NEW STANDARD ACADEMY

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PHYSICS

1. Two identical coils P and Q each of radius R are lying in perpendicular planes such that they have a common centre. Find the magnitude and direction of magnetic field at the common centre of the two coils, if they carry currents equal to I and √3I respectively.
2. State and use an Ampere's circuital law, obtain the expression for the magnetic field due to an infinitely long conductor/wire carrying current.
3. What is a solenoid? Derive an expression for the magnetic field due to a long solenoid at a point inside the solenoid on its axis.
4. Find the current density as a function of distance r from the axis of a radially symmetrical parallel stream of electrons if the magnetic induction inside the stream varies as B = b r^{α} where b and α are positive constants.
5. A single-layer coil (solenoid) has length l and cross-section radius R. A number of turns per unit length is equal to n. Find the magnetic induction at the centre of the coil when a current I flows through it.
6. A thin conducting strip of width h = 2.0 cm is tightly wound in the shape of a very long coil with cross-section radius cm to make a R = 2.5 single-layer straight solenoid. A direct current I = 5.0 A flows through the strip. Find the magnetic induction inside and outside the solenoid as a function of the distance r from its axis.
7. Find the magnetic moment of a thin round loop with current if the radius of the loop is equal to R=100 mm and the magnetic induction at its centre is equal to B = 6.0μT.
8. A long straight solenoid of cross-sectional diameter d = 5 cm and with n = 20 turns per one cm of its length has a round turn of copper wire of cross-sectional area S = 1.0 m m ^{2} tightly put on its winding. Find the current flowing in the turn if the current in the solenoid winding is increased with a constant velocity I = 100A / s The inductance of the turn is to be neglected.
9. A long solenoid of cross-sectional radius a has a thin insulated wire ring tightly put on its winding; one half of the ring has the resistance η times that of the other half. The magnetic induction produced by the solenoid varies with time as B = bt, where b is a constant. Find the magnitude of the electric field strength in the ring
10. A magnetic flux through a stationary loop with a resistance R varies during the time interval τ asΦ = at(τ - t) Find the amount of heat generated in the loop during that time. The inductance of the loop is to be neglected

CHEMISTRY

1. An ideal solution containing 1 mole of A and 3 moles of B has vapour pressure equal to 550 mm at 300K. When one mole of B is added to the above solution vapour pressure is increased by 10 mm at the same temperature. What is the vapour pressure of liquid A and liquid B?
2. When 10 g of a non-volatile solute are dissolved in 80 g of acetone at 300 K the lowering in vapour pressure is 12 mm Hg. If vapour pressure of pure acetone at 300K is 283 mm Hg, calculate the molar mass of solute.
3. Calculate the vapour pressure of 0.1M urea solution. Vapour pressure of water at the given temp. is 20 torr. Assume molarity and molality to be equal.
4. Calculate the EMF of Cu | $CuSO_4$ (0.1M). The salt is 90% dissociated. Given that E° (Cu^{2+} | Cu) = + 0.34 V.
5. Calculate the EMF of the cell at 25° C.
   Cu |Cu^{2+} (4M)||Ag^{+} (0.1M)| Ag
   Given that E° (Cu^{2+} / Cu) = 0.34V and E° (Ag^{+} |Ag) = 0.80 V
6. Calculate the EMF of the cell :
   $Cr|Cr^{3+}$ (0.1M)||Fe^{2+} (0.01M)| Fe
   Given that E°(Cr^{3+}|Cr)= - 0.75Vand
   E° (Fe^{2+} | Fe) = - 0.45 V
7. For the cell reaction given below EMF at 25 °C is 1.3 V.
   $Zn(S) + Cu^{2+}(1M) \rightleftharpoons Cu(S) + Zn^{2+}(0.1M)$
   Calculate E° of the cell reaction.
8. Why is N_2 less reactive?
9. What is the order of stability basic character, bond angle and reducing power of NH_3,PH_3,AsH_3,SbH_3 and BiH_3.
10. Which is more covalent $SbCl_5$ or $SbCl_3$

BIOLOGY

1. What is selection? How Artificial selection is different from natural selection?

2. Darwin observed a variety of beaks in small black birds inhabiting Galapogos islands. Explain what conclusions did he draw and how?
3. Explain convergent and divergent evolution with the help of example of each.
4. Why are the wings of butterfly and bird said to be alalogous organs? Name the type of evolution analogous orgains are a result of.
5. Antropogenic action can hasten the evolution. Explain with the help of a suitable example.
6. Explain adaptive ratiations and convergent evolution by taking example of some of Australian marsup and placental mammals.
7. In England during the post industrialised period, the count of melanic moths increased in urban area but remained low in rural areas. Explain.
8. State the theory of biogenesis. How does Miller's experiment support this theory?
9. How does industrial melanism support Darwin's theory of Natural Selection? Explain.
10. What is convergent and divergent evolution? Explain with the help of example.

MATHS

1. Is the function *f* defind by $f(x) = \tan x$ continuous at $x = \frac{\pi}{2}$
2. Find the value (s) of 'λ' for which the function *f* given as
$f(x) = \begin{cases} \frac{\sin^2 \lambda x}{x^2}, if\ x \neq 0 \\ 1, if\ x \neq 0 \end{cases}$ $is\ continuous\ at\ x = 0.$
3. Prove that the function $f(x) = \begin{cases} \frac{e^{1/x}-1}{e^{1/x+1}}, x \neq 0 \\ k, x = 0 \end{cases}$ remains discontinuous at x=0 regardless of the choice of k.
4. Prove that the following function are continuous
(i) $\frac{3x^2-7x+1}{x^2-4}$ (ii) 3-2x+|x|
5. Show that the function $f(x) = \begin{cases} x^2, x \leq 1 \\ \frac{1}{x}, x > 1 \end{cases}$ is continuous at x=1 but not differentiable.
6. Let $f(x) = \begin{cases} x \cos \frac{1}{x}, x > 0 \\ 0, x \leq 0 \end{cases}$. Examine the function the for continuity and differentiability at x = 0.
7. Show that the function $f(x) = 2x-|x|$ is continuous at x=0 but not differentiable at x = 0
8. Check the differentiability of the function *f* defined by $f(x) = |x-5|$ at the point x =5.
9. Check the differentiability of $f(x)$ $|\cos x|$ at $x = \frac{\pi}{2}$
10. Differentiate the following function *w.r.t.x*

(i) $\sqrt{2x-3}, x > \frac{3}{2}$ (ii) $(3x^2-5x+1)^7$