2021
BIOLOGY
(Theory)
Full Marks – 70
Time – 3 Hours

General Instructions :

(i) *All questions are compulsory.*

(ii) *Please write down the serial number of the question before attempting it.*

(iii) *Marks for each question are indicated against it.*

SECTION – A

1. Choose the correct answer : 5×1=5

   (a) A flower that has only stamens is a –

   (i) unisexual flower   (ii) bisexual flower

   (iii) complete flower   (iv) neuter flower

   (b) Which of the following is a starting codon ?

   (i) UAA   (ii) UAC

   (iii) AUG   (iv) UUU

   (c) The word pathogen refers to –

   (i) healthy living organism   (ii) cultured micro-organism

   (iii) inoculated organism   (iv) disease causing organism

   (d) Biogas is mainly –

   (i) O_2 (ii) CO_2

   (iii) N_2 (iv) CH_4

   (e) Select the statement which best explains parasitism –

   (i) One organism is benefited

   (ii) Both the organisms are benefited

   (iii) One organism is benefited, other is not affected

   (iv) One organism is benefited, other is affected

P.T.O.

2. Fill in the blanks : 5×1=5

   (a) Biodiversity increases from the _____ to the equator .

   (b) The edible portion of apple is fleshy _____ .

   (c) Oparin suggested the formation of clusters or specialised droplets called _____ .

   (d) A sequence of nitrogenous bases that code for an amino acid is called _____ .

   (e) Normal value of Dissolved Oxygen (D.O) in water bodies is _____ mg / litre.

3. State whether the following statements are *True* or *False* : 4×1=4

   (a) Western Ghats and North-East are the most biodiversity rich zones.

   (b) Memory cells produce antibodies or kill infected cells.

   (c) Self pollination is also known as xenogamy.

   (d) Estrogen is secreted by Graafian follicle.

SECTION – B

4. Write *any two* points of difference between Ectotherms and Endotherms. 2

5. What is biopatent ? Which countries can award biopatents ? 1+1=2

6. Name the indicator species for highly polluted water. Also explain what is meant by biological magnification. 1+1=2

7. What is Cancer ? Write *any two* points of differences between malignant and benign tumour. 1+½+½=2

8. Why is the fern *Azolla* frequently grown with rice crop ? 2

9. (a) How do oral contraceptives prevent pregnancy ?   2

OR

(b) What is the difference between vasectomy and tubectomy ?   2

10. Write *any two* criteria for a molecule to be a genetic material.   1+1=2

SECTION – C

11. Explain the law of Segregation in detail with a diagram.   2+1=3

12. (a) Write down *any three* applications of gene cloning.   1+1+1=3

OR

(b) How is RNA interference used to make plants nematode resistant ?   3

13. What is Bt Cotton ? How can Bt cotton help farmers ?   1+2=3

14. What is Placenta ? Write its functions.   1+2=3

15. Explain Logistic growth or S-shaped curve or Sigmoid curve with a diagram.   2+1=3

16. What are the effects of soil erosion ?   3

17. The immune system has two types of lymphocytes - T Cells and B Cells. Why are these two so named ? What are their respective functions ?   1+1+1=3

18. Write the causative organism, mode of spread and prevention of malaria.   ½+1+1½=3

19. Trace the inheritance of colour blindness when a carrier woman marries a colour blind male. Also write down the situation in which a woman can be colour blind.   2+1=3

SECTION – D

20. (a) Explain with diagram, amplification of gene of interest using PCR.   3+2=5

OR

(b) What is the cause of ADA deficiency ? Explain the steps in gene therapy to treat SCID patient with a suitable diagram.   1+2+2=5

21. (a) What is transcription ? Explain the sequence of events during transcription. Why are both the strands of DNA not copied during transcription ? 1+2+2=5

OR

(b) What is evolution ? Explain Darwin's theory of evolution by Natural Selection. 1+4=5

22. (a) Describe the structure of a pollen grain and draw neat labelled diagrams of pollen germination. 3+2=5

OR

(b) Describe the structure of a human ovum with a diagram. Also write down *any four* points of differences between spermatogenesis and oogenesis. 3+2=5

_____

2021

CHEMISTRY

(Theory)

Full Marks – 70

Time – 3 Hours

General Instructions :

