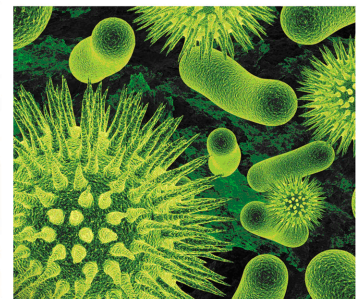
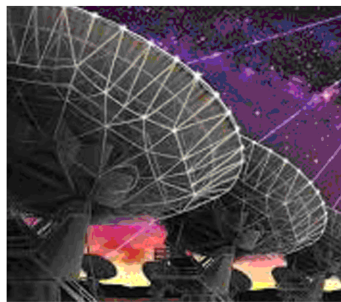


STUDY MATERIAL

NEET

BIOLOGY

Class 12



 **CP PUBLICATION**



BIOLOGY

Study Material for NEET preparation
Prepared by Career Point Kota Experts



CAREER POINT

CONTENTS OF THE PACKAGE AT A GLANCE

BIOLOGY

Class 12

Reproduction

- ◆ Sexual Reproduction in Flowering Plants
- ◆ Human Reproduction
- ◆ Reproductive Health

Genetic and Biotechnology

- ◆ Heredity and Variation
- ◆ Molecular basis of Inheritance
- ◆ Biotechnology : Principles and Process
- ◆ Biotechnology and Its Applications

Ecology

- ◆ Organisms and Environment
- ◆ Ecosystem
- ◆ Biodiversity and Conservation

Evolution & Biology in

Human Welfare

- ◆ Evolution
- ◆ Health and disease
- ◆ Microbes in human welfare

Features of The Product

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Theory & Concepts

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HUMAN REPRODUCTION

Chapter Contents

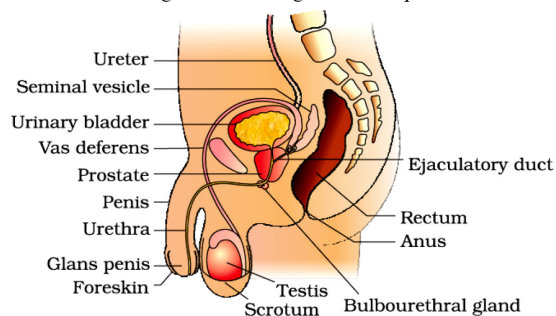
- Introduction
- Male Reproductive System
- Female Reproductive System
- Menstrual Cycle
- Breast
- Parturition
- Gestation Period
- Embryology
- Spermatogenesis
- Structure of sperm
- Oogenesis
- Types of Egg
- Fertilisation
- Human Embryology
- Implantation
- Extra Embryonic Membranes & Placenta

Introduction

- To continue its own race, an organism by the process of reproduction, produces offspring like its own. In sexual reproduction the organisms produce male and female gametes which on combining, develop into a new individual. The formation of gametes takes place in the reproductive organs.
- **Primary Sex Organ :**
Essential organs which form the gametes. In males, the gamete forming organs are the testes. In females, the corresponding organs are ovaries.
The male gametes is the spermatozoan.
The female gamete is the ovum
- **Secondary Sex Organ :**
These form the passage for the gametes to help the union of male & female gametes. In male this include epididymis, vas deferens, seminal vesicles, prostate, bulbourethral glands & penis.
While in female - Fallopian tube, uterus & vagina. (Breast is an accessory sex organ)
- **Development of Sex Organ :**
During intra uterine life (IUL) testis & ovary develop from mesoderm. They develop in abdominal cavity in IUL, at the time of birth, testes descend down into scrotal sac but ovaries remain in abdominal cavity.

Male Reproductive System

- In man, one pair of testes are the main or primary reproductive organ. Size 4-5 cm × 2-3 cm
- Both testes are located in a small bag like structure situated below & out side the abdominal cavity called as scrotum or scrotal sac. The temperature of scrotum is 2 to 3°C lesser than body temperature.
- Internally scrotum is lined by dartos muscle & spermatic fascia. Dartos muscle helps in regulation of the temperature with in the scrotum during cold season, It becomes contracted in cold & during warm season, it becomes relaxed. Cremaster muscles line inside the wall of scrotal & inguinal canal region and help in elevation of testes.



Practice Exercises

Exercise Level -1 : It contains single objective correct (SCQ) type concept building questions.

EXERCISE # 1

- Q.1** Progesterone hormone is secreted by –
(1) Corpus albicans
(2) Corpus collosum
(3) Corpus luteum in ovaries
(4) Corpus uteri
- Q.2** Which acid occur in semen –
(1) Citric acid (2) Mallic acid
(3) Oxalo acetic acid (4) Succinic acid
- Q.3** Secretion of which gland has high percentage of fructose –
(1) Prostate gland (2) Cowper's gland
(3) Seminal vesicle (4) Tyson
- Q.4** In mammals, failure of testes to descend into scrotum is known as –
(1) Paedogenesis (2) Castration
(3) Cryptorchidism (4) Impotency
- Q.5** Sertoli cells are involved in -
(1) Respiration
(2) Nutrition of sperms
(3) Excretion
(4) Development of sex organs
- Q.6** In mammals corpus luteum is found in which organ -
(1) Brain (2) Ovary (3) Liver (4) Eyes
- Q.7** Testosterone is secreted by -
(1) Leydig cells (2) Sertoli cells
(3) Seminiferous tubule (4) None of these
- Q.8** Common duct formed by union of vas-deferens and duct from seminal vesicle is –
(1) Urethra (2) Tunica-vasculosa
(3) Ejaculatory duct (4) Spermatic duct
- Q.9** Scrotum communicates with abdominal cavity through
(1) Urethra (2) Inguinal canal
(3) Vas-deferens (4) Epididymis
- Q.10** Penile urethra traverses through –
(1) Corpora cavernosa (2) Corpus spongiosum
(3) Corpus callosum (4) Corpus striatum
- Q.11** Seminiferous tubules are composed of –
(1) Spermatogonia (2) Glandular epithelium
(3) Sensory epithelium (4) Germinal epithelium
- Q.12** Bundles of muscles in penis are –
(1) Corpus cavernosa (2) Corpus spongiosum
(3) Both (4) None
- Q.13** Glans penis is covered by –
(1) Areomembrana (2) Prepuce
(3) Metrium (4) None
- Q.14** In mammals, the testes occur in scrotal sacs, out side the viscera because of the –
(1) Presence of urinary bladder
(2) Presence of rectum
(3) Long vas-deferens
(4) Requirement of low temperature for spermatogenesis
- Q.15** In between spermatogonia are found -
(1) Germinal cells (2) Sertoli cells
(3) Epithelial cells (4) Lymph space
- Q.16** Sertoli cells are found in –
(1) Testis of cockroach (2) Liver of mammals
(3) Testis of mammals (4) Testis of frog
- Q.17** Which accessory genital gland occurs only in male mammal
(1) Bartholin's gland (2) Perineal gland
(3) Prostate gland (4) All
- Q.18** Seminal vesicle is present at the junction of –
(1) Prostate and urethra
(2) Prostate and vas-deferens
(3) Prostate and cowper's gland
(4) vas-deferns and testis
- Q.19** During differentiation the spermatids remain associated with -
(1) Leyding's cells (2) Kuffer's cells
(3) Spermatogonia (4) Sertoli cell
- Q.20** Sugar fructose is present in the secretion of -
(1) Seminal vesicle (2) Perineal gland
(3) Cowper's gland (4) Bartholin's gland
- Q.21** Spermatozoa are nourished during their development by
(1) Sertoli cells (2) Interstitial cells
(3) Connective tissue cells (4) None
- Q.22** What would happen if vasa deferantia of man are cut
(1) Sperms are non nucleate
(2) Spermatogenesis does not occur
(3) Semen is with out sperms
(4) Sperm are non motile
- Q.23** Accessory sexual character in female is promoted by -
(1) Androgen (2) Progesterone
(3) Estrogen (4) Testosterone
- Q.24** Sertoli cells occur in -
(1) Human testis (2) Frog testis
(3) Human ovary (4) Frog ovary
- Q.25** Which one is primary sex organ
(1) Scrotum (2) Penis
(3) Testis (4) Prostrate

Exercise Level -2: It contains single objective type good quality questions on all the concepts of the chapter in mixed manner.

EXERCISE # 2

- Q.1** The lytic enzyme present in semen is –
(1) Ligase (2) Estrogenase
(3) Androgenase (4) Hyaluronidase
- Q.2** Seminal fluid has sperms and secretions of –
(1) Prostate, cowper's & Bartholin glands
(2) Seminal vesicle, Prostate & cowper's glands
(3) Seminal vesicle, ureter & Prostate gland
(4) Follicles, ureters and prostate gland
- Q.3** If the epididymis is not presented then what will happen
(1) Sperm life cycle is short
(2) Early cross the pathway
(3) Functional maturation is early
(4) Sperm will be incapable for fertilization
- Q.4** After vasectomy what happens
(1) Absence of semen
(2) Sperm are dead or inactive
(3) Sperm immediately disappear in semen
(4) Sperm gradually disappear in semen
- Q.5** In aged person inguinal canal becomes loose, and some part of intestine is pushed into scrotal sac, the disease is called
(1) Myctalopia (2) Hernia
(3) Achondroplasia (4) None
- Q.6** Progesterone is
(1) Carbohydrate (2) Steroid
(3) Protein (4) Sterol
- Q.7** Degenerative process of follicles or eggs in ovary is called –
(1) Metagenesis (2) Atresia
(3) Regression (4) None
- Q.8** Antrum is filled with fluid and is found in –
(1) Bone-marrow of bone
(2) Cavity of brain
(3) Graffian follicle of ovary
(4) Pericardium of heart
- Q.9** One of the following is fibrous layer of follicle
(1) Theca externa (2) Zona pellucida
(3) Membrana granulosa (4) Vitelline membrane
- Q.10** Eggs liberated from ovary in human in
(1) Secondary oocyte stage
(2) Primary oocyte stage
(3) Oogonial stage
(4) Mature ovum stage
- Q.11** Expanded proximal part of oviduct in female is –
(1) Uterus (2) Fallopian tube
(3) Fimbriated funnel (4) Vestibule
- Q.12** At the time of birth, ovum is the form of
(1) Oogonia (2) Primary oocyte
(3) Sec. oocytes (4) Egg
- Q.13** The animal in which testes descent into scrotum only during breeding season-
(1) Frog (2) Kangaroo
(3) Dog (4) Bat
- Q.14** In mammals the estrogens are secreted by the Graffian follicle from its
(1) External theca (2) Internal theca
(3) Zona pellucida (4) Corona radiata
- Q.15** If cowpers gland is removed which of the following will be affected –
(1) Sexual attraction (2) Fertilization
(3) Hardness of penis (4) Copulation
- Q.16** In uterus endometrium, proliferates in response to-
(1) Relaxin (2) Oxytocin
(3) Progesterone (4) Oestrogen
- Q.17** In mammals the female secondary sexual characters are developed mainly by the hormone-
(1) Relaxin (2) Estrogens
(3) Progesterone (4) Gonadotropins
- Q.18** Spermatogenesis and sperm differentiation are under the control of
(1) FSH (2) LH
(3) Progesterone (4) Parathyroid Hormone
- Q.19** In the absence of pregnancy, corpus luteum-
(1) Becomes active, secretes FSH and LH
(2) Produces lot of oxytocin and relaxin
(3) Degenerates after some time
(4) Is maintained by progesterone
- Q.20** Parturition duct in female is called-
(1) Uterus (2) Oviduct (3) Vagina (4) Cervix
- Q.21** If mammalian ovum fails to get fertilized, which one of the following is unlikely in this cycle -
(1) Estrogen secretion further decreases
(2) Progesterone secretion rapidly declines
(3) Corpus luteum will disintegrate
(4) Primary follicle starts developing
- Q.22** In mammals, maturation of sperms take place at a temperature-
(1) Equal to that of body
(2) Higher than that of body
(3) Lower than that of body
(4) At any piece of mammalian sperm

Exercise Level -3 : It contains previous years NEET exam questions from 2005 to upto to present year.

