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Knowledge is Discipline
BJNP
Learning with the Speed of Mumbai and the Tradition of Kota

Max. Marks: 200 **Date: 28.11.2022**

JB 1 MR BATCH
PHYSICS : PART TEST (SET B)
Topic: Circular Motion

1. Two identical cars A and B are moving at 36 km/h. A goes on a bridge, convex upward and B on concave upward. The radius of curvature of the bridge is 20 m. The ratio of normal forces exerted on the cars when they are at the middle of bridges is ($g = 10\ m/s^2$)

   (a) 1 : 3 (b) 1 : 2 (c) 2 : 3 (d) 1 : 5

2. A particle suspended by a thread of length l is projected horizontally with a velocity $\sqrt{3gl}$ at the lowest point. The height from the bottom at which the tension in the string becomes zero is

   (a) $\frac{4l}{3}$ (b) $\frac{2l}{3}$ (c) $\frac{5l}{3}$ (d) $\frac{l}{3}$

3. A body is revolving in a vertical circle with constant mechanical energy. the speed of the body at the highest point is $\sqrt{2rg}$. The speed of the body at the lowest point is

   (a) $\sqrt{7gr}$ (b) $\sqrt{6gr}$ (c) $\sqrt{8gr}$ (d) $\sqrt{9gr}$

4. A water bucket of mass ‘m’ is revolved in a verticle circle with the help of a rope of length ‘r’. If the velocity of the bucket at the lowest point is $\sqrt{7gr}$. Then the velocity and tension in the rope at the highest point are

   (a) $\sqrt{3gr}$, 2mg (b) $\sqrt{2gr}$, mg (c) $\sqrt{gr}$, mg (d) Zero, Zero

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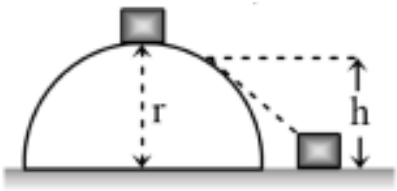
Space for Rough Work

5. A small body of mass m sides down from the top of a hemisphere of radius r. The surface of the block and hemisphere are frictionless. The height at which the body losses contact with the surface of the sphere is

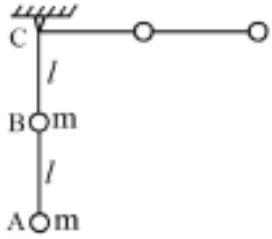


(a) $\sqrt{gr}\ \frac{3}{2}r$ (b) $\frac{2}{3}r$ (c) $\frac{1}{2}gt^2$ (d) $\frac{v^2}{2g}$

6. A person wants to drive on the vertical surface of a large cylindrical wooden 'well' commonly known as 'death well' in a circus. The radius of the well is 2 m, and the coefficient of friction between the tyres of the motorcycle and the wall of the well is 0.2. The minimum speed the motorcyclist must have in order to prevent slipping should be

(a) 10 m/s (b) 15 m/s (c) 20 m/s (d) 25 m/s

7. A weightless rod of length 2I carries two equal masses 'm', one tied at lower end A and the other at the middle of the rod at B. The rod can rotate in a vertical plane about a fixed horizontal axis passing through C. The road is released from rest in a horizontal position. The speed of the mass B at the instant rod become vertical is



(a) $\sqrt{\frac{3gl}{5}}$ (b) $\sqrt{\frac{4gl}{5}}$ (c) $\sqrt{\frac{6gl}{5}}$ (d) $\sqrt{\frac{7gl}{5}}$

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8. A pendulum consists of a wooden bob of mass 'm' and length '*l*'. A bullet of mass m_1 is fired towards the pendulum with speed v_1. The bullet emerges out of the bob with a speed $v_1/3$ and the bob just completes motion along a vertical circle. Find 'v_1'.

(a) $\left(\frac{m}{m_1}\right)\sqrt{5gl}$ (b) $\frac{3}{2}\left(\frac{m}{m_1}\right)\sqrt{5gl}$ (c) $\frac{2}{3}\left(\frac{m_1}{m}\right)\sqrt{5gl}$ (d) $\left(\frac{m_1}{m}\right)\sqrt{gl}$

9. A car turns a corner on a slippery road at constant speed of 12 m/s. If the coefficient of friction is 0.4, the minimum radius of the arc is in metres in which the car turns is

(a) 72 (b) 36 (c) 18 (d) 9

10. A car of mass 1000 kg negotiates a banked curved of radius 90 m on a frictionless road. If the banking angle is 45°, the speed of the car is:

(a) 10 ms^{-1} (b) 20 ms^{-1} (c) 30 ms^{-1} (d) 5 ms^{-1}

11. A car turns a corner on a slippery road at a constant speed of 10 m/s. If the coefficient of friction is 0.5, the minimum radius of the arc in metre in which the car turns is (Giving g = 10 m/s^2)

(a) 20 (b) 10 (c) 5 (d) 4

12. Assuming the coefficient of friction between the road and tyres of a car to be 0.5, the maximum speed with which the car can move round a curve of 40.0 m radius without slipping, if the road is unbanked, should be

(a) 25 m/s (b) 19 m/s (c) 14 m/s (d) 11 m/s

13. A wooden block is placed inside a rotating cylindrical shell of radius 4 m, if the coefficient of friction between shell and block is 0.2, then what should be the angular velocity of the cylinder so that wooden block does not fall? (g = 9.8 m/s^2)

(a) 3.5 rad/s (b) 4.5 rad/s (c) 3.0 rad/s (d) 4.0 rad/s

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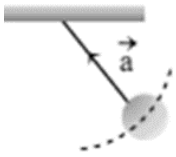
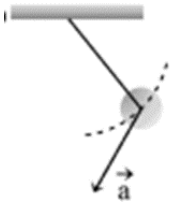
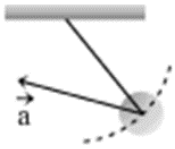
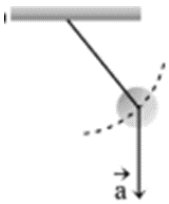
14. A simple pendulum is oscillating without damping. When the displacement of the bob is less than maximum, its acceleration vector $\vec{a}$ is correctly shown in

(a) 

(b) 

(c) 

(d) 

15. Two point size bodies of the same mass are knotted to a horizontal string one at the end, and the other at the midpoint of it. The string is rotated in a horizontal plane with the other end as the center. If T is tension in the string between cetnre of circles and first body then the tension in the string between the two bodies is

(a) $\frac{T}{2}$ (b) $2T$ (c) $\frac{2T}{3}$ (d) $\frac{3T}{2}$

16. A train is moving towards north. At one place it turns towards north-east, here we observe that

(a) The radius of curvature of outer rail will be greater than that of the inner rail

(b) The radius of the inner rail will be greater than that of the outer rail

(c) The radius of curvature of one of the rails will be greater

(d) The radius of curvature of the outer and inner rails will be the same

17. The angular speed of a fly wheel making 120 revolutions/minute is

(a) 2π rad/s (b) $4\pi^2$ rad/s (c) π rad/s (d) 4π rad/s

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18. Certain neutron stars are believed to be rotating at rev/sec. If such a star has a radius of 20 km, the acceleration of an object on the equator of the star will be:

(a) 20×10^8 m/sec^2 (b) 8×10^5 m/sec^2 (c) 120×10^5 m/sec^2 (d) 4×10^8 m/sec^2

19. If a_r and a_t represent radial and tangential accelerations, the motion of a particle will be uniformly circular if:

(a) $a_r = 0$ and $a_t = 0$ (b) $a_r = 0$ but $a_t \neq 0$ (c) $a_r \neq 0$ but $a_t = 0$ (d) $a_r \neq 0$ and $a_t \neq 0$

20. A stone of mass 0.5 kg is attached to a string of length 2 m and is whirled in a horizontal circle. If the string can with stand a tension of 9N, the maximum velocity with which the stone can be whirled is

(a) 6 m/s (b) 8 m/s (c) 4 m/s (d) 12 m/s

21. A particle moves from rest at 'A' on the surface of a smooth circular of radius 'r' as shown. At B it leaves the cylinder. The equation relating α and β is

(a) $3 \sin \alpha = 2 \cos \beta$ (b) $2 \sin \alpha = 3 \cos \beta$

(c) $3 \sin \beta = 2 \cos \alpha$ (d) $2 \sin \beta = 3 \cos \alpha$

22. A stone tied to a string of length L is whirled in a vertical circle with the other end of the string at the centre. At a certain instant of time, the stone is at its lowest position and has a speed u. The magnitude of the change in its velocity as it reaches a position where the string is horizontal is

(a) $\sqrt{u^2 - 2gL}$ (b) $\sqrt{2gL}$ (c) $\sqrt{u^2 - gL}$ (d) $\sqrt{2(u^2 - gL)}$

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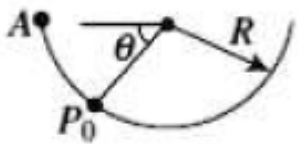
23. The figure shows a smooth vertical circular track AB of radius R. A block slides R. A block slides along the surface AB when it is given a velocity equal to $\sqrt{6gR}$ art point A. The ratio of the force exerted by the track on the block at point A to that at point B is