(i)   *All questions are compulsory.*

(ii)   *Marks for each question are indicated against it.*

(iii) *Use log tables if necessary.*

(iv)   *Use of calculator is not allowed.*

1. Aldehydes and ketones can be distinguished by –   1

    (a) Tollen's reagent   (b) Sodium bicarbonate test

    (c) $FeCl_3$ solution   (d) Carbylamine test

2. Which of the following amine give carbylamine test ?   1

    (a) $C_2H_5NH_2$ (b) $(C_2H_5)_2NH$

    (c) $(C_2H_5)_3N$ (d) $CH_3NHC_2H_5$

3. The IUPAC name for $CH_2=CHCH_2NHCH_3$ is –   1

    (a) N - methylprop - 1 - en - 3 - amine

    (b) N - methylprop - 2 - en - 1 - amine

    (c) 4 - aminebut -1 - ene

    (d) 4 - aminepent -1- ene

4. The IUPAC name of the compound   1
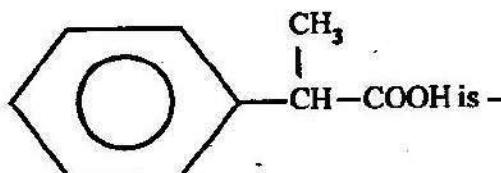
    (a) 2 - methylbenzoic acid   (b) 2 - methyl - 2 - phenylethanoic acid

    (c) 2 - phenylpropanoic acid   (d) 2 - phenylethanoic acid

P.T.O.

5. At high altitudes, the boiling point of water decreases because –   1
   - (a) the atmospheric pressure is high
   - (b) the atmospheric pressure is low
   - (c) the temperature is high
   - (d) the temperature is low

6. The colligative properties of a dilute solution depend on –   1
   - (a) nature of the solute
   - (b) nature of the solvent
   - (c) number of solute particles
   - (d) molecular mass of solute

7. The half life period for a first order reaction is 693 sec, its rate constant is –   1
   - (a) $10^3 \, s^{-1}$
   - (b) $10 \, s^{-1}$
   - (c) $10^{-3} \, s^{-1}$
   - (d) $10^{-4} \, s^{-1}$

8. The unit of rate constant for a zero order reaction is –   1
   - (a) $mol \, L^{-1} \, s^{-1}$
   - (b) s^{-1}
   - (c) $L \, mol^{-1} \, s^{-1}$
   - (d) $L^2 mol^{-2} \, s^{-1}$

9. Blue colour of the sky is due to –   1
   - (a) refraction of light
   - (b) scattering of light
   - (c) transmission of light
   - (d) absorption of light

10. The structure of XeF_4 is –   1
    - (a) Square planar
    - (b) Octahedral
    - (c) T-shaped
    - (d) Tetrahedral

11. Electrolytic conduction –   1
    - (a) is carried by movement of ions
    - (b) is carried by movement of electrons
    - (c) decreases with increase in temperature
    - (d) involves no change in chemical properties of the conductor

12. The principal oxidation state of lanthanoids is –   1
    - (a) +2
    - (b) +3
    - (c) +4
    - (d) +5

13. The number of unpaired electrons in Fe^{3+} is –   1
    - (a) 2
    - (b) 3
    - (c) 4
    - (d) 5

14. The hydrolysis products of sucrose is –   1
    - (a) Fructose + Fructose
    - (b) Glucose + Glucose
    - (c) Glucose + Galactose
    - (d) D-Glucose + D-Fructose

15. Why is methylamine a stronger base than ammonia ?   2

16. (a) Write a short note on Clemmensen reduction. 2

OR

(b) Write a short note on Stephen reduction. 2

17. What are the conditions causing Frenkel defects ? 2

18. Explain why nitrogen exists as diatomic molecule and phosphorus exists as tetraatomic molecule. 2

19. Write the mechanism of hydration of alkenes. 2

20. Explain why the para isomer of dichlorobenzene has a higher melting point than ortho and meta isomer. 2

21. Why do phenols have higher boiling point than toluene ? 2

22. Write a short note on Friedel Craft's acylation. 2

23. Write a short note on Reimer Tiemann reaction. 2

24. Write the chemical reaction for the conversion of propan-1-ol to propan-2-ol. 2

25. Write the reaction for the conversion of benzene to benzaldehyde. 2

26. Write *three* differences between physical adsorption and chemical adsorption. 3

27. What is Lanthanoid contraction? Write *two* consequences of Lanthanoid contraction. 3

28. On the basis of Valence Bond Theory, explain the hybridisation, geometry and magnetic behaviour of $Fe(H_2O)_6^{3+}$. 3

