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January 2020 maths paper 2 solutions

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We suggest you go through the article once, it will help you to understand your performance and with the help of this article, you will be able to understand that which concept is important, Type of exam questions, etc. Chemistry Mathematics Physics Q1. The number of sp² hybridized carbon atoms in aspartame. Solution The aspartame structure is given below: The number of sp² hybridised carbon atoms in aspartame is 9. Q2. Find the bond order and magnetic nature of CN⁻. Solution The bond order of CN⁻ is 3 and all the electrons are paired in this ion, thus it is diamagnetic in nature. Q3. Which one of the two elements among the following pairs (F, Cl), (S, Se) and (Li, Na) will release more energy on gaining of an electron? Solution From the given pairs, the more energy on gaining of an electron will be released by the following elements: Cl, S, and Li Q4. 3 grams of acetic acid is mixed in 250 mL of 0.1 M HCl. This mixture is now diluted to 500 mL. 20 mL of this solution is now taken in another container and 1/2 mL of 5M NaOH is added to this. Find the pH of this solution. (log 3 = 0.4771, pK_a = 4.74) Solution m mole of acetic acid in 20 mL = 2 m mole of HCl in 20 mL = 1 m mole of NaOH = 2.5 ² 3/2 0 0 0.5 0 3/2 pH = 4.74 + log 3 pH = 4.74 + 0.48 = 5.22 Thus, the correct answer is 5.22 Q5. The standard enthalpy of formation(in kJ/mol) of ethane, it the enthalpies of combustion of ethane, dihydrogen, and C(graphite) are -1560kJ/mol, -286kJ/mol and -393.5kJ/mol respectively is: Solution The reactions we have:(i)(ii)(iii) Multiply eq(ii) by 2 and eq(iii) by 3. Now, Hof = 2 x eq(ii) + 3eq(iii) - 1 Thus, the equaton is given as: Q6. Select the correct options : (1) A = CMPS, B = CAverage, C = CRMS, (2) A = CAverage, B = CMPS, C = CRMS (3) A = CRMS, B = CAverage, C = CMPS, (4) A = CAverage, B = CMPS, C = CRMS Solution CRMS > CAverage > CMPS. Option 1 is correct. Q7. Solution Option 3 is correct. Q8. A and B are in the given reaction ? Solution Option 1 is correct. Q9. Amongs the following which is a redox reaction? Solution Option 1 is correct. Q10. Solution Option 1 is correct. Q11. There are two beakers (I) having a pure volatile solvent and (II) having a volatile solvent and non-volatile solute. If both beakers are placed together in a closed container then: (1) Volume of solvent beaker will decrease and solution beaker will increase (2) Volume of solvent beaker will increase and solution beaker will also increase (3) Volume of solvent beaker will decrease and solution beaker will also decrease (4) Volume of solvent beaker will increase and solution beaker will decrease Solution There will be lowering in vapour pressure in the second beaker. Option 1 is correct. Q12. Metal with low melting point containing impurities of high melting point can be purified by (1) Zone refining (2) Vapor phase refining (3) Distillation (4) Liqueation Solution Concept-based. Option 4 s correct. Q13. Which of the following statements are correct? (i) On the decomposition of H₂O₂, O₂ gas is released. (ii) 2-ethylantraquinol is used in preparation of H₂O₂ (iii) On heating KClO₃, Pb(NO₃)₂, NaNO₃, O₂ gas is released. (iv) In the preparation of sodium peroxoborate, H₂O₂ is treated with sodium metaborate. (1) I, II, IV (2) II, III, IV (3) I, II, III, IV (4) I, II, III Solution Concept based. Option 3 is correct. Q14. Which of the following reactions are possible? Solution 1. Vinyl halides (C) do not give Fridel Craft's reaction because of unstable carbocation formation. 2. Aryl halides (A) do not give Fridel Craft's reaction with Benzene because of formation of unstable phenyl carbocation. Option 2 is correct. Q15. The correct statement about gluconic acid is (1) It is prepared by oxidation of glucose with HNO₃ (2) It is obtained by partial oxidation of glucose (3) It is a dicarboxylic acid (4) It forms hemiacetal or acetal Solution Gluconic acid is obtained by partial oxidation of glucose by Tollen's reagent or Fehling solution or Br₂/H₂O. Gluconic acid can not form hemiacetal or acetal. option 2 is correct. Q16. The standard enthalpy of formation(in kJ/mol) of ethane, it the enthalpies of combustion of ethane, dihydrogen, and C(graphite) are -1560kJ/mol, -286kJ/mol and -393.5kJ/mol respectively is: Solution The reactions we have:(i)(ii)(iii) Multiply eq(ii) by 2 and eq(iii) by 3. Now, Hof = 2 x eq(ii) + 3eq(iii) - 1 Thus, the equaton is given as: Q17. Flocculation value for As₂S₃ sol by HCl is 30 mmoleL⁻¹. Calculate mass of H₂SO₄ required in gram for 250 mL sol. Solution For 1L sol 30 mmol of HCl is required. Thus, for 1L sol 15 mmol H₂SO₄ is required For 250 mL of sol: (15/4) x 10-3 mmol H₂SO₄ = 0.3675 g Thus, the correct answer is 0.37 Q18. Determine total number of atoms per unit formula of (A), (B) and (C). Solution (A) = Cr₂O₂Cl₂ (B) = Na₂Cr₂O₄ (C) = Cr₂O₅ Thus, the correct answer is 18. Q19. 