EXERCISE # 3

- Q.1** Middle piece of mammalian sperm possesses : [CBSE 1991]
(1) Mitochondria and centriole
(2) Mitochondria only
(3) Centriole only
(4) Nucleus and mitochondria
- Q.2** Human egg has : [CBSE 1991]
(1) One Y-chromosome
(2) One X-chromosome
(3) Two Y-chromosome
(4) One X- chromosome and one Y-chromosome
- Q.3** During cleavage, what is true about embryo ? [CBSE 1991]
(1) Nucleocytoplasmic ratio remains unchanged
(2) Size does not increase
(3) There is less consumption of oxygen
(4) The division is like meiosis
- Q.4** During pregnancy, the urine of would contain [CBSE 1993]
(1) LH (2) Progesterone
(3) FSH (4) HCG
- Q.5** Ovulation occurs under the influence of- [CBSE 1994]
(1) LH (2) FSH
(3) Estrogen (4) Progesterone
- Q.6** In 28 day human ovarian cycle, ovulation occurs on - [CBSE 1994]
(1) Day 1 (2) Day 5
(3) Day 14 (4) Day 28
- Q.7** At the end of first meiotic division, male germ cell differentiates into : [CBSE 1994]
(1) Secondary spermatocyte
(2) Primary spermatocyte
(3) Spermatogonium
(4) Spermatid
- Q.8** Extra-embryonic membranes of the mammalian embryo are derived from : [CBSE 1994]
(1) Inner cell mass (2) Trophoblast
(3) Formative cells (4) Follicle cells
- Q.9** What is true about cleavage in fertilized egg of humans? [CBSE 1994]
(1) Meroblastic
(2) Starts when egg reaches uterus
(3) Starts in fallopian tubes
(4) It is identical to normal mitosis
- Q.10** Estrous cycle is characteristic of [CBSE 1995]
(1) Human females
(2) Mammalian females
(3) Mammalian females other than primates
(4) Mammals
- Q.11** After ovulation follicles converted into- [CBSE 1999]
(1) Corpus luteum (2) Corpus albicans
(3) Corpus cavernosa (4) Corpus calosum
- Q.12** Division of human egg is : [CBSE 2000]
(1) Equal holoblastic (2) Unequal holoblastic
(3) Superficial meroblastic (4) Discoidal meroblastic
- Q.13** Mainly which type of hormones control the menstrual cycle in human beings- [CBSE 2002]
(1) FSH (2) LH
(3) FSH, LH, Estrogen (4) Progesterone only
- Q.14** When both ovary are removed from rat then which hormone is decreased in blood- [CBSE 2002]
(1) Oxytocin
(2) Prolactin
(3) Estrogen
(4) Gonadotrophic releasing factor
- Q.15** Hormone controlling human menstrual cycle- [CBSE 2002]
(1) Estrogen (2) FSH
(3) LH (4) All the above
- Q.16** What is true for cleavage: [CBSE 2002]
(1) Size of embryo increases
(2) Size of cells decrease
(3) Size of cells increase
(4) Size of embryo decreases
- Q.17** Bartholin's glands are situated- [CBSE 2003]
(1) On the sides of the head of some amphibians
(2) At the reduced tail end of birds
(3) On either side of vagina in humans
(4) On either side of vas deferens in humans
- Q.18** Ovulation in the human female normally takes place during the menstrual cycle- [CBSE 2004]
(1) At the end of the proliferative phase
(2) At the end of the proliferative phase
(3) Just before the end of the secretory phase
(4) At the beginning of the proliferative phase
- Q.19** Select the correct option describing gonadotropin activity in a normal pregnant female. [CBSE-2014]
(1) High level of FSH and LH stimulates the thickening of endometrium.
(2) High level of FSH and LH facilitates implantation of the embryo.
(3) High level of hCG stimulates the synthesis of estrogen and progesterone
(4) High level of hCG stimulates the thickening of endometrium.

Answer key

Above mentioned all exercises provided with answer key

ANSWER KEY

EXERCISE # 1

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	3	1	3	3	2	2	1	3	2	2	4	3	2	4	2	3	3	2	4	1
Ques.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	1	3	3	1	3	2	1	3	2	2	1	4	1	4	2	2	3	3	2	2
Ques.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	4	2	3	4	4	3	1	3	3	4	3	1	2	2	1	1	2	3	2	2
Ques.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	3	3	4	1	4	4	3	3	1	4	4	2	4	1	3	4	1	4	2	3
Ques.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Ans.	4	1	3	2	1	2	2	1	3	3	3	3	1	3	1	3	3	2	2	3
Ques.	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Ans.	2	3	3	2	1	2	2	4	1	3	2	2	1	2	3	4	3	1	1	3
Ques.	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
Ans.	2	1	2	3	2	4	4	3	4	2	4	3	2	3	3	3	3	1	3	4
Ques.	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155					
Ans.	4	2	3	1	1	4	1	1	2	2	3	2	2	1	2					

STUDY MATERIAL

NEET

CHEMISTRY

Class 12



 **CP PUBLICATION**



CHEMISTRY

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CAREER POINT

CONTENTS OF THE PACKAGE AT A GLANCE

CHEMISTRY

Class 12

Physical Chemistry (II)

- ◆ Electro Chemistry
- ◆ Solution
- ◆ Chemical Kinetics

Organic Chemistry (II)

- ◆ Halogen Compounds
- ◆ Alcohol, Phenol, Ether
- ◆ Carbonyl Compound
- ◆ Carboxylic acid & Its Derivatives
- ◆ Nitrogen Compounds
- ◆ Biomolecules
- ◆ Purification Chemistry & Characterisation of Organic Compound

Inorganic Chemistry (II)

- ◆ p-Block Element
- ◆ d & f Block
- ◆ Coordination compound
- ◆ Practical Chemistry

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SOLUTION

KEY CONCEPT

1. Solution

A solution is a homogeneous mixture of a solute, the substance that dissolves and a solvent, the substance in which the solute dissolves.

- (a) The component of solution which is in lesser amount (Which is dissolved) is called **solute**.
- (b) The component of solution in which solute is dissolved is called **solvent**.

Solution = Solute + Solvent

2. Concentration of Solution

It is calculated by following two methods

- (a) Weight % : Weight of solute per 100 gram of solution.
- (b) Volume % :
 - (i) Weight of solute per 100 ml of solution
 - (ii) Volume of solute per 100 ml of solution
- (c) Concentration of a solution expressed in following terms.

2.1 MOLARITY (M)

It is the number of moles of solute in one litre of solution

$$\text{Molarity} = \frac{\text{No. of moles of solute}}{\text{Volume of solution (litre)}}$$

- (a) Molarity is expressed by putting a suffix 'M' after a number, say 'X'. It means if concentration of a solution is given to be XM, it means X moles of solute are there per litre of solution.

- (b) Some times amount of solute is given in grams. So,

$$\text{Moles of solute} = \frac{\text{amount (gram)}}{\text{mol. wt. in (gram)}}$$

- (c) We Should be careful about unit of volume taken. We have to use volume in litre in the formula for molarity. So, if volume is given in ml (mili litre) convert it into litre as-

$$\text{volume in litre} = \text{volume in ml} \times 10^{-3}$$

- (d) Some times we get confused when volume is given in cm^3 . A cm^3 is nothing but a milliliter. So, volume in litre = volume (cm^3) $\times 10^{-3}$

- (e) Unit of molarity is mole L^{-1} .

- (f) Millimoles = $M \times V(\text{ml}) = \frac{\text{wt.} \times 1000}{\text{mol. wt.}}$

- (g) Strength of solution = $\frac{\text{wt. of solute} \times 1000}{\text{volume of solution (ml)}}$

- (h) Molarity is a temperature dependent unit.

$$\text{Molarity} \propto \frac{1}{\text{temp.}}$$

2.2 MOLALITY (m)

It is the number of moles of solute per kilogram of solvent.

$$\text{Molality} = \frac{\text{moles of solute}}{\text{mass of solvent (kg)}}$$

- (a) Unit of molality is mole kg^{-1}
- (b) Sometimes mass of solution is given instead of solvent, so subtract the mass of solute to get mass of solvent
- (c) Represented by a suffix 'm' after a number x. xm means x moles of solute are there per kg of solvent.
- (d) Molality does not change with increase of temperature.
- (e) Relation between molarity and molality-

$$m = \frac{1000M}{1000d - MM_B}$$

Where,

m = Molality

M = Molarity

d = density of solution in gm/litre

M_B = Molecular wt. of solute

Derivation :-

$$\frac{M}{m} = \frac{\text{wt. of solvent}}{\text{volume of solution}}$$

$$\frac{M}{m} = \frac{W_A}{V(\text{litre})}$$

Since, wt. of solvent = wt. of solution - wt. of solute
 $= V \times d - MM_B$

Therefore,
$$\frac{M}{m} = \frac{Vd - MM_B}{V}$$

$$m = \frac{MV}{Vd - MM_B}$$

2.3 MOLE FRACTION (X)

- (a) Mole fraction of a component in solution is equal to the ratio of number of moles of that component to the total number of moles of all the components in the solution. Mole fraction of component A is represented by x_A .

- (b) Let, there be two components A (solvent) & B (solute)

$$X_A = \frac{n_A}{n_A + n_B} \text{ and } X_B = \frac{n_B}{n_A + n_B} \text{ where,}$$

X_A = Mole fraction of solvent and

X_B = Mole fraction of solute.

Here,
$$n_A = \frac{w_A}{M_A}$$

(wt. of A in grams/mol. wt. of A, $x_A + x_B = 1$)

In Chapter Examples

To clarify the application of theory & concept accurately & correctly, there is number of solved in-chapter questions following each topic. It proves practically very effective to understand and correct application of related theory.

Questions based on Raoult's Law

Ex.1 At 300 K, the vapour pressure of an ideal solution containing one mole of A and 3 moles of B is 550 mm of Hg. At the same temperature, if one mole of B is added to this solution, the vapour pressure of solution increases by 10mm of Hg. Calculate the vapour pressure of A and B in their pure state.

- (1) 400 mm, 600 mm
 (2) 600 mm, 400 mm
 (3) 200 mm, 300 mm
 (4) 300 mm, 200 mm (Ans. 1)

Sol. Initially,

$$P_M = P_A^\circ \cdot X_A + P_B^\circ \cdot X_B$$

$$550 = P_A^\circ \left(\frac{1}{1+3} \right) + P_B^\circ \left(\frac{3}{1+3} \right)$$

$$P_A^\circ + 3P_B^\circ = 2200$$

When 1 mole of B is further added to it

$$P_M = P_A^\circ \cdot X_A + P_B^\circ \cdot X_B$$

Questions based on Colligative properties of Dilute Solution

Ex.2 What will be the temperature at which a solution containing 6 g of glucose per 1000 g water will boil, if molal elevation constant for water is 0.52 / 1000 g.

- (1) 100.173°C (2) 100.0173°C
 (3) 100.173°C (4) None (Ans. 2)

Sol. $w = 6\text{g}$, $W = 1000\text{g}$,

$$\text{Mol. wt. of glucose} = 180$$

$$\Delta T_b = \frac{1000 \times k_b \times w}{m \times W}$$

$$= \frac{1000 \times 0.52 \times 6}{180 \times 1000}$$

$$= 0.0173^\circ\text{C}$$

Hence boiling point of solution

$$= \text{b.p. of water} + \Delta T_b$$

$$= 100 + 0.0173 = 100.0173^\circ\text{C}$$

Solved Examples

To understand the concept application, in end of the each chapter there is sufficient number of solved examples.