29. Hexaaquamanganse (II) ion contains five unpaired electrons, while hexacyanomanganese (II) ion contains only one unpaired electron. Explain using Crystal Field Theory. 3

30. Distinguish between globular proteins and fibrous proteins. 3

31. A metal having atomic mass $50 \, g \, mol^{-1}$ has a body centered cubic crystal structure. The density of metal is $5.96 \, g \, cm^{-3}$. Find the volume of the unit cell. 3

32. The boiling point of benzene is 353.23K. When 1.80 g of non-volatile solute was dissolved in 90g of benzene, the boiling point is raised to 354.11K. Calculate the molar mass of the solute. (K_b for benzene is 2.53K kg / mol) 3

33. (a) The thermal decomposition of a compound is of first order. If 50% of the compound is decomposed in 120 minutes, how long will it take for 90% of the compound to decompose ? 3

OR

(b) The three fourth of a first order reaction is completed in 32 minutes. What is the half life period of the reaction ? 3

34. (a) (i) Can we store copper sulphate in a vessel made of iron ? Justify your answer. 2

(ii) Calculate the resistance of 0.01N solution of an electrolyte whose equivalent conductivity is 420 ohm^{-1} cm^2 equiv^{-1}. (The cell constant of the cell is 0.88 cm^{-1}) 3

OR

(b) (i) Why is the alternating current used for measuring the resistance of an electrolytic solution ? 2

(ii) Calculate the e.m.f of the cell in which the following reaction takes place.

$$Ni_{(s)} + 2 Ag^+(0.002M) \rightarrow Ni^{2+}(0.160M) + 2 Ag_{(s)}$$
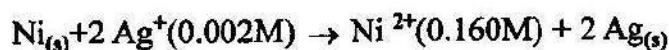
Given that the standard electrode potential of the cell is 1.05 V. 3

35. (a) (i) Fluorine exhibits only −1 oxidation state whereas other halogens exhibit positive oxidation states such as +1, +3 ,+5 and +7. Explain. 2

(ii) $SOCl_2$ act as Lewis acid as well as Lewis base. Explain. 3

OR

(b) (i) Why does OF_6 not exist but SF_6 exist ? 2

(ii) Explain why the electron gain enthalpies of halogens are largely negative. 3

2021

COMPUTER SCIENCE

(Theory)

Full Marks – 70

Time : 3 hours

General instructions :

(i)   All questions are compulsory.

(ii) Programming Language : C++.

(iii) Figures in the margin indicate marks.

1.   Choose the correct answer :   5×1=5

   (a)   The full form of URL is –

      (i)   Uniform Resource Locator   (ii)   Universal Resource Locator

      (iii) Universal Resource Language   (iv)   Uniform Resource Language

   (b)   A member function of a class is also called a _____ .

      (i)   Method   (ii)   Property

      (iii) Class   (iv)   Signature

   (c)   Overloaded functions have same name but different –

      (i)   Protocol   (ii)   Return type

      (iii) Names   (iv)   Signature

   (d)   Processing each and every element of a data structure is called –

      (i)   Sorting   (ii)   Traversal

      (iii) Searching   (iv)   Merging

   (e)   Number of rows in a relation is known as _____ .

      (i)   Tuples   (ii)   Attributes

      (iii) Cardinality   (iv)   Degree

2.   Fill in the blanks :   5×1=5

   (a)   The _____ gate is a gate with only one input signal and one output signal. (OR/ AND/NOT)

(b) Today's internet has evolved from _____ of US Department of Defence. (ARPA NET / H.T.T.P / WAN)

(c) A constructor that takes no argument is _____. (Null constructor/Default constructor / Copy Constructor)

(d) Which data type is used to represent a number having a fractional part _____. (int / float / void)

(e) AND operator performs an operation of boolean algebra called _____. (logical multiplication / logical addition / logical subtraction)

3. State whether the following statements are *True* or *False* :   4×1=4

   (a) A candidate key which is not primary key is alternate key.

   (b) Linear search can work for only sorted arrays.

   (c) Stack is a LIFO (Last In First Out).

   (d) The pattern of interconnection of nodes in a network is protocol.

4. Answer the following questions.   13×2=26

   (a) Why is char often treated as integer data type ?

   (b) Given the two following expression :

       (i)   val = 3;

       (ii) val = = 3;

       Answer the following questions.

       (i)   How are these two different ?

       (ii) What will be the result of the two if the value of 'val' is 5 initially ?