(a) 0.25 (b) 0.35 (c) 0.45 (d) 0.55

24. A 2 kg stone is swinging in a vertical circle by attaching it at the end of a string of length 2 m. If the string can withstand a tension of 140.6 N, the maximum speed with which the stone can be roated is

(a) 22 ms^{-1} (b) 44 ms^{-1} (c) 33 ms^{-1} (d) 11 ms^{-1}

25. A bead of mass m is released from rest at A to move along the fixed smooth circular track as shown in figure. The ratio of magnitudes of centripetal force and normal reaction by the track on the bead at any point P_0 described by the angle $\theta(\neq 0)$ would



(a) Increase with θ (b) Decrease with θ

(c) Remain constant (d) First increase with θ and then decrease

Space for Rough Work

Date: 28.11.2022

JB 1 MR BATCH
CHEMISTRY : PART TEST (SET B)
Topic: Chemical Bonding + Mole Concept + Periodic Properties

26. The statement that is not correct for periodic classification of elements is
    (a) The properties of elements are the periodic functions of their atomic numbers.
    (b) Non-metallic elements are less in number than metallic elements.
    (c) The first ionization energies of elements along a period do not vary in a regular manner with an increase in atomic number.
    (d) For transition elements the ionization energies increase gradually with increase in atomic number.

27. The screening effect of d-electron is
    (a) Equal to p-electron (b) Much more than p-electrons
    (c) Same as f-electron (d) Less than p-electrons

28. The correct order of increasing radii are
    (a) $Be^{2+}, Mg^{2+}, Na^{\oplus}$ (b) $K^{\oplus}, Ca^{2+}, S^{2-}$ (c) $O^{2-}, F^{\ominus}, N^{3-}$ (d) S^{2-}, O^{2-}, As^{3-}

29. 5 mL of N-HCl, 20 mL of N/2 H_2SO_4 and 30 mL of N/3 HNO_3 are mixed together and the volume is made to 1 L. The normality of the resulting solution is
    (a) N/5 (b) N/10 (c) N/20 (d) N/40

30. The Ew of H_3PO_4 in the reaction is
    $Ca(OH)_2 + H_3PO_4 \rightarrow CaHPO_4 + 2H_2O$
    (Ca = 40, P = 31, O = 16)
    (a) 49 (b) 98 (c) 32.66 (d) 147

31. 10 mL of 1 M $BaCl_2$ solution and 5 mL 0.5 M K_2SO_4 are mixed together to precipitate out $BaSO_4$. The amount of $BaSO_4$ precipitated will be
    (a) 0.005 mol (b) 0.00025 mol (c) 0.025 mol (d) 0.0025 mol

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Space for Rough Work

For Problems 32-34

If 20 mL M/10 Ba $(MnO_4)_2$ completely reacts with FeC_2O_4 in acidic medium.

32. mEq of FeC_2O_4 reacted is

(a) 6 (b) 20 (c) 40 (d) None

33. Millimoles of FeC_2O_4 reacted is

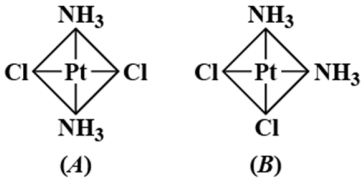
(a) $\frac{20}{3}$ (b) $\frac{20}{2}$ (c) $\frac{20}{6}$ (d) $\frac{20}{10}$

34. What is the volume of CO_2 produced at STP?

(a) 112 mL (b) 224 mL (c) 448 mL (d) None

For Problems 35-39

The platinum-chlorine distance has been found to be 2.32 Å in several crystalline compounds. This value appkies to both compounds A and B given here.



Based on the above structures, answer the following questions.

35. Cl–Cl distance in structure (A) is

(a) 2.32 Å (b) 4.64 Å (c) 1.16 Å (d) 9.28 Å

36. Cl–Cl distance in structure (B) is

(a) 2.32 Å (b) 1.52 Å (c) 2.15 Å (d) 3.28 Å

37. Structure A is

(a) cis-isomer (b) trans-isomer (c) chiral isomer (d) none of these

38. Structure B is

(a) cis-isomer (b) nuclear isomer (c) chiral isomer (d) co-ordinate isomer

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39. The C–C single bond distance is 1.54 Å. What is the distance between the terminal carbons in propane? Assume that the four bonds of any carbon atoms are pointed towards the corners of a regular tetrahedron.