SOLVED EXAMPLES

Ex.1 A 6.90 M solution of KOH in water has 30% by weight of KOH. Calculate density of solution.

- (A) 1.288 g mL⁻¹ (B) 12.88 g mL⁻¹
 (C) 24.88 g mL⁻¹ (D) 2.488 g mL⁻¹

(Ans. A)

Sol. KOH solution is 30% by weight.

∴ wt. of KOH = 30 g
 and Wt. of solution = 100 g

$$\therefore \text{Volume of solution} = \frac{100}{d}$$

$$\therefore \text{Molarity} = 6.90 = \left(\frac{30}{56 \times \frac{100}{1000 \times d}} \right)$$

$$= 1.288 \text{ g mL}^{-1}$$

Ex.2 What is mole fraction in its one molal aqueous solution-

- (A) 0.108 (B) 0.018
 (C) 0.008 (D) None (Ans. B)

Sol. Mole fraction = $\frac{n_A}{n_A + n_B}$

$$n_A = 1 \text{ and } n_B = \frac{1000}{18} = 55.4$$

$$= \frac{1}{1+55.4} = \frac{1}{56.4} = 0.018$$

Ex.4 Calculate the molality and mole fraction of the solute in aqueous solution containing 3.0 gm of urea per 250 gm of water (Mol. wt. of urea = 60).

- (A) 0.2 m, 0.00357 (B) 0.4 m, 0.00357
 (C) 0.5 m, 0.00357 (D) 0.7m, 0.00357

(Ans. A)

Sol. Wt. of solute (urea) dissolved = 3.0 gm
 Wt. of the solvent (water) = 250 gm
 Mol. wt. of the solute = 60

$$3.0 \text{ gm of the solute} = \frac{3.0}{60} \text{ moles} = 0.05 \text{ moles}$$

Thus 250 gm of the solvent contain = 0.05 moles of solute

∴ 1000 gm of the solvent contain

$$= \frac{0.05 \times 1000}{250} = 0.2 \text{ moles}$$

Hence molality of the solution = 0.2 m

In short,

Molality = No. of moles of solute/1000 g of solvent

$$\therefore \text{Molality} = \frac{3/60}{250} \times 1000 = 0.2 \text{ m}$$

Calculation of mole fraction

3.0 gm of solute = 3/60 moles = 0.05 moles

$$250 \text{ gm of water} = \frac{250}{18} \text{ moles} = 13.94 \text{ moles}$$

∴ Mole fraction of the solute

$$= \frac{0.05}{0.05 + 13.94} = \frac{0.05}{13.99} = 0.00357$$

Ex.5 15 gram of methyl alcohol is dissolved in 35 gram of water. What is the mass percentage of methyl alcohol

Practice Exercises

Exercise Level -1 : It contains TOPIC WISE single objective correct (SCQ) type concept building questions.

EXERCISE # 1

- Q.1** The boiling point of C_6H_6 , CH_3OH , $C_6H_5NH_2$ and $C_6H_5NO_2$ are $80^\circ C$, $65^\circ C$, $184^\circ C$ and $212^\circ C$ respectively. Which will show highest vapour pressure at room temperature-
(1) C_6H_6 (2) CH_3OH
(3) $C_6H_5NH_2$ (4) $C_6H_5NO_2$
- Q.2** The relative lowering of vapour pressure is equal to the mole fraction of the nonvolatile solute, This statement was given by -
(1) Raoult (2) Henry
(3) Joule (4) Dalton
- Q.3** If Raoult's law is obeyed, the vapour pressure of the solvent in a solution is directly proportional to -
(1) Mole fraction of the solvent
(2) Mole fraction of the solute
(3) Mole fraction of the solvent and solute
(4) The volume of the solution
- Q.4** Which one of the following is the incorrect form of Raoult's law
(1) $\frac{P_s}{P^0} = \frac{N}{n+N}$ (2) $\frac{P^0}{P^0 - P_s} = 1 + \frac{N}{n}$
(3) $\frac{P^0 - P_s}{P_s} = \frac{n}{n+N}$ (4) $\frac{P_s}{P^0 - P_s} = \frac{N}{n}$
- Q.5** The vapour pressure of a solution having solid as solute and liquid as solvent is -
(1) Directly proportional to mole fraction of the solvent
(2) Inversely proportional to mole fraction of the solvent
(3) Directly proportional to mole fraction of the solute
(4) Inversely proportional to mole fraction of the solute
- Q.6** If P_0 and P_s are the vapour pressure of solvent and its solution respectively. N_1 and N_2 are the mole fraction of solvent and solute respectively then -
(1) $P_s = \frac{P_0}{N_2}$
(2) $P_0 - P_s = P_0 N_2$
(3) $P_s = P_0 N_2$
(4) $\frac{(P_0 - P_s)}{P_s} = \frac{N_1}{(N_1 + N_2)}$
- Q.7** 1 mole of heptane (V.P. = 92 mm of Hg) was mixed with 4 moles of octane (V.P. = 31 mm of Hg). The vapour pressure of resulting ideal solution is -
(1) 46.2 mm of Hg (2) 40.0 mm of Hg
(3) 43.2 mm of Hg (4) 38.4 mm of Hg
- Q.8** One mole of non volatile solute is dissolved in two moles of water. The vapour pressure of the solution relative to that of water is -
(1) $\frac{2}{3}$ (2) $\frac{1}{3}$ (3) $\frac{1}{2}$ (4) $\frac{3}{2}$
- Q.9** The vapour pressure of a dilute aqueous solution of Glucose is 750 mm of mercury at 373 K. The mole fraction of solute is -
(1) $\frac{1}{10}$ (2) $\frac{1}{7.6}$ (3) $\frac{1}{35}$ (4) $\frac{1}{76}$
- Q.10** The vapour pressure of water at room temperature is 23.8 mm of Hg. The vapour pressure of an aqueous solution of sucrose with mole fraction 0.1 is equal to -
(1) 23.9 mm Hg (2) 24.2 mm Hg
(3) 21.42 mm Hg (4) 31.44 mm Hg
- Q.11** At $88^\circ C$ benzene has a vapour pressure of 900 torr and toluene has a vapour pressure of 360 torr. What is the mole fraction of benzene in the mixture with toluene that will boil at $88^\circ C$ at 1 atm. pressure, benzene - toluene form an ideal solution -
(1) 0.416 (2) 0.588
(3) 0.688 (4) 0.740
- Q.12** Among the following, that does not form an ideal solution is -
(1) C_6H_6 and $C_6H_5CH_3$ (2) C_2H_5Cl and C_6H_5OH
(3) C_6H_5Cl and C_6H_5Br (4) C_2H_5Br and C_2H_5I
- Q.13** Which condition is not satisfied by an ideal solution
(1) $\Delta H_{\text{mixing}} = 0$ (2) $\Delta V_{\text{mixing}} = 0$
(3) $\Delta S_{\text{mixing}} = 0$ (4) Obedience of Raoult's law
- Q.14** Colligative properties of the solution depend upon
(1) Nature of the solution
(2) Nature of the solvent
(3) Number of solute particles
(4) Number of moles of solvent
- Q.15** Which is not a colligative property ?
(1) Osmotic pressure
(2) Lowering in vapour pressure
(3) Depression in freezing point
(4) Refractive index
- Q.16** The lowering of vapour pressure of a solvent by addition of a non-volatile solute to it is directly proportional to -
(1) The strength of the solution
(2) The nature of the solute in the solution
(3) The atmospheric pressure
(4) All

Exercise Level -2 : It contains single objective type good quality questions on all the concepts of the chapter in mixed manner.

EXERCISE # 2

- Q.1** Select correct statement -
 (1) b.p. of 1 molal NaCl solution is twice that of 1 molal sucrose solution
 (2) b.p. elevation of 1 molal glucose solution is half of the 1 molal KCl solution
 (3) b.p. is a colligative property
 (4) All of the above
- Q.2** At a given temperature, total vapour pressure in Torr of a mixture of volatile components A and B is given by

$$P = 120 - 75 X_B$$
 hence, vapour pressure of pure A and B respectively (in Torr) are -
 (1) 120, 75 (2) 120, 195
 (3) 120, 45 (4) 75, 45
- Q.3** Decimolar solution of potassium ferricyanide, $K_3[Fe(CN)_6]$ has osmotic pressure of 3.94 atm at 27°C. Hence percent ionisation of the solute is -
 (1) 10% (2) 20%
 (3) 30% (4) 40%
- Q.4** A complex containing K^+ , Pt (IV) and Cl^- is 100% ionised giving $i = 3$. Thus, complex is -
 (1) $K_2[PtCl_4]$ (2) $K_2[PtCl_6]$
 (3) $K_3[PtCl_5]$ (4) $K[PtCl_3]$
- Q.5** If $pK_a = -\log K_a = 4$, and $K_a = C\alpha^2$ then van't Hoff factor for weak monobasic acid when $C = 0.01$ M is -
 (1) 0.01 (2) 1.02 (3) 1.10 (4) 1.20
- Q.6** In which case van't Hoff factor is maximum ?
 (1) KCl, 50% ionised (2) K_2SO_4 40% ionised
 (3) $FeCl_3$, 30% ionised (4) $SnCl_4$, 20% ionised
- Q.7** The hard shell of an egg is dissolved in acetic acid and then egg was subsequently placed in saturated solution of NaCl
 (1) The egg will shrink
 (2) The egg will become harder
 (3) The egg will swell
 (4) No change in the size of egg
- Q.8** The vapour pressure of a pure liquid 'A' is 70 torr at 27°C. It forms an ideal solution with another liquid B. The mole fraction of B is 0.2 and total vapour pressure of the solution is 84 torr at 27°C. The vapour pressure of pure liquid B at 27°C is -
 (1) 14 (2) 56 (3) 140 (4) 70
- Q.9** The vapour pressure of pure A is 10 torr and at the same temperature when 1g of B is dissolved in 20 gm of A, its vapour pressure is reduced to 9.0 torr. If the molecular mass of A is 200 amu, then the molecular mass of B is -
 (1) 100 amu (2) 90 amu
 (3) 75 amu (4) 120 amu
- Q.10** The value of K_b for water is 1.86, calculated from Glucose solution. The value of K_b for water calculated for NaCl solution will be -
 (1) = 1.86 (2) < 1.86 (3) > 1.86 (4) Zero
- Q.11** As a result of osmosis the volume of the concentrated solution -
 (1) Gradually decreases (2) Gradually increases
 (3) Suddenly increases (4) None
- Q.12** If a thin slice of sugar beet is placed in concentrated solution of NaCl then -
 (1) Sugar beet will lose water from its cells
 (2) Sugar beet will absorb water from solution
 (3) Sugar beet will neither absorb nor lose water
 (4) Sugar beet will dissolve in solution
- Q.13** If mole fraction of the solvent in solution decreases then -
 (1) Vapour pressure of solution increases
 (2) B. P. decreases
 (3) Osmotic pressure increases
 (4) All are correct
- Q.14** A solution containing 4g of a non volatile organic solute per 100 ml was found to have an osmotic pressure equal to 500 cm of mercury at 27°C. The molecular weight of solute is -
 (1) 14.97 (2) 149.7
 (3) 1697 (4) 1.497
- Q.15** If a 6.84% (wt./ vol.) solution of cane-sugar (mol. wt. 342) is isotonic with 1.52% (wt./vol.) solution of thiocarbamide, then the molecular weight of thiocarbamide is -
 (1) 152 (2) 76 (3) 60 (4) 180
- Q.16** The osmotic pressure of blood is 7.65 atm. at 310 K. an aqueous solution of Glucose that will be isotonic with blood iswt/vol. -
 (1) 5.41% (2) 54.1%
 (3) 3.5% (4) 4.53%
- Q.17** Equimolar solutions of A and B show depression in freezing point in the ratio of 2 : 1. A remains in normal state in solution. B will be in.....state in solution -
 (1) Normal (2) Associated
 (3) Hydrolysed (4) Dissociated
- Q.18** The substance A when dissolved in solvent B shows the molecular mass corresponding to A_3 . The vant Hoff's factor will be -
 (1) 1 (2) 2 (3) 3 (4) $\frac{1}{3}$
- Q.19** The freezing point of 1 molal NaCl solution assuming NaCl to be 100% dissociated in water is ($K_f = 1.86$ K Molality⁻¹)
 (1) - 1.86 °C (2) -3.72 °C
 (3) +1.86 °C (4) +3.72 °C

Exercise Level -3 : It contains previous years NEET exam questions from 2005 to upto to present year.