   (c) Why is main function special in C++ ?

   (d) What is a base class and a derived class ?

   (e) (i)   What is the disadvantage of using inline function ?

                                     OR

       (ii) What is the advantage of using inline function ?

   (f) State condition(s) under which binary search is applicable.

   (g) (i)   What is a default constructor ?

                                     OR

       (ii) What is a destructor ?

   (h) Can a particular array (say a dynamic array) contain integers, float and characters ? Explain to support your answer.

   (i) What are the various data models available for database systems ?

   (j) (i)   What is meant by candidate key in a table ? Give a suitable example of candidate keys from a table containing some meaningful data.

OR

(ii) What is meant by primary key ? Give a suitable example of primary key from a table containing some meaningful data.

(k) Explain the concept of private visibility modes in context of Object Oriented Programming.

(l) How do repeaters differ from routers in terms of functionality ?

(m) (i) In Boolean Algebra, verify using truth table that

$X+XY=X$ for each X,Y in $\{0,1\}$

OR

(ii) Prepare a table of combinations for the boolean algebra expression :

$\overline{X}.\overline{Y} + \overline{X}.Y$

5. Answer the following questions : 10×3=30

(a) Illustrate the concept of default argument of a function using a suitable example program.

(b) Discuss the concepts of Object Oriented Programming language. How are these implemented in software terms in C++ ?

(c) (i) What is copy constructor ? Explain with an example.

OR

(ii) Define a class student with the following specifications :

private members of the class student :

admno	integer
sname	20 character,
eng, math, science	float
total	float
ctotal ( )	A function to calculate eng+math+science

public member functions of the class student :

takedata( )	A function to accept values for sname, eng, math, science and invoke ctotal ( ) to calculate total
showdata( )	A function to display all the data members on the screen.

(d) (i) Illustrate the concept of function call by reference with suitable example.

OR

(ii) Explain all the fundamental data types in C++.

(e) (i) A 2-D array defined as A [4...7, –1...3] requires 2 words of storage space for each element. If the array is stored in row-major form, calculate the address of A [6, 2] given the base address as 100 (one hundred).

OR

(ii) X is 2-D array [10×5]. Each element of the array is stored in 2 memory locations. If X [1,1] begins at address 150, find the location of X [3,4]. Use the formula for calculation. (The arrangement is in row-major).

(f) Explain the efficiency of linear search and binary search in relation to the number of elements in the list being searched.

(g) Reduce the following Boolean expression using K-Map :

$$F(A, B, C, D) = \sum(0, 1, 2, 4, 5, 8, 9, 10, 11)$$

(h) What are the different types of network topologies ?

(i) Mention and explain at least *three* characteristics of destructors.

(j) Consider the following table and write SQL commands for statements (i) to (iii)

TABLE : TRAVEL

NO	NAME	TDATE	KM	CODE	NOP
101	RINA	13/11/2015	200	101	32
103	SIAMA	21/4/2016	100	103	45
105	PUIA	23/3/2016	350	102	42
102	LIANI	13/2/2016	90	102	40
107	THARA	10/1/2015	75	104	2
104	BENA	28/5/2016	80	105	4
106	ENGI	6/2/2016	200	101	25

(i) To display NO, NAME, TDATE from the table TRAVEL in descending order of NO.

(ii) To display the NAME of all travellers who are travelling by vehicle with CODE 101 or 102.

(iii) To display all the data from the table TRAVEL.

2021

ENGLISH

(CORE)

Full Marks – 80

Time – 3 Hours

General Instructions :

(i)   *The paper is divided into three sections: A,B & C. All the sections are compulsory.*

(ii)   *Separate instructions are given with each section and question wherever necessary. Read these instructions very carefully and follow them.*

(iii)   *Do not exceed the prescribed word limit while answering the questions.*

(iv)   *Marks for each question are indicated against it.*

SECTION – A : Reading (*15 marks*)

1.   Read the following passage carefully and answer the questions that follow :

The word 'depressed' in common usage means sad, frustrated, fed up, bored or pessimistic. The mood of a depressed person is much lower at his or her worst moments than the mood of a normal person at his or her worst. Depression is a state of mind. It is specifically a mental disorder characterised by a lowering of the individuals' vitality, his mood, desires, hopes, aspirations and of his self-esteem.

