.** (1)	**40.** (50)
41. (120)	**42.** (4)	**43.** (1)	**44.** (3)	**45.** (2)	**46.** (2)	**47.** (4)	**48.** (4)
49. (1)	**50.** (392)	**51.** (3)	**52.** (1)	**53.** (3)	**54.** (100)	**55.** (3)	**56.** (4)
57. (18)	**58.** (1)	**59.** (4)	**60.** (5)	**61.** (1)	**62.** (2)	**63.** (6)	**64.** (4)
65. (3)	**66.** (2)	**67.** (4)	**68.** (1)	**69.** (12)	**70.** (4)	**71.** (50)	**72.** (3)
73. (3)	**74.** (1)	**75.** (2)	**76.** (3)	**77.** (3)	**78.** (1)	**79.** (3)	**80.** (2)
81. (2)	**82.** (3)	**83.** (2)	**84.** (12)	**85.** (1)	**86.** (500)	**87.** (1)	**88.** (2)
89. (2)	**90.** (1)	**91.** (1)	**92.** (4)	**93.** (3)	**94.** (20)	**95.** (1)	**96.** (3)
97. (4)	**98.** (2)	**99.** (1)	**100.** (3)	**101.** (2)	**102.** (580)	**103.** (8)	**104.** (4)
105. (3)	**106.** (1)	**107.** (4)	**108.** (3)	**109.** (1)	**110.** (1)	**111.** (2)	**112.** (1)