0.6 g of urea on strong heating with NaOH evolves NH₃. Liberated NH₃ will combine completely with which of the following HCl solution? (1) 100 mL of 0.2 N HCl (2) 400 mL of 0.2 N HCl (3) 100 mL of 0.1 N HCl (4) 200 mL of 0.2 N HCl Solution 2 x mole of Urea = mole of NH₃(1) mole of NH₃ = mole of HCl(2) mole of HCl = 2 x mole of Urea = 2 x (0.6/60) = 0.02 mol. 100 x 0.2 x 1= 0.02 mol. from 1. So, option 1 is correct. Q20. Which of the following statements are incorrect? (A) Co+3 with strong field ligand forms a high magnetic moment complex. (B) For Co+3 if pairing energy(P) > then the complex formed will have a configuration (C) For [Co(en)3] 3+ is less than for [CoF₆] 3- (D) If = 18000 cm⁻¹ for Co+3 then with same ligands for it = 16000 cm⁻¹ (1) A, D (2) B, C (3) A, B (4) A, B, C, D Solution Concept-Based. Option 1 is correct. Q21. Stability order of following alkoxide ions is. Solution When negative charge is delocalised with electron withdrawing group like (NO₂) then stability increases. (A) Negative charge is localised (B) Negative charge is delocalised with NO₂ group (C) Negative charge is delocalised with carbon of alkene Option 1 is correct. Q22. For the complex [Ma₂b₂] if M is sp³ or dsp² hybridised respectively then total number of optical isomers are respectively : (1) 1, 1 (2) 2, 1 (3) 0, 0 (4) 1, 2 Solution Both will not show optical isomerism. Option 3 is correct. Q.1 if the sum of the first 40 terms of the series 3+4+8+9+13+14+18+19+..... Is 102m then what is the value of m Solution Q2. What is the coefficient of in the expansion of is? Solution Q3. Find the area between the curve Solution Point of intersection (-1,4),(3,36) Q4. Let A = [aij], B=[bij] are two 3 × 3 matrices such that &|B| = 81. Find |A| if = 3. Solution: Taking Common from and from Taking Common from and from Q5. Pair of tangents are drawn from origin to the circle then the square of the length of the chord of contact is? Solution Length of the tangent from the origin (0,0) is The radius of the circle Length of Chord of contact Q6. The contrapositive of if and then Solution: Contrapositive of Q7. Let y(x) is the solution of the differential equation , then find the value of x where curve cuts the x-axis Solution: Hence Q8. are two solutions of the equal to Solution: Q9. If , then a number of ordered pairs (r, k) are -(where). Solution r should be less than or equal to 35 Hence r can be 5 and 35 For =5 we get k=-2,-5 For =35 we get k=-3,3 We get 4 ordered pair Q10. Solution Q11. Let f(x) is a five-degree polynomial that has critical points and then which one is incorrect. (1) f(x) has minima at x = 1 & maxima at x = -1 (2) f(1) -4f(-1) = 4 (3) f(x) is maxima at x = 1 and minima at x = -1 (4) f(x) is odd Solution On solving f(x) is maxima at x = 1 and minima at x = -1 Q12. If are unit vectors such that and and then Solution Q13. Let if LMVT is applicable on the value of c is Solution f(x) is a polynomial function Therefore, it is continuous and differentiable in [0, 1] Here f(0) = 11, f(1) = 1 - 4 + 8 + 11 = 16 Q14. There are 5 machines. The probability of a machine being faulted is . Probability of atmost two machines is faulted, is then the value of k is Solution Required probability = when no. the machine has fault + when only one machine has fault + when only two machines have the fault. Q15. Let and are the roots of such that then which one is incorrect? Solution Q16. From any point P on line x = 2y perpendicular is drawn on y = x. Let foot of perpendicular is Q. Find the locus of midpoint of PQ. Solution Using midpoint so locus is Q17. If mean and variance of 2, 3, 16, 20, 13, 7, x, y are 10 and 25 respectively then find xy ? Solution Q18. If the system of equation x + y + z = 6, x + 2y + 3z = 10, 