Depression arising out of environmental factors is called reactive depression whereas depression arising out of some biochemical changes in the brain is called endogenous depression. If depression is mild or moderate and if the individual is in touch with his surroundings, it is known as neurotic depression. If the individual is severely disturbed and is not able to comprehend what is happening around, he can be said to be in a state of psychotic depression.

Old age is one of the stages of human development where a person attains wisdom, maturity, social and economic stability with social recognition and emotional fulfilment. Generally, societies show a great respect and consideration for the aged. In ancient times, old people were considered as the guiding stars in Indian families, since they were symbols of tradition, respect, wisdom and experience. In primitive, ancient and medieval cultures, old persons had a recognised social role. They were of a great value because they could impart knowledge and skill to youngsters. The old people were considered as repositories of wisdom and tradition and were not perceived as problems.

P.T.O.

At present, social structures and values are undergoing transformation from traditional to modern. There is a rapid stride in urbanization and industrialization leading to the breaking up of joint families and property. This has ultimately weakened the traditional families, social position and status of the aged in the family. From time to time, changes in the institutions of marriage and family have diminished the control of parents over their children. It has increased the freedom of children and they view the aged as a useless and non-productive entity. Modernisation has eventually led to the degradation of their status and authority. Consequently, the integrity of the family and the existence of the elderly as an integral part of the family are being uprooted. The importance of their functional positions thus decline and consequently their authority and much of the respect and prestige that they enjoyed earlier get faded. These changes generally bring about depression in older people.

As the old age advances, events at home may also contribute more to their problems. The 'empty nest' feeling arising as a result of the grown-up children leaving the home, daughters departing as a result of wedlock and sons leaving station in pursuit of higher education or jobs may make the aged more lonely.

The loneliness also arises out of premature loss of spouse. This would deprive the person of a long-standing emotional bond that had provided plenty of emotional succour and security. The loss, wherever it might occur in the later years, may leave the individual terribly lonely and at the mercy of sons and daughters-in-law. Added to these, the increasing gap and interactional stress and strain in the family may leave the elderly without peace of mind. The elderly as a result of these developments feel marginalized, alienated and left out of the mainstream. The foregoing are the common problems faced by most of the elderly. These either directly or indirectly lead to a state of depression and make aging for many an unwanted and unpleasant event to be abhorred.

Usually, the mild depression which is caused due to environmental factors is temporary. The person reconciles within a short time and tries to forget the loss. Kind words and timely support of friends, relatives and members of the family help one recover from depression.

A. Based on your understanding of the passage, answer the following questions :   2×2=4

  (a) What are the causes for the disintegration of the joint family system ?

  (b) How does one recover from mild depression ?

B. Select the appropriate answer from the given options :   2×1=2

  (a) Reactive depression arises out of –

     (i) environmental factors

     (ii) biochemical changes in the brain

     (iii) emotional factors

     (iv) disintegration of joint family system

(b) The status of the old people in ancient time was –
   (i) not recognised by society
   (ii) valued and recognised by society
   (iii) valued and recognised by the old people
   (iv) not recognised by the youth

C. Choose the correct word from the given options which conveys similar meaning to the following :

$2 \times 1 = 2$

(a) To feel that they do not belong to a group.
   (i) abhorred
   (ii) alienated
   (iii) diminished
   (iv) uprooted

(b) A husband or wife.
   (i) daughter-in-law
   (ii) elderly
   (iii) spouse
   (iv) youngsters

2. Read the following passage and answer the questions that follow :

Consumerism is economically manifested in the chronic purchasing of new goods and services, with little attention to their true need, durability and product origin or the environmental consequences of manufacture and disposal. Consumerism is driven by huge sums spent on advertising designed to create both a desire to follow trends, and the resultant personal self reward system based on acquisition. Materialism is one of the end results of consumerism.

Consumerism interferes with the workings of society by replacing the normal common-sense desire for an adequate supply of life's necessities, community life, a stable family and healthy relationships with an artificial ongoing and insatiable quest for things and the money to buy them with little regard for the true utility of what is bought. An intended consequence of this, promoted by those who profit from consumerism, is to accelerate the discarding of the old, either because of lack of durability or a change in fashion.

It is often stated that the economy would improve if people just bought more things, bought more cars and spend more money. Financial resources better spent on social capital such as education, nutrition, housing etc. are spent on products of dubious value and little social return. In addition, the purchaser is robbed by the high prices of new things, the cost of the credit to buy them, and the less obvious expenses such as, in the case of automobiles, increased registration, fees, insurance, repair and maintenance costs.