(a) 3.08 Å (b) 1.54 Å (c) 2.52 Å (d) 1.26 Å

40. Select the correct statement(s).

(a) NF_3 is weaker base than NH_3. (b) $NO^{\oplus}$ is more stable than O_2.

(c) $AlCl_3$ has higher melting point than AlF_3. (d) $SbCl_3$ is more covalent than $SbCl_5$.

41. Which of the following are true?

(a) SH_6 and $BiCl_5$ do not exist. (b) There are two $p\pi$-$d\pi$ bonds in SO_3.

(c) SeF_4 and CH_4 are tetrahedral ion. (d) $I_3^{\ominus}$ is a linear molecule with sp^3d hybridisation

42. White vitriol is not isomorphous with

(a) K_2SO_4 (b) $MgSO_4$ (c) $CaSO_4$ (d) H_2SO_4

43. The nitrogen oxide(s) containing N–N bond is/are

(a) N_2O (b) N_2O_3 (c) N_2O_4 (d) N_2O_5

44. Hydrogen bonding plays a central role in the following phenomena:

(a) Ice floats in water

(b) Higher Lewis basicity of primary than tertiary amines in aqueous solutions

(c) Formic acid is more acidic that acetic acid

(d) Dimerisation of acetic acid in benzene

45. The compound(s) with two lone pairs of electrons on the central atom is(are)

(a) BrF_5 (b) ClF_3 (c) XeF_4 (d) SF_4

46. According to molecular orbital theory

(a) C_2^{2-} is expected to be diamagnetic

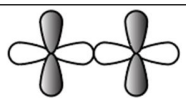
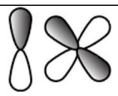
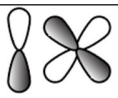
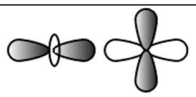
(b) O_2^{2+} is expected to have a long bond length that O_2

(c) N_2^+ and N_2^- have the same bond order

(d) He_2^+ has the same energy as two isolated He atoms

Space for Rough Work

47. Match the orbital overlap figure shown in List I with the description given in List II and select the correct answer using the code given below the lists.

	Column I		Column II
P.		1.	p-d π-anti-bonding
Q.		2.	d-d σ-bonding
R.		3.	p-d π-bonding
S.		4.	d-d σ-anti-bonding

	P	Q	R	S		P	Q	R	S
(a)	2	1	3	4	(b)	4	3	1	2
(c)	2	3	1	4	(d)	4	1	3	2

48. Based on VSEPR theory, the number of 90° F – Br – F angles is a molecules of BrF_5 is _____.

49. Among the triatomic molecules/ions, $BeCl_2, N_3^{\ominus}, N_2O, NO_2^{\oplus}, O_3, SCl_2, ICl_2^{\ominus}, I_3^{\ominus}$ and XeF_2, the total number of linear molecule(s)/ion(s) where the hybridization of the central atom does not have contribution from the d-orbital(s) is

[Atomic number: S = 16, Cl = 17, I = 53 and Xe = 54]

50. Among $H_2, He_2^{\oplus}, Li_2, Be_2, B_2, C_2, N_2^{\ominus}$ and F_2 the number of diamagnetic species is

(Atomic numbers: H = 1, He = 2, Li = 3, Be = 4, B = 5, C = 6, N = 7, O = 8, F = 9)

Space for Rough Work

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JB 1 MR BATCH
PHYSICS : PART TEST (SET B) ANSWER KEY
Topic: Circular Motion

1.	(a)	2.	(a)	3.	(b)	4.	(a)	5.	(b)
6.	(a)	7.	(c)	8.	(b)	9.	(b)	10.	(c)
11.	(a)	12.	(c)	13.	(a)	14.	(c)	15.	(c)
16.	(a)	17.	(d)	18.	(b)	19.	(c)	20.	(a)
21.	(c)	22.	(d)	23.	(d)	24.	(d)	25.	(c)

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JB 1 MR BATCH
CHEMISTRY : PART TEST (SET B) ANSWER KEY
Topic: Chemical Bonding + Mole Concept + Periodic Properties

26.	(d)	27.	(d)	28.	(a)	29.	(d)	30.	(a)
31.	(d)	32.	(b)	33.	(s)	34.	(b)	35.	(b)
36.	(d)	37.	(b)	38.	(a)	39.	(d)	40.	(a, b)
41.	(a, b, d)	42.	(a, b, c, d)	43.	(a, b, c)	44.	(a, b, d)	45.	(b, c)
46.	(a, c)	47.	(c)	48.	(8)	49.	(4)	50.	(6)