3x + 2y + z = has more than two solutions, then value of Solution x + y + z = 6 (1) x + 2y + 3z = 10 (2) 3x + 2y + z = ... (3) from (1) and (2) if z = 0 x + y = 6 and x + 2y = 10 y = 4, x = 2 (2, 4, 0) if y = 0 x + z = 6 and x + 3z = 10 z = 2 and x = 4 (4, 0, 2) so, 3x + 2y + z = must pass through (2, 4, 0) and (4, 0, 2) = 14 and 12 + 2 = = 1 = 13 Q19. If f(x) is defined in Find k such that f(x) is continuous Solution Q20. If is foot of perpendicular drawn from P(1, 0, 3) on a line L and if line L is passing through (, 7, 1), then value of is Solution Since PQ is perpendicular to L, therefore Q21. Then find number of elements in the smallest subset of X which contain elements of both A and B Solution Q22. If Solution Q23. a₁, a₂, a₃ a₉ are in GP where a₁ < 0, a₁ + a₂ = 4, a₃ + a₄ = 16, If then find the Solution a₁ + a₂ = 4(i) a₃ + a₄ = 16 a₁r₂ + a₁r₃ = 16(ii) Q24. Solution as z is purely real Q25. 3x + 4y = 12 is the tangent to the ellipse then the distance between foci of ellipse is Solution condition of tangency distance between foci = JEE Main 2020 exam - Physics (7th January second shift) Q1. What is the dimensional formula of , where B is the magnetic field and is permeability of free space? Solution The energy density of Electromagnetic wave= So, Q2. Moment of inertia of a cold disc as mass per unit area varies as A+Bx², given the radius of the body is 'a'- solution We take an elemental ring of mass dm at a distance x from the centre. So Area of an elemental ring= As moment of inertia for an elemental ring = Total moment of inertia= Q3. A lift can hold a maximum of 10 people, each of mass 68 kg, a mass of lift is 920 kg, friction of 6000 N is acting on it. Lift is moving with a velocity of 3 m/s. If a lift is moving upward, calculate the power supplied by the motor to the lift, it is moving with its maximum intensity. Solution The elevator moves upward hence frictional force (F) opposes their motion downward, so, net force act on elevator =mg+F Fnet=((10*68+920) x 10+6000)=22000 N using power =Fnet x speed=22000*3=66000 Watt Using 1 HP=746 Watts So power=88.47 HP Q4. If weight of an object at pole is 196 N then weight at equator is [g = 10 m/s²; radius of earth = 6400 Km] Solution Given weight = 196N, therefore mass = 19.6Kg At pole centripetal acceleration is zero, there for w=mg Due to rotation of the earth the effective weight is Q5. In a house 15 Bulbs of 45 W, 15 bulbs of 100 W, 15 bulbs of 10 W and Two heaters of 1 KW each is connected to 220 V Mains supply then find minimum fuse current Option 1)5 2)20 3)25 4)1 Solution Power =VI So current Minimum fuse current should be 20A Q6. A block of mass 10kg is suspended from a string of length 4m. When pulled by a force F along horizontal from the midpoint. The upper half of the string makes 45° with vertical. The value of F is options- 1)100N 2)90N 3)75N 4)70N Solution Equating the vertical force Equating the horizontal force Q7. Cascaded Carnot engine is an arrangement in which the heat sink of one engine is a source for other engines If the high temperature for one engine is T₁, low temperature for other engines is T₂ (Assume work done by both engine is same) Calculate the lower temperature of the first engine, options: a) b) c) 0 d) Solution Since the heat sink of one engine is a source for other So And Work done by 1st engine = work done by 2nd engine Let the lower temperature of the first engine=T And in Carnot engine So Q8. The activity of a substance changes from 700 s⁻¹ to 500 s⁻¹ in 30 minutes. Find its half-life in minutes options- a)66 b)50 c)62 d)56 Solution Activity at any time is given as For half-life so Now for from (i) and (ii) Q9. In YDSE, the separation between slits is 0.15 mm, the distance between slits and screen is 1.5 m and the wavelength of light is 589 nm, then the fringe width of solution- a)5.9 mm b)1.9 mm c)3.9 mm d)2.3 mm Solution Given d=0.15 mm D=1.5 m Fringe width The fringe width is 5.9 mm Q10. An ideal fluid is flowing in a pipe in streamline flow. A pipe has a maximum and minimum diameter of 6.4 cm and 4.8 cm respectively. Find out the ratio of minimum to maximum velocity. Solution By equation of continuity If the area is large velocity is minimum Therefor Q11. There is an electric circuit as shown in the figure. Find the potential difference between points a and b. Solution A diode is forward biased