Many consumers run out of rooms in their homes to store the things that they buy. A rapidly growing industry in America is that of self-storage. Thousands of acres of land, good farm land, are paved over every year to build these cities of orphaned and unwanted things so as to give people more room to house the new things that they are persuaded to buy. If these stored products were so essential in the first place, why do they need to be warehoused? An over-abundance of things lessen the value of what people possess.

Malls have replaced parks, churches and community gatherings for many who no longer even take the trouble to meet their neighbours or care to know their names. People move frequently as though neighbourhoods and cities were products to be tried out like brands of deodorant. Consumerism sets each person against themselves in an endless quest for the attainment of material things or the imaginary world conjured up and made possible by things yet to be purchased. Weight training, diet centers, cosmetic surgery, permanent eye make-up, liposuction, collagen injections, these are some examples of people turning themselves into human consumer goods more suited for the 'marketplace' than living in a healthy balanced society.

(a) On the basis of your reading of the passage make notes on it using recognisable abbreviations wherever necessary. Supply a suitable title to it.   4

(b) Write a summary of the above passage in about 80 words.   3

SECTION – B : Writing (*25 marks*)

3.   You are Mawia of Chanmari, Lunglei. You want to sell your computer set as you are shifting to another place for work. Draft a suitable advertisement to be published in a daily newspaper in not more than 50 words.   5

4.   As the Secretary of the Student Council, Z.S. Memorial Higher Secondary School, Lunglei, write a notice in not more than 50 words asking the students of your school to donate old clothes, books and bags for the underprivileged children. Sign yourself as Mawizuali.   5

5.   (a)   You are Lianmawia / Lianmawii of Y-02, Chaltlang, Aizawl. You have seen an advertisement in 'Vanglaini' inviting applications for the post of English Lecturer in Fairdale Higher Secondary School, Kawnpui, Mizoram. Write a letter in response to the advertisement. Also give your detailed bio-data.   10

OR

(b) You are James, H/No-007, Dawrpui, Aizawl. Recently you bought a mobile phone from 'The Phone Shop', Bazar Bungkawn, Aizawl. The mobile phone developed a problem within a week of purchase. Write a letter to the manager of the shop giving details about the nature of the problem and asking him to either rectify the defect or to replace the phone. 10

6. (a) You have recently attended a symposium on the topic 'Effect of Pollution on Quality Life'. As the Editor of your school magazine, write a report on the event for your school magazine. You are Lalhlima, Holy Heart Higher Secondary School, Kolasib. 5
(Word limit – 120 words)

OR

(b) The Cancer Society of Mizoram recently organised a 'No Tobacco' workshop in your school in order to create awareness regarding the harmfulness of tobacco products among school children. Write a report on the same to be published in the newspaper in about 120 words. 5

SECTION – C : Literature *(40 marks)*

7. Read the following extract and answer the questions that follow : 4×1=4

I. Life is what it is about ;
I want no truck with death.
If we were not so single-minded
about keeping our lives moving,
and for once could do nothing,
perhaps a huge silence
might interrupt this sadness

(a) 'Keeping Quiet' is written in blank verse by –

(i) Stephen Spender

(ii) Pablo Neruda

(iii) Louis Fischer

(iv) John Keats

(b) 'Keeping Quiet' is a simple poem about –

    (i) greed

    (ii) not speaking in any language

    (iii) self introspection

    (iv) relaxing

(c) Man is 'single-minded' about –

    (i) being a better human being

    (ii) his own selfish motives

    (iii) helping his brothers

    (iv) total inactivity

(d) The 'sadness' refers to –

    (i) man not understanding his fellow man

    (ii) man not working

    (iii) the killing of whales

    (iv) man not keeping quiet

OR

II. Driving from my parent's home to Cochin last Friday morning, $4 \times 1 = 4$
I saw my mother, beside me, doze, open mouthed,
her face ashen like that of a corpse and
realised with pain that she was as old as she looked
but soon put that thought away…

(a) The name of the poem and the poet is –

    (i) My Mother at Sixty Six – Kamala Das

    (ii) A Thing of Beauty – John Keats

    (iii) Keeping Quiet – Pablo Neruda

    (iv) An Elementary School Classroom in a Slum - Stephen Spender

(b) The poet was going –

    (i) for a ride

    (ii) to visit her friend

    (iii) to Cochin Airport

    (iv) to her parents' house

(c) The poet's mother looked –

    (i) young and sweet

    (ii) pale as death

    (iii) active and lively

    (iv) worried and sick

(d) The poet realized that –

    (i) her mother will live long enough

    (ii) her mother will survive her pain

    (iii) her mother won't mind her driving

    (iv) her mother won't live long

8. Answer the following questions in about 30 words :   3×2=6

   (a) What is the theme of the poem 'An Elementary School Classroom in a Slum' ?