EXERCISE # 3

- Q.1** Which of the following solutions would have the highest osmotic pressure - [AIPMT-91]
 (1) $\frac{M}{10}$ NaCl (2) $\frac{M}{10}$ Urea
 (3) $\frac{M}{10}$ BaCl₂ (4) $\frac{M}{10}$ Glucose
- Q.2** Which of the following solution has the highest boiling point - [AIPMT-91]
 (1) 0.1 M glucose (2) 0.1 M BaCl₂
 (3) 0.1 M NaCl (4) 0.1 M Urea
- Q.3** Which of the following is a colligative property - [AIPMT-92]
 (1) Viscosity (2) Surface tension
 (3) Optical rotation (4) Osmotic pressure
- Q.4** The compound whose 0.1 M solution has maximum osmotic pressure at 25°C will be - [AIPMT-94]
 (1) CaCl₂ (2) KCl
 (3) Glucose (4) Urea
- Q.5** Which of the following salt has the same value of Vont Hoff's factor as that of K₃[Fe(CN)₆] [AIPMT-94]
 (1) Al₂(SO₄)₃ (2) NaCl
 (3) Al(NO₃)₃ (4) Na₂SO₄
- Q.6** Which one of the following modes of expressing concentration of solution is independent of temperature - [AIPMT-91-95]
 (1) Molarity (2) Molality
 (3) Normality (4) Grams per litre
- Q.7** According to raoult's law the relative lowering of vapour pressure for a solution is equal to - [AIPMT-95]
 (1) Moles of solute
 (2) Mole fraction of solvent
 (3) Moles of solvents
 (4) Mole fraction of solute
- Q.8** The relationship between osmotic pressure at 273 K when 10 g glucose (P₁) 10 g urea (P₂) and 10 g sucrose (P₃) are dissolved in 250 ml of water is - [AIPMT-96]
 (1) P₁ > P₂ > P₃ (2) P₃ > P₁ > P₂
 (3) P₂ > P₁ > P₃ (4) P₃ > P₂ > P₁
- Q.9** The vapour pressure of an ideal solution having 0.2 Mole non-volatile solute & 0.8 mole solvent, is 60 mm. The vapour pressure of pure solvent at this temperature will be - [AIPMT-96]
 (1) 120 mm (2) 150 mm
 (3) 60 mm (4) 75 mm
- Q.10** What is the molarity of H₂SO₄ solution which is 98% by weight and the density of solution at 35°C is 1.84 gm/cm³- [AIPMT-96]
 (1) 4.18 M (2) 8.14 M
 (3) 18.4 M (4) 18 M
- Q.11** Vapour pressure of CCl₄ at 25°C is 143 mm Hg. 0.5 gm of a non-volatile solute (mol. wt. 65) is dissolved in 100 ml of CCl₄. Find the vapour pressure of the solution. (Density of CCl₄ 1.58 gm/cm³) [AIPMT-96]
 (1) 141.93 mm (2) 94.39 mm
 (3) 199.34 mm (4) 143.9 mm
- Q.12** The vapour pressure decreases by 10 mm of Hg when solute's mole fraction in a solution is 0.2. If the vapour pressure decreases is 20 mm of Hg then the mole fraction of solute will be - [AIPMT-98]
 (1) 0.2 (2) 0.4 (3) 0.6 (4) 0.8
- Q.13** 5% solution of sucrose is isotonic with 1% solution of a compound 'A' then the molecular weight of compound 'A' is - [AIPMT-98]
 (1) 32.4 (2) 68.4 (3) 121.6 (4) 34.2
- Q.14** The vapour pressure of benzene at a certain temperature is 640 mm of Hg. A non-volatile and electrolytic solid weighting 2.175 g is added to 39.08 g of benzene. If the vapour pressure of the solution is 600 mm of Hg. What is the molecular weight of the solid substance? [AIPMT-99]
 (1) 79.82 (2) 65.25
 (3) 59.60 (4) 49.50
- Q.15** What is false for mole fraction - [AIPMT-99]
 (1) x < 1 (2) - 2 < x ≤ 2
 (3) 0 < x ≤ 1 (4) Always non negative
- Q.16** From the colligative properties of solution which one is the best method for the determination of mol. wt. of proteins & polymers - [AIPMT-2001]
 (1) Osmotic pressure
 (2) Lowering in freezing point
 (3) Lowering in V.P.
 (4) Elevation in B.Pt.
- Q.17** Pure water can be obtain from sea water by - [AIPMT-2001]
 (1) Centrifugation (2) Plasmolysis
 (3) Reverse osmosis (4) Sedimentation
- Q.18** Molarity of liquid HCl if density of liquid HCl is 1.17 gm/cc - [AIPMT-2001]
 (1) 36.5 (2) 18.25
 (3) 32.05 (4) 42.10
- Q.19** A solution contains non volatile solute of molecular mass M₂. Which of the following can be used to calculate the molecular mass of solute in terms of osmotic pressure - [AIPMT-2002]
 (1) $M_2 = \left(\frac{m_2}{\pi}\right) VRT$ (2) $M_2 = \left(\frac{m_2}{V}\right) \frac{RT}{\pi}$
 (3) $M_2 = \left(\frac{m_2}{V}\right) \pi RT$ (4) $M_2 = \left(\frac{m_2}{V}\right) \frac{\pi}{RT}$
- Note :** m₂ → mass of solute
 V → Volume of solution
 π → Osmotic pressure

EXERCISE # 4

- Q.1** In a mixture of A and B, components show negative deviation when – [AIEEE-2002]
 (1) A – B interaction is stronger than A – A and B – B interaction
 (2) A – B interaction is weaker than A – A and B – B interaction
 (3) $\Delta V_{\text{mix}} > 0$, $\Delta S_{\text{mix}} > 0$
 (4) $\Delta V_{\text{mix}} = 0$, $\Delta S_{\text{mix}} > 0$
- Q.2** Benzene and toluene form nearly ideal solutions. At 20°C, the vapour pressure of benzene is 75 torr and that of toluene is 22 torr. The partial vapour pressure of benzene at 20°C for a solution containing 78 g of benzene and 46 g of toluene in torr is– [AIEEE-2005]
 (1) 25 (2) 50
 (3) 53.5 (4) 37.5
- Q.3** Equimolal solutions in the same solvent have – [AIEEE-2005]
 (1) Same freezing point but different boiling point
 (2) Same boiling point but different freezing point
 (3) Different boiling and different freezing point
 (4) Same boiling and same freezing points
- Q.4** The vapour pressure of water at 20° C is 17.5 mm Hg. If 18g of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) is added to 178.2 g of water at 20° C, the vapour pressure of the resulting solution will be - [AIEEE 2008]
 (1) 15.750 mm Hg (2) 16.500 mm Hg
 (3) 17.325 mm Hg (4) 17.675 mm Hg
- Q.5** A binary liquid solution is prepared by mixing n-heptane and ethanol. Which one of the following statements is correct regarding the behaviour of the solution ? [AIEEE 2009]
 (1) The solution is non-ideal, showing +ve deviation from Raoult's Law
 (2) The solution is non-ideal, showing –ve deviation from Raoult's Law
 (3) n-heptane shows +ve deviation while ethanol shows –ve deviation from Raoult's Law
 (4) The solution formed is an ideal solution
- Q.6** Two liquids X and Y form an ideal solution At 300 K, vapour pressure of the solution containing 1 mol of X and 3 mol of Y is 550 mmHg. At the same temperature, if 1 mol of Y is further added to this solution, vapour pressure of the solution increases by 10 mmHg. Vapour pressure (in mmHg) of X and Y in their pure states will be, respectively - [AIEEE 2009]
 (1) 300 and 400 (2) 400 and 600
 (3) 500 and 600 (4) 200 and 300
- Q.7** Aqueous solutions of 0.004 M Na_2SO_4 and 0.01 M Glucose are isotonic. The degree of dissociation of Na_2SO_4 is - [IIT-2004]
 (1) 25% (2) 60% (3) 75% (4) 85%
- Q.8** In a 0.2 molal aqueous solution of a weak acid HX the degree of ionization is 0.3. Taking k_f for water as 1.85, the freezing point of the solution will be nearest to - [AIEEE-2003]
 (1) – 0.480°C (2) – 0.360°C
 (3) – 0.260°C (4) + 0.480°C
- Q.9** If liquids A and B form an ideal solution – [AIEEE-2003]
 (1) the enthalpy of mixing is zero
 (2) the entropy of mixing is zero
 (3) the free energy of mixing is zero
 (4) the free energy as well as the entropy of mixing are each zero
- Q.10** 18 g of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) is added to 178.2g of water. The vapour pressure for this aqueous solution at 100°C is - [AIEEE-2006]
 (1) 759.00 torr (2) 7.60 torr
 (3) 76.00 torr (4) 752.40 torr
- Q.11** A 5.25% solution of a substance is isotonic with a 1.5% solution of urea (molar mass = 60g mol^{-1}) in the same solvent. If the densities of both the solutions are assumed to be equal to 1.0 g cm^{-3} , molar mass of the substance will be - [AIEEE-2007]
 (1) 115.0 g mol^{-1} (2) 105.0 g mol^{-1}
 (3) 210.0 g mol^{-1} (4) 90.0 g mol^{-1}
- Q.12** The density (in g mL^{-1}) of a 3.60 M sulphuric acid solution that is 29% H_2SO_4 (Molar mass = 98 g mol^{-1}) by mass will be - [AIEEE-2007]
 (1) 1.88 (2) 1.22
 (3) 1.45 (4) 1.64
- Q.13** Ethylene glycol is used as an antifreeze in a cold climate. Mass of ethylene glycol which should be added to 4 kg of water to prevent it from freezing at –6° C will be : (K_f for water = 1.86 K kg mol^{-1} , and molar mass of ethylene glycol = 62 g mol^{-1}) [AIEEE-2011]
 (1) 804.32 g (2) 204.30 g
 (3) 400.00 g (4) 304.60 g
- Q.14** The degree of dissociation (α) of a weak electrolyte, A_xB_y is related to van't Hoff factor (i) by the expression : [AIEEE-2011]
 (1) $\alpha = \frac{i-1}{(x+y-1)}$ (2) $\alpha = \frac{i-1}{(x+y+1)}$
 (3) $\alpha = \frac{x+y-1}{i-1}$ (4) $\alpha = \frac{x+y+1}{i-1}$

Answer key

Above mentioned all exercises provided with answer key

EXERCISE # 1

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	2	1	1	3	1	2	3	1	4	3	4	2	3	3	4	1	2	1	3	1
Q.No.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	2	1	4	2	1	4	4	2	1	2	1	4	2	3	3	1	3	2	3	3
Q.No.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	4	2	4	1	1	4	2	2	2	3	2	2	2	3	2	3	3	2	1	2
Q.No.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	2	4	3	1	3	4	3	3	4	3	4	3	1	2	4	3	4	1	3	1
Q.No.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Ans.	3	1	3	2	1	2	3	3	2	4	4	4	3	1	3	4	4	3	3	4
Q.No.	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115					
Ans.	3	1	3	2	2	4	3	4	1	1	2	4	2	2	2					

Revision Plan

We emphasize that every student should prepare his/her own revision plan. For this purpose there is Revision Plan Section in each chapter which student should prepare while going through the study material. This will be useful at the time of final revision before final exam for quick & effective revision.