So the circuit will be as follows The potential difference between a and b is Q12. A particle of mass m and positive charge q is projected with a speed of v₀ in the y-direction in the presence of electric and magnetic fields are in the x-direction. Find the instant of time at which the speed of particle becomes double the initial speed. Options- a) b) c) d) Solution Initially As both electric and magnetic field is in the x-direction And initial velocity is perpendicular to both electric and magnetic fields. So particle will move in a helical motion and magnitude of velocity does not change in y-z plane and Speed will be increased due to electric filed only i.e in the x-direction and finally, the speed of the particle becomes double the initial speed. i.e And in x-direction So Q13. In an adiabatic process, the volume is doubled then find the ratio of final average relaxation time and initial relaxation time Solution relaxation time= and using gives Q14. Two sources of sound moving with the same speed v and emitting a frequency of 1400 Hz are moving such that one source s₁ is moving towards the observer and s₂ is moving away from an observer. If the observer hears a beat frequency of 2 Hz. Then find the speed of the source. Given Vsound >> VSource and Vsound = 350 m/s. Solution given f₀=1400Hz Now, Q15. An electron & a photon have the same energy E. Find the ratio of de Broglie wavelength of an electron to the wavelength of the photon. Given the mass of an electron is m & speed of light is c. Solution Q16. A ring is rotated about a diametric axis in a uniform magnetic field perpendicular to the plane of the ring. If initially, the plane of the ring is perpendicular to the magnetic field. Find the instant of time at which EMF will be maximum & minimum respectively. Solution We know that And Q17. The electric field in space is given by . A positively charged particle at is given velocity . The direction of force acting on a particle is: Solution Force due to electric field is in direction because at t=0, Force due to the magnetic field is in direction therefore, it is parallel to therefore the net force is antiparallel to Q18. The focal length of the convex lens in air is . Now the lens is submerged in a liquid of refractive index 1.42. Find the ratio of focal length in medium to focal length in the air:- Solution Q19. The hysteresis curve for the material is shown in the figure. Then for the material retentivity, coercivity and saturation magnetization respectively will be - saturation magnetization So, by matching with the diagram from the question and solution, option 3 is correct. Q20. An inductor of inductance 10 mH and a resistance of 5 is connected to a battery of 20 V at t = 0. Find the ratio of current in the circuit at t = to current at t = 40 sec. (1) 1.06 (2) 1.48 (3) 1.15 (4) 0.84 Solution As we know that the So, from the question, we can write that - By putting t = We get, Again at t = 40 sec So, So option 1 is much closer. So option 1 will be correct. Q21. A solid cube of side 'a' is shown in the figure. Find the maximum value of for which the block does not topple before sliding solution For no toppling Using using i.e but this is not possible as b can maximum be equal to 0.5a So Q22. Magnitude of rotation of two vectors and is equal to magnitude of . Find the angle between and resultant of and . Solution As Now Vector P is doubled but vector Q is the same so the angle between will be also And If resultant of is Then from the figure angle between is and Q23. When n gram of steam at 100°C is mixed with 200 gm of ice at 0°C, it results in the water at 40°C. Find the value of n in gram. given : Latent heat of fusion (L_F) = 80 cal/gm, Latent heat of vaporisation (L_v) = 540 cal/gm, specific heat of water (C_w)= 1 cal/gm/°C) Solution Q24. A battery of unknown emf connected to a potentiometer has to balance length of 560 cm. If a resistor of resistance 10 ohm is connected in parallel with the cell the balancing length change by 60 cm. If the internal resistance of the cell is n/10 ohm, the value of 'n' is Q25. A capacitor of 60 pF charged to 20 volt. Now battery is removed and then this capacitor is connected to another identical uncharged capacitor. Find heat loss in nJ solution Therefor n =6 Stay tuned with us for further updates.

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