   (b) What does a thing of beauty do for us ?

   (c) How, according to the poet, Pablo Neruda, can the earth teach us ?

9. Answer the following questions in about 30 words :   4×2=8

   (a) What is ironical about Saheb's name ?

   (b) When did Douglas' aversion to water begin ?

   (c) What did Franz wonder about when he entered the class that day ?

   (d) Why did Gandhi chide the lawyers of Muzzafarpur ?

10. Choose the correct answer from the given options :   2×1=2

   (a) Douglas received training from the instructor for –

      (i) six months

      (ii) seven months

      (iii) five months

      (iv) nine months

   (b) Franz saw a crowd in front of the –

      (i) saar   (ii) school

      (iii) garden   (iv) bulletin-board

11. Answer *any one* of the following questions in about *100 –120* words each :   5

   (a) What was the sense of panic that gripped William Douglas? How did he overcome it?

   (b) What are the instances in 'The Rattrap' that show that the character of the ironmaster is different from that of his daughter in many ways ?

12. Answer the following questions in about *30* words : 2×2=4
    (a) What advice did Annan give Bama ? Why was it so important ?
    (b) Why did Roger Skunk's mommy not like her son smelling of roses?

13. Choose the correct answer from the given options : 6×1=6
    (a) In Zitkala's tribe, short hair was worn by –
        (i) mourners
        (ii) warriors
        (iii) the elderly
        (iv) palefaces
    (b) The name of the narrator's friend in 'The Third Level' was –
        (i) Sam Warner
        (ii) Sam Weiner
        (iii) John Warner
        (iv) John Weiner
    (c) In 'The Enemy', the servants had cleaned the guest room and burned sulphur –
        (i) to get rid of any bacteria
        (ii) to get the white man's smell out of it
        (iii) to make the room smell nice
        (iv) because it was a tradition
    (d) Roger Skunk had only_____ pennies when he first met the wizard.
        (i) two
        (ii) five
        (iii) three
        (iv) four
    (e) Among the things that Mr. Lamb did to understand and appreciate the world around him, which is not one of them ?
        (i) listening
        (ii) waiting
        (iii) reading
        (iv) thinking
    (f) The General did not take action on Sadao for harbouring the white man because Sadao –
        (i) was sentimental
        (ii) was a good friend
        (iii) was indispensible to him
        (iv) was a patriot

14. Answer *any one* of the following questions in about 100-120 words:
    (a) Describe the Grand Central station at 'The Third Level'. 5

OR

    (b) How does Jo show her independent thinking in the story 'Should Wizard Hit Mommy'?
    5

—————————

2021
GEOLOGY
(Theory)
Full Marks – 70
Time – 3 Hours

General Instructions :

(i) All questions are compulsory.

(ii) Marks for each question are indicated against it.

(iii) Please write down the question number before attempting it.

1. Choose the correct answer :   14×1=14

    (a) Pelecypods having two strong and slightly curved teeth in the hinge –

        (i)   Heterodont   (ii) Isodont

        (iii) Dysodont   (iv) Desmodont

    (b) The earliest record of fossil Lamellibranchs have been traced from the rock of –

        (i)   Quaternary   (ii) Jurassic

        (iii) Ordovician   (iv) Silurian

    (c) Transformation of bones, shells or plant tissues into calcite, silica or pyrite is –

        (i)   Petrifaction   (ii) Combustion

        (iii) Coalification   (iv) Impression

    (d) Graphite minerals are usually formed by the process of –

        (i)   Sedimentary   (ii) Magmatic

        (iii) Residual   (iv) Metamorphic

    (e) The temperature of hydrothermal solution is about –

        (i) $500°C$ (ii) $450°C$

        (iii) $350°C$ (iv) $550°C$

(f)   The process which result in the formation of sulphide minerals that is usually associated with Pt, Au, Ag and Cu is –

(i)   Immiscible liquid segregation   (ii)   Injection

(iii)   Dissemination   (iv)   Metasomatism

(g)   Fault which appear to have been rotated about a point on a fault plane like a scissor is –