Revision Plan

Prepare Your Revision plan today!

After attempting Exercise Sheet, please fill below table as per the instruction given.

- Write Question Number (QN) which you are unable to solve at your own in **column A**.
- After discussing the Questions written in **column A** with faculty, strike off them in the manner so that you can see at the time question number during Revision, to solve such questions again.
- Write down the Question Number you feel are important or good in the **column B**.

EXERCISE	COLUMN A	COLUMN B
	Questions unable to solve in first attempt	Good or Important questions
Exercise-1		
Exercise-2		
Exercise-3		
Exercise-4		

Revision Strategy:

Whenever you wish to revision this chapter, follow the following steps-

- Step-1:** Review your theory notes.
- Step-2:** Solve Questions of column A
- Step-3:** Solve Questions of Column B
- Step-4:** Solve questions from other Question Bank, Problem book etc.

Online Solutions

Self explanatory and detailed solution of all exercises mentioned above are available on Career Point website www.careerpoint.ac.in

SOLUTION

EXERCISE-1

Answer Key & Solution

Question Number	Solution	Question Number	Solution	Question Number	Solution	Question Number	Solution
1	Click Here	30	Click Here	59	Click Here	88	Click Here
2	Click Here	31	Click Here	60	Click Here	89	Click Here
3	Click Here	32	Click Here	61	Click Here	90	Click Here
4	Click Here	33	Click Here	62	Click Here	91	Click Here
5	Click Here	34	Click Here	63	Click Here	92	Click Here
6	Click Here	35	Click Here	64	Click Here	93	Click Here
7	Click Here	36	Click Here	65	Click Here	94	Click Here
8	Click Here	37	Click Here	66	Click Here	95	Click Here
9	Click Here	38	Click Here	67	Click Here	96	Click Here
10	Click Here	39	Click Here	68	Click Here	97	Click Here
11	Click Here	40	Click Here	69	Click Here	98	Click Here
12	Click Here	41	Click Here	70	Click Here	99	Click Here
13	Click Here	42	Click Here	71	Click Here	100	Click Here
14	Click Here	43	Click Here	72	Click Here	101	Click Here
15	Click Here	44	Click Here	73	Click Here	102	Click Here
16	Click Here	45	Click Here	74	Click Here	103	Click Here
17	Click Here	46	Click Here	75	Click Here	104	Click Here
18	Click Here	47	Click Here	76	Click Here	105	Click Here
19	Click Here	48	Click Here	77	Click Here	106	Click Here
20	Click Here	49	Click Here	78	Click Here	107	Click Here
21	Click Here	50	Click Here	79	Click Here	108	Click Here
22	Click Here	51	Click Here	80	Click Here	109	Click Here
23	Click Here	52	Click Here	81	Click Here	110	Click Here
24	Click Here	53	Click Here	82	Click Here	111	Click Here
25	Click Here	54	Click Here	83	Click Here	112	Click Here
26	Click Here	55	Click Here	84	Click Here	113	Click Here
27	Click Here	56	Click Here	85	Click Here	114	Click Here
28	Click Here	57	Click Here	86	Click Here	115	Click Here
29	Click Here	58	Click Here	87	Click Here		

Sol.1 [2]

$$V.P. \propto \frac{1}{BP}$$

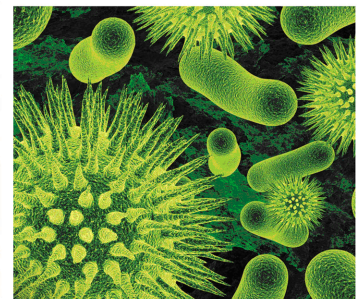
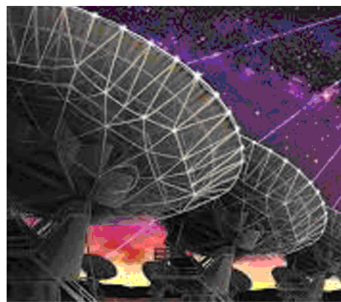
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PHYSICS

Class 12

Electrodynamics

[A]

- ◆ Electrostatics
- ◆ Gauss's Law
- ◆ Capacitance
- ◆ Current Electricity & Electrical Instrument

[B]

- ◆ Magnetism & Magnetic material
- ◆ Magnetic effect of current
- ◆ Electro Magnetic Induction
- ◆ Alternating Current
- ◆ Electro Magnetic Wave

Optics

RAY OPTICS

- ◆ Reflection at Plane Surface
- ◆ Reflection at Curved Surface
- ◆ Refraction at Plane Surface
- ◆ Refraction at Curved Surface
- ◆ Prism (Deviation & Dispersion)
- ◆ Optical Instruments

Wave Optics

- ◆ Interference of Light
- ◆ Diffraction of Light
- ◆ Polarisation

Modern Physics

- ◆ Atomic Structure
- ◆ Matter Waves
- ◆ Photoelectric Effect
- ◆ X-Rays
- ◆ Nuclear Physics
- ◆ Semiconductor & Electronic Devices

Features of The Product

This study material is especially designed for NEET aspirants. The entire study material is arranged in such a way so that the learning process progresses gradually from the basic to advanced stages. This easy-to-grasp material enables students to apply the fundamentals they have learned and boost their confidence to tackle the problems asked in the NEET and other medical competitive examinations.

Key Features of the Chapter

Theory & Concepts

Theory provides all the basic concepts in clear and precise manner. It comprises all the related and required diagrams, tables, graphs, real life examples, info graphics, conceptual questions that makes it more comprehensive. It also highlights tips and tricks, facts, notes, misconceptions, key points, and problem solving tactics.

ELECTRO MAGNETIC INDUCTION

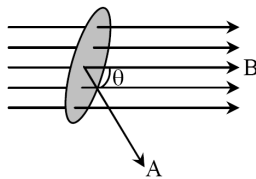
KEY CONCEPT

1. Magnetic Flux

- (a) The number of lines of flux passing through an area held perpendicular to the field is equal to the magnetic flux linked with that plane.
- (b) Mathematically, magnetic flux is the product of the field and the area of the plane. i.e.

$$\phi = \vec{B} \cdot \vec{A} = BA \cos \theta$$

is the angle between Magnetic induction and area vector (area vector is perpendicular to the plane of the area).



- (c) This is a scalar quantity.
- (d) Unit : MKS - weber or Tesla- m^2
or N-m /amp.
CGS - Maxwell or Gauss- cm^2
1 weber (wb) = 1 Tesla- m^2
 $= 1 \times 10^8$ Maxwell = 10^8 Gauss- cm^2

Note: (i) $\text{weber} = \frac{\text{newton}}{\text{amp.m}} \times m^2 = \frac{\text{newton .m}}{\text{amp}}$
 $= \frac{\text{joule}}{\text{amp}} = \frac{\text{volt} \times \text{coul}}{\text{amp}}$
 $= \frac{\text{volt} \times \text{amp .sec}}{\text{amp}} = \text{volt.sec.}$

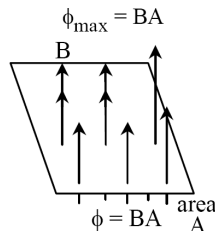
(ii) $\text{weber} = \frac{\text{volt} \times \text{coul}}{\text{amp}} = \text{ohm-coul.}$

(iii) $\text{weber} = \text{volt-sec}$
 $= \frac{\text{volt}}{\text{amp / sec}} \times \text{amp} = \text{henry-amp.}$

(e) Dimension : [$ML^2 T^{-2} A^{-1}$]

(f) Net flux leaving a surface = $\phi = \oint \vec{B} \cdot d\vec{s}$

- (g) If $\theta = 0$ i.e. area is held perpendicular to the Magnetic lines of force, then flux from the surface is maximum.



- (h) If $\theta = 90^\circ$ i.e. area is held parallel to lines of force, then flux from the surface is zero. i.e. $\phi = BA \cos 90^\circ = 0$

- (i) Net flux linked with a closed surface is zero. i.e.

$$\phi = \oint \vec{B} \cdot d\vec{s} = 0$$

WHY ? This is because

Magnetic lines of force are closed curves. So the number of lines entering a closed surface is equal to the number of lines leaving the surface. Hence net flux = 0.

- (j) Flux linked with a surface depends on the following quantities :

- (i) Intensity of magnetic field B .
 (ii) Area of the surface A .
 (iii) Orientation of surface relative to magnetic field.

Ex.1 At certain location in the northern hemisphere, the earth's magnetic field has a magnitude of $42 \mu T$ and points down ward at 57° to vertical. The flux through a horizontal surface of area $2.5 m^2$ will be-

(given $\cos 33^\circ = 0.839$, $\cos 57^\circ = 0.545$)

- (1) 42×10^{-6} Wb (2) 42×10^{-6} Wb/ m^2
 (3) 57×10^{-6} Wb (4) 57×10^{-6} Wb/ m^2

Sol. (3) The flux through the area is

$$\phi = BA \cos 57^\circ = 42 \times 10^{-6} \times 2.5 \times 0.545$$

$$= 57 \times 10^{-6} \text{ Wb.}$$

2. Faraday's Laws of Electromagnetic Induction

- (a) Whenever the number of magnetic lines of force or magnetic flux passing through a circuit changes an emf is produced in the circuit called induced emf.
- (b) If the circuit is closed a current flows through it called induced current.
- (c) The induced emf is given by rate of change of magnetic flux linked with the circuit i.e.

$$e = \frac{d\phi}{dt} \quad \text{or} \quad e = \frac{d(N\phi)}{dt}$$

where e = induced emf

N = Total number of turns.

- (d) emf is induced in the circuit only till there is a change in the flux linked with it.

- (e) From $e = \frac{d\phi}{dt}$, we can say that 1 Volt = $\frac{1 \text{wb}}{\text{sec}}$

3. Lenz's Law

- (a) This gives the direction of induced emf.
- (b) According to this law, the direction of induced emf or current in the coil is such a way such as to oppose the change that produces it.
- (c) From Lenz's law and Faraday's Law, induced emf is given by $e = - \frac{d\phi}{dt}$, Where minus sign is to show that emf opposes the change of flux linked with it.
- (d) This law is based upon Law of conservation of energy.

In Chapter Examples

To clarify the application of theory & concept accurately & correctly, there is number of solved in-chapter questions following each topic. It proves practically very effective to understand and correct application of related theory.

