

**Presidency College
Geology Department
Admission Test 2007**

Time: 2 hours

Full Marks: 100

Answer to each group to be written in separate answersheets

Group: A

PHYSICS

Marks: 30

1. Distinguish between *streamline* and *turbulent* flow. State the principle by which a crumpled cotton cloth will gradually straighten out when thrown into a pond. 2+3=5
2. How does a rainbow form? Why does it look like a bow? What would be the shape of a rainbow if one sees it from above the cloud cover? 1+2=5
3. A concave mirror of focal length 20cm is placed at a distance of 20cm behind a concave lens. A pin placed 68.6cm in front of the lens forms an inverted image by the lens-mirror combination, which coincides with itself. With the help of a suitable ray diagram calculate the focal length of the lens. 5
4. What will be the equilibrium positions of a magnetic needle at the magnetic equator and magnetic poles? If a small bar magnet of magnetic moment 100cgs unit is placed perpendicular to the magnetic meridian, its north pole points east. Find the force experienced by an isolated south pole of strength 20cgs unit when it is placed on the axis of the magnet at a distance of 10cm from the centre of it. ($H=0.3\text{Oe}$). 1+4=5
5. How does the acceleration due to gravity vary with the latitude of the place? If the radius of the Earth is suddenly reduced to half of its present value, how will the length of the day be affected. 3+2=5
6. Define electro-volt (eV). How many ergs are there in 1eV? The rate of disintegration of a radio-element is 4750 per second. After 5 minutes the rate becomes 2700 per second. Find the half-life period of the radio-element. 2+3=5

Group: B

CHEMISTRY

Marks: 30

7. Choose the correct answer from the given options: 10X1=10
 - a) Which liquid has the highest boiling point? i) CHCl_3 ii) SiHCl_3 iii) CF_4 iv) NH_3
 - b) Which one has the highest number of intermediate H-bonds? i) HF ii) H_2O iii) H_2S iv) HCl
 - c) Which has the highest radius? i) Li ii) Na iii) Mg iv) Al
 - d) Which has the lowest ionization potential? i) Ca ii) Se iii) Br iv) O
 - e) Which is a 4-f series element? i) Ca ii) Fe iii) Ra iv) Ce
 - f) A sp^3 hybrid orbital contains the character of: i) 1/4 of s ii) 1/2 of s iii) 2/3 of s iv) 3/4 of s
 - g) The angle between two covalent bonds is maximum in: i) H_2O ii) CO_2 iii) NH_3 iv) NF_3
 - h) The volume of 0.1M $\text{K}_2\text{Cr}_2\text{O}_7$ required to oxidize 35ml of 0.5M FeSO_4 solution is i) 29ml ii) 87ml iii) 175ml iv) 145ml
 - i) Which has the maximum magnetic moment? i) Mn^{2+} ii) Fe^{3+} iii) Ti^{3+} iv) Cr^{2+}
 - j) A solution that obeys the Rault's Law is: i) normal ii) molar iii) ideal iv) saturated.
8. Naturally occurring Argon consists of three isotopes, atoms of which occur in the following abundances: 0.34% ^{36}Ar , 0.07% ^{38}Ar and 99.59% ^{40}Ar . Calculate the atomic weight of Argon. (Given: isotopic masses of $^{36}\text{Ar} = 35.9676\text{U}$, $^{38}\text{Ar} = 37.9627\text{U}$ and $^{40}\text{Ar} = 39.9624\text{U}$) 5
 9. Write the electronic configuration of Fe^{2+} and indicate the number of unpaired electrons. 2+1=3
 10. Arrange the following with increasing dipole moment: BF_3 , H_2S , H_2O 2
 11. Indicate whether the aqueous solution of AlCl_3 is acidic or basic or neutral? Support your answer with a net ionic equation. 1+2=3
 12. Write down the balanced chemical equation for the reaction when $\text{CO}_2(\text{g})$ is passed through a concentrated NaCl solution saturated with $\text{NH}_3(\text{g})$. 2
 13. Balance the following equation by ion-electron method: 3

$$\text{FeSO}_4 + \text{KMnO}_4 + \text{H}_2\text{SO}_4 \rightleftharpoons \text{Fe}_2(\text{SO}_4)_3 + \text{MnSO}_4 + \text{K}_2\text{SO}_4 + \text{H}_2\text{O}$$
 14. Calculate the change in enthalpy when 3 moles of an ideal gas undergo reversible isothermal expansion from 3.0 Litres to 5.0 Litres at 400°K . 2

15. Let d be the perpendicular distance from the centre of an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ to the tangent drawn at a point P on the ellipse. If F_1 and F_2 are the two foci of the ellipse then find the value of $(PF_1 - PF_2)$ [given $PF_1 > PF_2$]. 4
16. If α and β be the roots of $ax^2 + 2bx + c = 0$ and $\alpha + \delta$ and $\beta + \delta$ be those of $Ax^2 + 2Bx + C = 0$, then find the value of $(b^2 - ac)/(B^2 - AC)$. 4
17. Solve the equation for real roots: $x + \log_{10}(1 + 2^x) = x \log_{10} 5 + \log_{10} 6$. 4
18. If $y = \frac{x \sin^{-1} x}{\sqrt{1-x^2}} + \log \sqrt{1-x^2}$, find $\frac{dy}{dx}$. 4
19. Solve the equation $3^{\sin 2x + 2 \cos^2 x} + 3^{1 - \sin 2x + 2 \sin^2 x} = 28$ 4