Ex.3 A rectangular coil of size 10 cm × 20 cm has 60 turns. It is rotating in magnetic field 0.5 Wb/m² with a rate of 1800 revolutions per minutes. The maximum induced e.m.f. across the ends of the coil is-

- (1) 111 V (2) 112 V (3) 113 V (4) 114 V

Sol. (4) Given, area = 10 × 20 cm² = 200 × 10⁻⁴ m²

$$B = 0.5 \text{ T}$$

$$N = 60$$

$$\omega = 2\pi \times 1800/60$$

$$\therefore e = - \frac{d(N\phi)}{dt} = -N \frac{d}{dt} (BA \cos \omega t)$$

$$= NBA\omega \sin \omega t$$

$$\therefore e_{\max} = NAB\omega$$

$$= 60 \times 2 \times 10^{-2} \times 0.5 \times 2\pi \times 1800/60$$

$$= 113 \text{ volt.}$$

Ex.4 A closed coil of copper whose area is 1 m × 1 m is free to rotate about an axis. The coil is placed perpendicular to a magnetic field of 0.10 Wb/m². It is rotated through 180° in 0.01 second. The induced e.m.f. and induced current in the coil will respectively be-

(The resistance of the coil is 2.0 Ω)

- (1) 20 V, 10A (2) 10 V, 20 A

- (3) 10 V, 10 A (4) 20 V, 20 A

Sol. (1) The change in flux linked with the coil on rotating it through 180° is

$$= nAB - (-nAB) = 2nAB$$

$$\therefore \text{induced e.m.f.} = - \frac{d\phi}{dt}$$

$$= 2nAB/dt \text{ (numerically)} = \frac{2 \times 1 \times 0.1}{0.01} = 20 \text{ V}$$

The coil is closed and has a resistance of 2.0 Ω. Therefore $i = 20/2 = 10\text{A}$.

Note : When the coil is opened, the induced e.m.f. is still present in it but the induced current becomes zero.

Points To Remember

This part contain important Theories, concepts, formulas of chapter at one place in short manner, So that student can revise all these in short time.

POINTS TO REMEMBER

- The unit of magnetic flux ϕ is weber. Since $B = \phi/A$, so the unit of magnetic field is also expressed as 'weber/meter²'. That is why the magnetic field induction B is also called the 'magnetic flux density'. As we have read, the unit of B is also newton/(ampere-meter).
- C.G.S. unit of flux is Maxwell. 1 weber = 10⁸ Maxwell.
- 1 weber/m² = 1 Tesla.
- If a plane is parallel to the magnetic field, then no flux-line will pass through it and the magnetic flux linked with that plane will be zero.
- Magnetic flux can change in a number of ways, Some of them are-
 - If a coil with plane area A be kept perpendicular to a magnetic field B, then the magnetic flux linked with the coil will be $\phi_1 = BA$.
 - If the coil is suddenly withdrawn from the magnetic field, then the magnetic flux linked with the coil will become $\phi_2 = 0$. Hence, the change in flux

$$\Delta\phi = \phi_2 - \phi_1 = 0 - BA = -BA$$

Solved Examples

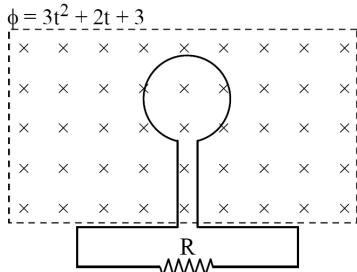
To understand the concept application, in end of the each chapter there is sufficient number of solved examples.

SOLVED EXAMPLES

- Ex.1** A loop of wire is placed in a magnetic field $\vec{B} = 0.02 \hat{i}$ tesla. Then the flux through the loop is its area vector is $\vec{A} = 30 \hat{i} + 16 \hat{j} + 23 \hat{k}$ cm², is.
- (1) $60 \mu\text{W}$ (2) $32 \mu\text{Wb}$
 (3) $46 \mu\text{Wb}$ (4) $138 \mu\text{Wb}$

Sol.(1) $\phi = \vec{B} \cdot \vec{A}$
 $= (0.02 \hat{i}) \cdot (30 \hat{i} + 16 \hat{j} + 23 \hat{k}) \times 10^{-4}$
 $= 0.6 \times 10^{-4} \text{ Wb} = 60 \mu\text{Wb}$

- Ex. 2** The magnetic flux passing perpendicular to the plane of the coil and directed into the paper is varying according to the relation.



Where ϕ is in milliwbers and t is in seconds. Then the magnitude of emf induced in the loop when $t = 2$ second is-

- (1) 31 mV (2) 19 mV (3) 14 mV (4) 6 mV
- Sol.(3)** The induced emf

$$E = -d\phi/dt = -\frac{d}{dt}(3t^2 + 2t + 3) \times 10^{-3}$$

(because given flux is in mWb).

$$\text{Thus } E = (-6t - 2) \times 10^{-3}$$

at $t = 2$ sec,

$$E = (-6 \times 2 - 2) \times 10^{-3} = -14 \text{ mV.}$$

Note : The direction of the current flow in the resistance R would be anticlockwise. Think why ?

- Ex.3** 5.5×10^{-4} magnetic flux lines are passing through a coil of resistance 10 ohm and number of turns 1000. If the number of flux lines reduces to 5×10^{-5} in 0.1 sec. The electromotive force and the current induced in the coil will be respectively-

- (1) 5V, 0.5 A
 (2) 5×10^{-4} V, 5×10^{-4} A
 (3) 50 V, 5 A
 (4) none of the above.

- Sol.(1)** Initial magnetic flux $\phi_1 = 5.5 \times 10^{-4}$ weber.

Final magnetic flux $\phi_2 = 5 \times 10^{-5}$ weber.

\therefore change in flux

$$\Delta\phi = \phi_2 - \phi_1 = (5 \times 10^{-5}) - (5.5 \times 10^{-4})$$

$$= -50 \times 10^{-5} \text{ weber.}$$

Time interval for this change, $\Delta t = 0.1$ sec.

\therefore induced emf in the coil

$$e = -N \frac{\Delta\Phi}{\Delta t} = -1000 \times \frac{(-50 \times 10^{-5})}{0.1} = 5 \text{ volt.}$$

Resistance of the coil, $R = 10$ ohm. Hence induced current in the coil is

$$i = \frac{e}{R} = \frac{5 \text{ volt}}{10 \text{ ohm}} = 0.5 \text{ ampere.}$$

- Ex.4** A gramophone disc of brass of diameter 30 cm rotates horizontally at the rate of 100/3 revolutions per minute. If the vertical component of the earth's magnetic field be 0.01 weber / meter², then the emf induced between the centre and the rim of the disc will be-

- (1) 7.065×10^{-4} V (2) 3.9×10^{-4} V
 (3) 2.32×10^{-4} V (4) none of the above.

- Sol. (2)** Magnetic flux passing through the disc is $\phi = BA$

$$= 0.01 \frac{\text{weber}}{\text{meter}^2} \times 3.14 \times (15 \times 10^{-2} \text{ meter})^2$$

$$= 7.065 \times 10^{-4} \text{ weber.}$$

The line joining the centre and the circumference of the disc cuts 7.065×10^{-4} weber flux in one round. So, the rate of cutting flux (i.e. induced emf)

= flux x number of revolutions per second

$$= 7.065 \times 10^{-4} \times \frac{100}{60 \times 3} = 3.9 \times 10^{-4} \text{ volt.}$$

- Ex.5** A closed coil consists of 500 turns on a rectangular frame of area 4.0 cm² and has a resistance of 50 ohm. The coil is kept with its plane perpendicular to a uniform magnetic field of 0.2 weber/meter². The amount of charge flowing through the coil if it is turned over (rotated through 180°) will be -

- (1) 1.6×10^{-19} C (2) 1.6×10^{-9} C
 (3) 1.6×10^{-3} C (4) 1.6×10^{-2} C

- Sol. (3)** The magnetic flux passing through each turn of a coil of area A, perpendicular to a magnetic field B is given by

$$\phi_1 = BA.$$

The magnetic flux through it on rotating it through 180° will be

$\phi_2 = -BA$. (- sign is put because now the flux lines

enters the coils through the outer face)

\therefore change in magnetic flux

$$\Delta\phi = \phi_1 - \phi_2 = -BA - (-BA) = -2BA.$$

Suppose this change takes in time Δt . According to Faraday's law, the emf induced in the coil is given by

$$e = -N \frac{\Delta\Phi}{\Delta t} = \frac{2NBA}{\Delta t},$$

where N is number of turns in the coil. The current in the coil will be

$$i = \frac{e}{R} = \frac{1}{R} \frac{2NBA}{\Delta t}$$

where R is the resistance of the circuit. The current persists only during the change of flux i.e. for the time interval Δt second. So, the charge passed through the circuit is

$$q = i \times \Delta t = \frac{2NBA}{R}.$$

Here $N = 500$, $B = 0.2$ weber/meter²,

$A = 4.0 \text{ cm}^2 = 4.0 \times 10^{-4} \text{ meter}^2$ and $R = 50$ ohm.

$$\therefore q = \frac{2 \times 500 \times 0.2 \times 4.0 \times 10^{-4}}{50} = 1.6 \times 10^{-3} \text{ coulomb.}$$

Note : Rotating the coil slow or fast has no effect on the charge flow through the coil. Charge flow depends upon the total change in magnetic flux, not on the rate of change of magnetic flux.

Practice Exercises

Exercise Level -1 : It contains TOPIC WISE single objective correct (SCQ) type concept building questions.

EXERCISE # 1

Q.1 A flux of 1m Wb passes through a strip having an area $A = 0.02 \text{ m}^2$. The plane of the strip is at an angle of 60° to the direction of a uniform field B. The value of B is-
 (1) 0.1 T (2) 0.058 T
 (3) 4.0 mT (4) none of the above.

Q.2 A small loop of area of cross section 10^{-4} m^2 is lying concentrically and coplanar inside a bigger loop of radius 0.628 m. A current of 10 A is passed in the bigger loop. The smaller loop is rotated about its diameter with an angular velocity ω . The magnetic flux linked with the smaller loop will be-
 (1) $10^{-7} \sin \omega t$ (2) $10^{-7} \cos \omega t$
 (3) $10^{-9} \sin \omega t$ (4) $10^{-9} \cos \omega t$

Q.3 A coil of N turns and area A is rotated at the rate of n rotations per second in a magnetic field of intensity B, the magnitude of the maximum magnetic flux will be-
 (1) NAB (2) nAB (3) NnAB (4) $2\pi nNAB$

Q.4 The number of turns in a long solenoid is 500. The area of cross-section of solenoid is $2 \times 10^{-3} \text{ m}^2$. If the value of magnetic induction, on passing a current of 2 amp, through it is 5×10^{-3} Tesla, the magnitude of magnetic flux connected with it in Weber will be-
 (1) 5×10^{-3} (2) 10^{-2} (3) 10^{-5} (4) 2.5

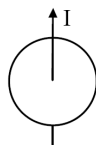
Q.5 The instantaneous flux associated with a closed circuit of 10Ω resistance is indicated by the following reaction $\phi = 6t^2 - 5t + 1$, then the value in amperes of the induced current at $t = 0.25$ sec will be-
 (1) 1.2 (2) 0.8 (3) 6 (4) 0.2

Q.6 A cylindrical bar magnetic is lying along the axis of a circular coil. If the magnet is rotated about the axis of the coil then-
 (1) e.m.f. will be induced in the coil
 (2) Only induced current will be generated in the coil
 (3) No current will be induced in the coil
 (4) Both e.m.f. and current will be induced in the coil

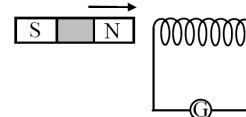
Q.7 When a coil of area 2 cm^2 and having 30 turns, whose plane is normal to the magnetic field, is drawn out of the magnetic field, a charge of 1.5×10^{-4} coulomb flows in the circuit. If its resistance is 40 ohm, then the magnetic flux density in Tesla will be-
 (1) 10 (2) 0.1 (3) 1 (4) 0.01

Q.8 When a magnet is being moved towards a coil, the induced emf does not depend upon-
 (1) the number of turns of the coil
 (2) the motion of the magnet
 (3) the magnetic moment of the magnet
 (4) the resistance of the coil

Q.9 A wire carrying current I, lie on the axis of a conducting ring. The direction of the induced current in the ring, when I is decreasing at a steady rate is-
 (1) clockwise
 (2) anticlockwise
 (3) alternatively clock and anticlockwise
 (4) no induced current flow in the ring



Q.10 A magnet is brought towards a fixed coil rapidly. Due to this induced emf, current and charge are E, I and Q respectively. If the speed of the magnet is doubled, then wrong statement is-



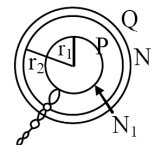
(1) E increases (2) I increases
 (3) Q remains unchanged (4) Q increases

Q.11 A field of $5 \times 10^4/\pi$ ampere-turns/metre acts at right angles to a coil of 50 turns of area 10^{-2} m^2 . The coil is removed from the field in 0.1 second. Then the induced emf in the coil is-
 (1) 0.1 V (2) 80 KV
 (3) 7.96 V (4) none of the above

Q.12 A coil having n turns and area A is initially placed with its plane normal to the magnetic field B. It is then rotated through 180° in 0.2 sec. The emf induced at the ends of the coils is-
 (1) 0.1 nAB (2) nAB (3) 5 nAB (4) 10 nAB

Q.13 A conducting circular loop is placed in a uniform magnetic field $B = 40 \text{ mT}$ with its plane perpendicular to the field. If the radius of the loop starts shrinking at a constant rate of 2mm/s, then the induced emf in the loop at an instant when its radius is 1.0 cm is-
 (1) $0.1 \pi \mu \text{ V}$ (2) $0.2 \pi \mu \text{ V}$
 (3) $1.0 \pi \mu \text{ V}$ (4) $1.6 \pi \mu \text{ V}$

Q.14 Two plane circular coils P and Q have radii r_1 and r_2 , respectively, ($r_1 < r_2$) and are coaxial as shown in fig. The number of turns in P and Q are respectively N_1 and N_2 . If current in coil Q is varied steadily at a rate x ampere/sec then the induced emf in the coil P will be approximately-



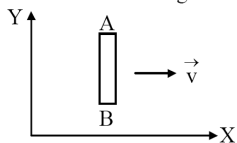
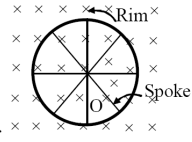
(1) $\mu_0 N_1 N_2 \pi r_1^2$ (2) $\mu_0 N_1 N_2 \pi r_1^2 x$
 (3) $\mu_0 N_1 N_2 \pi r_1^2 x / 2r_2$ (4) 0

Q.15 The rate of change of magnetic flux density through a circular coil of area 10^{-2} m^2 and number of turns 100 is $10^3 \text{ Wb/m}^2/\text{s}$. The value of induced e.m.f. will be -
 (1) 10^{-2} V (2) 10^{-3} V (3) 10V (4) 10^3 V

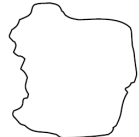
Q.16 A long solenoid contains 1000 turns/cm and an alternating current of peak value 1A is flowing in it. A search coil of area of cross-section $1 \times 10^{-4} \text{ m}^2$ and having 50 turns is placed inside the solenoid with its plane perpendicular to the axis of the solenoid. A peak voltage of $2\pi^2 \times 10^{-2} \text{ V}$ is produced in the search coil. The frequency of current in the solenoid will be -
 (1) 50 Hz (2) 100 Hz (3) 500 Hz (4) 1000 Hz

Exercise Level -2 : It contains single objective type good quality questions on all the concepts of the chapter in mixed manner.

EXERCISE # 2

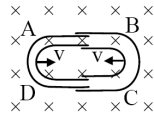
- Q.1** The coefficient of mutual inductance of two circuits A and B is 3 mH and their respective resistances are 10 ohm and 4 ohm. How much current should change in 0.02 second in the circuit A. So that the induced current in B should be 0.006 ampere-
 (1) 0.24 amp (2) 1.6 amp
 (3) 0.18 amp (4) 0.16 amp
- Q.2** The coefficient of self inductance is 5 mH. If the emf of the cell in the circuit is 1.1 volt and at any instant the rate of increase of current is 6 ampere/second, then at that instant, the resultant e.m.f. in the circuit will be-
 (1) 1.13 V (2) 0.13 V (3) 1.07 V (4) 1.4 V
- Q.3** The phase difference between the flux linkage and the induced e.m.f. in a rotating coil in a uniform magnetic field is-
 (1) π (2) $\pi/2$ (3) $\pi/4$ (4) $\pi/6$
- Q.4** A dynamo is sometimes said to generate electricity. It actually acts as a source of-
 (1) charge (2) magnetism
 (3) e.m.f. (4) energy
- Q.5** In a step-down transformer the number of turns in-
 (1) primary are less
 (2) primary are more
 (3) primary and secondary are equal
 (4) primary are infinite
- Q.6** An inductor coil stores 32 J of magnetic field energy and dissipates energy as heat at the rate of 320 W, when a current of 4 A is passed through it. The time constant of the circuit when this coil is joined across an ideal battery will be-
 (1) 0.2 s (2) 0.3 s (3) 0.4 s (4) 0.5 s
- Q.7** A solenoid of inductance 50 mH and resistance 10 Ω is connected to a battery of 6 V. The time elapsed before the current acquires half of its steady-state value will be-
 (1) 3.01 s (2) 3.02 s (3) 3.03 s (4) 3.5 ms
- Q.8** An inductor - resistance battery circuit is switched on at $t = 0$. If the emf of the battery is E. The charge which passes through the battery in one time constant τ will be-
 (1) $i_0 \tau/e$ (2) $i_0 e/\tau$ (3) $\tau e/i_0$ (4) $i_0 e \tau$
- Q.9** Two conducting circular loops of radii R_1 and R_2 are placed in the same plane with their centres coinciding. The mutual inductance between them assuming $R_2 \ll R_1$, will be-
 (1) $\frac{\mu_0 \pi R_2^2}{2R_1}$ (2) $\frac{\mu_0 R_2^2}{2R_1}$ (3) $\frac{\mu_0 R_2}{2R_1}$ (4) $\frac{\mu_0 \pi R_2^2}{2R_1^2}$
- Q.10** A conductor rod AB moves parallel to X-axis in a uniform magnetic field, pointing in the positive Z-direction. The end A of the rod gets-

 (1) positively charged
 (2) negatively charged
 (3) neutral
 (4) first positively charged and then negatively charged
- Q.11** A closed coil of copper whose area is $1\text{m} \times 1\text{m}$ is free to rotate about an axis. The coil is placed perpendicular to a magnetic field of 0.10 Wb/m^2 . It is rotated through 180° in 0.01 second. The induced e.m.f. and induced current in the coil will respectively be-
 (The resistance of the coil is $2.0\ \Omega$)
 (1) 20 V, 10A (2) 10 V, 20 A
 (3) 10 V, 10 A (4) 20 V, 20 A
- Q.12** A bicycle wheel of radius 0.5 m has 32 spokes. It is rotating at the rate of 120 revolutions per minute, perpendicular to the horizontal component of earth's magnetic field $B_H = 4 \times 10^{-5}$ Tesla. The emf induced between the rim and the centre of the wheel will be-

 (1) 6.28×10^{-5} V (2) 4.8×10^{-5} V
 (3) 6.0×10^{-5} V (4) 1.6×10^{-5} V
- Q.13** The current in a coil varies with respect to time t as $I = 3t^2 + 2t$. If the inductance of coil be 10 mH, the value of induced e.m.f. at $t = 2\text{s}$ will be-
 (1) 0.14 V (2) 0.12 V (3) 0.11 V (4) 0.13 V
- Q.14** If circular coil with N_1 turns is changed in to a coil of N_2 turns. What will be the ratio of self inductances in both cases-
 (1) $\frac{N_1}{N_2}$ (2) $\frac{N_2}{N_1}$ (3) $\frac{N_1^2}{N_2^2}$ (4) $\sqrt{\frac{N_1}{N_2}}$
- Q.15** A solenoid has an inductance of 50 mH and a resistance of $0.025\ \Omega$. If it is connected to a battery, how long will it take for the current to reach one half of its final equilibrium value ?
 (1) 1.34 s (2) 1.2 s (3) 6.32 s (4) 0.23 s
- Q.16** 5.5×10^{-4} magnetic flux lines are passing through a coil of resistance 10 ohm and number of turns 1000. If the number of flux lines reduces to 5×10^{-5} in 0.1 sec. The electromotive force and the current induced in the coil will be respectively-
 (1) 5V, 0.5 A (2) 5×10^{-4} V, 5×10^{-4} A
 (3) 50 V, 5 A (4) none of the above
- Q.17** A closed coil consists of 500 turns on a rectangular frame of area 4.0 cm^2 and has a resistance of 50 ohm. The coil is kept with its plane perpendicular to a uniform magnetic field of 0.2 Weber/meter². The amount of charge flowing through the coil if it is turned over (rotated through 180°) will be -
 (1) 1.6×10^{-19} C (2) 1.6×10^{-9} C
 (3) 1.6×10^{-3} C (4) 1.6×10^{-2} C
- Q.18** When the current through a solenoid increases at a constant rate, the induced current-
 (1) is a constant and is in the direction of the inducing current
 (2) is a constant and is opposite to the direction of the inducing current
 (3) increase with time and is in the direction of the inducing current
 (4) increase with time and opposite to the direction of the inducing current

EXERCISE # 3

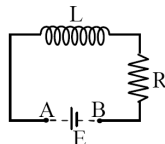
- Q.1** A magnet is allowed to fall through a metal ring. During fall its acceleration will be- [AIPMT-1996]
 (1) equal to g
 (2) greater than g
 (3) less than g
 (4) less than or greater than g depending on which pole is pointing downwards
- Q.2** An ideal transformer is used on 220 V line to deliver 2A at 110 V. The current through the primary is- [AIPMT-1996]
 (1) 10A (2) 5A (3) 1A (4) 0.1A
- Q.3** Which of the following combination has the dimension of time- [AIPMT-1996]
 (1) R/L (2) LC (3) 1/LC (4) L/R
- Q.4** The primary winding of a transformer has 500 turns whereas its secondary has 5000 turns. The primary is connected to a supply of 20V, 50 Hz. The secondary will have an output of- [AIPMT-1997, AIIMS-1999]
 (1) 200 V, 50 Hz (2) 2 V, 50 Hz
 (3) 200 V, 500 Hz (4) 2 V, 5 Hz
- Q.5** Two coil have a mutual inductance 0.005 H. The current changes in first coil according to equation $I = I_0 \sin \omega t$, where $I_0 = 2A$ and $\omega = 100\pi$ rad/sec. The maximum value of induced emf in second coil is- [AIPMT-1998]
 (1) $4\pi V$ (2) $3\pi V$ (3) $2\pi V$ (4) πV
- Q.6** Turn ratio of a step-up transformer is 1 : 25. If current in load coil is 2A, then the current in primary coil will be- [AIPMT-1998]
 (1) 25A (2) 50A (3) 0.25A (4) 0.5A
- Q.7** Initially plane of coil is parallel to the uniform magnetic field B . In time Δt it makes to perpendicular to the magnetic field, then charge flows through the coil depends on this time as- [AIPMT-1999]
 (1) $\propto \Delta t$ (2) $\propto \frac{1}{\Delta t}$
 (3) $\propto (\Delta t)^0$ (4) $\propto (\Delta t)^2$
- Q.8** For an inductor coil $L = 0.04$ H, then work done by source to establish a current of 5A in it is- [AIPMT-1999]
 (1) 0.5 J (2) 1.00 J (3) 100 J (4) 20 J
- Q.9** For a coil having $L = 2$ mH, current flow through it is $I = t^2 e^{-t}$ then the time at which induced emf become zero- [AIPMT-2001]
 (1) 2 sec (2) 1 sec (3) 4 sec (4) 3 sec
- Q.10** The magnetic flux through a circuit of resistance R changes by an amount $\Delta\phi$ in a time Δt . The total quantity of electric charge Q that passes any point in the circuit during the time Δt is represented by- [AIPMT-2004]
 (1) $Q = \frac{\Delta\phi}{R}$ (2) $Q = \frac{\Delta\phi}{\Delta t}$
 (3) $Q = R \cdot \frac{\Delta\phi}{\Delta t}$ (4) $Q = \frac{1}{R} \cdot \frac{\Delta\phi}{\Delta t}$
- Q.11** A coil of 40 henry inductance is connected in series with a resistance of 8 ohm and the combination is joined to the terminals of a 2 volt battery. The time constant of the circuit is- [AIPMT-2004]
 (1) $\frac{1}{5}$ sec (2) 40 sec (3) 20 sec (4) 5 sec
- Q.12** As a result of change in the magnetic flux linked to the closed loop shown in the figure, an e.m.f. V volt is induced in the loop. The work done (joules) in taking a charge Q coulomb once along the loop is- [AIPMT-2005]
- 
- (1) QV (2) $QV/2$ (3) $2QV$ (4) Zero
- Q.13** Two coils of self inductances 2mH and 8 mH are placed so close together that the effective flux in one coil is completely linked with the other. The mutual inductance between these coils is- [AIPMT-2006]
 (1) 10 mH (2) 6 mH (3) 4 mH (4) 16 mH
- Q.14** The primary and secondary coils of a transformer have 50 and 1500 turns respectively. If the magnetic flux ϕ linked with the primary coil is given by $\phi = \phi_0 + 4t$, where ϕ is in webers, t is time in seconds and ϕ_0 is a constant, the output voltage across the secondary coil is- [AIPMT-2007]
 (1) 30 volts (2) 90 volts
 (3) 120 volts (4) 220 volts
- Q.15** A transformer is used to light a 100 W and 110 V lamp from a 220 V mains. If the main current is 0.5 amp, the efficiency of the transformer is approximately- [AIPMT-2007]
 (1) 10% (2) 30% (3) 50% (4) 90%
- Q.16** An electric bulb in series with a large inductor when connected across a DC source take a little time before reaching a stable glow. If an iron core is inserted to the inductor, the delay will- [AIIMS-1994]
 (1) increases
 (2) decreases
 (3) remain the same
 (4) may change in either direction depending upon the values of inductance and resistance
- Q.17** The device that does not work on the principle of mutual induction is- [AIIMS-1996]
 (1) motor (2) tesla coil
 (3) transformer (4) induction coil
- Q.18** To induce an emf in a coil, the magnetic flux linking- [AIIMS-1996]
 (1) can either increase or decrease
 (2) must remain constant
 (3) must increase
 (4) must decrease
- Q.19** The bob of a simple pendulum is replaced by a magnet. The oscillation are set along the length of the magnet. A copper coil is added so that one pole of the magnet passes in and out of the coil. The coil is shortcircuited. Then which of the following happens? [AIIMS-1996]
 (1) period does not change
 (2) oscillations are damped
 (3) amplitude increases
 (4) period decreases
- Q.20** A coil of copper having 1000 turns is placed in a magnetic field ($B = 4 \times 10^{-3}$ T) perpendicular to its plane. The cross sectional area of the coil is 0.05 m^2 . If it turns through 180° in 0.01 sec, then the induced emf in the coil is- [AIIMS-1997]
 (1) 0.4 V (2) 0.2 V (3) 40 V (4) 4 V

EXERCISE # 4

- Q.1** One conducting U tube can slide inside another as shown in figure, maintaining electrical contacts between the tubes. The magnetic field B is perpendicular to the plane of the figure. If each tube moves towards the other at a constant speed v , then the induced emf in the circuit, where ℓ is the width of each tube- [AIEEE-2005]



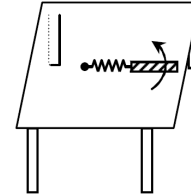
- (1) $2B\ell v$ (2) Zero (3) $-B\ell v$ (4) $B\ell v$
- Q.2** A coil of inductance 300 mH and resistance 2Ω is connected to a source of voltage 2V . The current reaches half of its steady state value in- [AIEEE-2005]
 (1) 0.3 s (2) 0.15 s (3) 0.1 s (4) 0.05 s
- Q.3** Which of the following units denotes the dimensions ML^2/Q^2 , where Q denotes the electric charge- [AIEEE-2006]
 (1) Weber (2) Wb/m^2 (3) Henry (4) H/m^2
- Q.4** In an AC generator, a coil with N turns, all of the same area A and total resistance R , rotates with frequency ω in a magnetic field B . The maximum value of emf generated in the coil is- [AIEEE-2006]
 (1) $NAB\omega$ (2) $NABR\omega$ (3) NAB (4) $NABR$
- Q.5** The flux linked with a coil at any instant 't' is given by $\phi = 10t^2 - 50t + 250$. The induced emf at $t = 3\text{ s}$ is- [AIEEE-2006]
 (1) 190 V (2) -190 V (3) -10 V (4) 10 V
- Q.6** An inductor ($L = 100\text{ mH}$), a resistor ($R = 100\Omega$) and a battery ($E = 100\text{V}$) are initially connected in series as shown in the figure. After a long time the battery is disconnected after short circuiting the points A and B. The current in the circuit 1 ms after the short circuit is- [AIEEE-2006]



- (1) 1 A (2) $1/e\text{ A}$ (3) $e\text{ A}$ (4) 0.1 A
- Q.7** An ideal coil of 10H is connected in series with a resistance of 5Ω and a battery of 5V . 2 seconds after the connection is made, the current flowing in amperes in the circuit is- [AIEEE-2007]
 (1) e (2) $e - 1$ (3) $(1 - e^{-1})$ (4) $(1 - e)$
- Q.8** Two coaxial solenoids are made by winding thin Cu wire over a pipe of cross-sectional area $A = 10\text{ cm}^2$ and length = 20 cm . If one of the solenoids has 300 turns and the other 400 turns, their mutual inductance is- [AIEEE-2008]
 (1) $2.4\pi \times 10^{-5}\text{ H}$ (2) $4.8\pi \times 10^{-4}\text{ H}$
 (3) $4.8\pi \times 10^{-5}\text{ H}$ (4) $2.4\pi \times 10^{-4}\text{ H}$
- Q.9** A coil is suspended in a uniform magnetic field, with the plane of the coil parallel to the magnetic lines of force. When a current is passed through the coil it starts oscillating; it is very difficult to stop. But if an aluminium plate is placed near to the coil, it stops. This is due to- [AIEEE-2012]

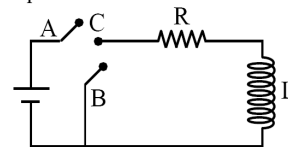
- (1) induction of electrical charge on the plate
 (2) shielding of magnetic lines of force as aluminium is a paramagnetic material
 (3) electromagnetic induction in the aluminium plate giving rise to electromagnetic damping
 (4) development of air current when the plate is placed

- Q.10** A metallic rod of length ' ℓ ' is tied to a string of length 2ℓ and made to rotate with angular speed ω on a horizontal table with one end of the string fixed. If there is a vertical magnetic field 'B' in the region, the e.m.f. induced across the ends of the rod is - [JEE-Main 2013]



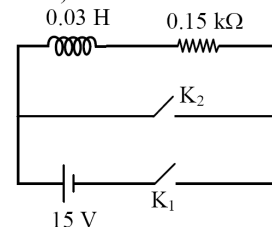
- (1) $\frac{4B\omega\ell^2}{2}$ (2) $\frac{5B\omega\ell^2}{2}$
 (3) $\frac{2B\omega\ell^2}{2}$ (4) $\frac{3B\omega\ell^2}{2}$

- Q.11** A circular loop of radius 0.3 cm lies parallel to a much bigger circular loop of radius 20 cm . The centre of the small loop is on the axis of the bigger loop. The distance between their centres is 15 cm . If a current of 2.0 A flow through the smaller loop, then the flux linked with bigger loop is- [JEE-Main 2013]
 (1) $3.3 \times 10^{-11}\text{ weber}$ (2) $6.6 \times 10^{-9}\text{ weber}$
 (3) $9.1 \times 10^{-11}\text{ weber}$ (4) $6 \times 10^{-11}\text{ weber}$
- Q.12** In the circuit shown here, the point C is kept connected to point A till the current flowing through the circuit becomes constant. Afterward, suddenly, point C is disconnected from point A and connected to point B at time $t = 0$. Ratio of the voltage across resistance and the inductor at $t = L/R$ will be equal to - [JEE-Main 2014]



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

- Q.13** An inductor ($L = 0.03\text{ H}$) and a resistor ($R = 0.15\text{ k}\Omega$) are connected in series to a battery of 15V EMF in a circuit shown below. The key K_1 has been kept closed for a long time. Then at $t = 0$, K_1 is opened and key K_2 is closed simultaneously. At $t = 1\text{ ms}$, the current in the circuit will be : ($e^5 \cong 150$) [JEE Main 2015]



- (1) 100 mA (2) 67 mA (3) 6.7 mA (4) 0.67 mA

Answer key

Above mentioned all exercises provided with answer key

EXERCISE-1																				
Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	2	4	1	1	4	3	3	4	4	4	1	4	4	3	4	1	2	3	2	1
Q.No.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	4	1	1	3	1	2	2	2	2	4	3	2	2	2	3	4	1	1	3	4
Q.No.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	1	3	4	1	1	1	4	3	4	2	2	2	3	3	3	3	4	1	4	3
Q.No.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78		
Ans.	3	2	1	3	2	2	2	1	2	1	3	1	1	2	3	1	2	2		

Revision Plan

We emphasize that every student should prepare his/her own revision plan. For this purpose there is Revision Plan Section in each chapter which student should prepare while going through the study material. This will be useful at the time of final revision before final exam for quick & effective revision.

Revision Plan

Prepare Your Revision plan today!

After attempting Exercise Sheet, please fill below table as per the instruction given.

- Write Question Number (QN) which you are unable to solve at your own in **column A**.
- After discussing the Questions written in **column A** with faculty, strike off them in the manner so that you can see at the time question number during Revision, to solve such questions again.
- Write down the Question Number you feel are important or good in the **column B**.

EXERCISE	COLUMN A	COLUMN B
	Questions unable to solve in first attempt	Good or Important questions
Exercise-1		
Exercise-2		
Exercise-3		
Exercise-4		

Revision Strategy:

Whenever you wish to revision this chapter, follow the following steps-

- Step-1:** Review your theory notes.
- Step-2:** Solve Questions of column A
- Step-3:** Solve Questions of Column B
- Step-4:** Solve questions from other Question Bank, Problem book etc.

Online Solutions

Self explanatory and detailed solution of all exercises mentioned above are available on Career Point website www.careerpoint.ac.in

ELECTRO MAGNETIC INDUCTION

EXERCISE-1

Answer Key & Solution

Question Number	Solution
1	Click Here
2	Click Here
3	Click Here
4	Click Here
5	Click Here
6	Click Here
7	Click Here
8	Click Here
9	Click Here
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Question Number	Solution
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Question Number	Solution
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Sol.1 [2]

$$\phi = BA \cos \theta \Rightarrow B = \frac{\phi}{A \cos \theta}$$

[Top](#)