(i)   Reverse   (ii)   Thrust

(iii)   Step   (iv)   Pivot

(h)   Fault with circular like outcrop on a level surface –

(i)   Arcuate   (ii)   Radial

(iii)   En-echelon   (iv)   Parallel

(i)   Horny calcareous plate which close the aperture of Gastropods –

(i)   Suture   (ii)   Operculum

(iii)   Apex   (iv)   Whorl

(j)   Columnar joints are usually associated with –

(i)   Ultrabasic rocks   (ii)   Basic rocks

(iii)   Intermediate rocks   (iv)   Acidic rocks

(k)   Vadose water is found in the zone of –

(i)   Capillary   (ii)   Saturation

(iii)   Aeration   (iv)   Recharge area

(l)   Artesian well can occur in –

(i)   Perched aquifer   (ii)   Unconfined aquifer

(iii)   Recharge area   (iv)   Confined aquifer

(m) Which of the following is a natural Green House Gas ?

    (i) Carbon dioxide   (ii) Water vapour

    (iii) Methane   (iv) All of these

(n) The rock formation which have both porosity and permeability is –

    (i) Aquitard   (ii) Aquifer

    (iii) Aquifuge   (iv) Aquiclude

2. Answer the following questions :   7×2=14

    (a) Define porosity.

    (b) Define tenor.

    (c) What is lunule in pelecypods ?

    (d) Define plunging fold.

    (e) What are sheet joints ?

    (f) What is metasomatic replacement ?

    (g) Define eluvial placer deposits.

3. What is sedimentary deposits ? Mention different processes associated with sedimentary mineralization.   1+2=3

4. Explain the different processes of early magmatic deposits.   1+1+1=3

5. Write down the importance of dip and strike in structural geology.   1½+1½=3

6. With a neat diagram, explain the difference between normal and reverse fault.   1½+1½=3

7. What is the difference between umbilicus and columella in gastropods ?   3

8. What are the differences between unaltered soft parts and unaltered hard parts preserved in fossils ?   3

9. What are the *six* green house gases ?   3

10. Explain *any three* types of precipitation.   3

11. Explain the *two* types of Aquifers.   3

12. (a) Define folds. Classify folds on the basis of mechanism of folding.   1+4=5

<div align="center">***OR***</div>

  (b) With neat sketches, explain the special types of folds.   1+4=5

13. (a) Explain with a labelled diagram, the morphological characteristics of gastropods. 2+3=5

<div align="center">***OR***</div>

  (b) Explain with a labelled diagram, the morphological features of pelecypods.   2+3=5

14. (a) What are the factors responsible for the formation of residual concentration deposits? Give an example of deposits formed by residual concentration.   4+1=5

<div align="center">***OR***</div>

  (b) Write notes on the classification of hydrothermal deposits on the basis of temperature of formation.   5

2021

MATHEMATICS

Full Marks – 80

Time – 3 hours

General Instructions :

(i)   *All questions are compulsory.*

(ii)   *Marks for each question are indicated against it.*

(iii)   *Use of calculator is not permitted; however, you may ask for logarithmic tables if required.*

(iv)   *Please write down the serial number of the questions before attempting it.*

1.   Choose the correct answer from the following :   16×1=16

(a)   If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then adj A equals to –

(i) $\begin{bmatrix} d & -c \\ -b & a \end{bmatrix}$ (ii) $\begin{bmatrix} -d & b \\ c & -a \end{bmatrix}$

(iii) $\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$ (iv) $\begin{bmatrix} -d & -b \\ c & a \end{bmatrix}$

(b)   The value of x for which the matrix $A = \begin{bmatrix} 3-2x & x+1 \\ 2 & 4 \end{bmatrix}$ is a singular matrix is –

(i)   –1   (ii)   1

(iii) 2   (iv) – 2

(c)   Let $f : R \rightarrow R : f(x) = x^5$ is –

(i)   one-one and onto   (ii) one-one and into

(iii) many-one and onto   (iv) many-one and into

P.T.O.

(d) The principal value of $\cot^{-1}(-1)$ is –

(i) $-\dfrac{\pi}{4}$ (ii) $\dfrac{\pi}{4}$

(iii) $\dfrac{5\pi}{4}$ (iv) $\dfrac{3\pi}{4}$

(e) If $y = \log(\sin 3x)$, then $\dfrac{dy}{dx}$ is –

(i) $\cot 3x$ (ii) $-\cot 3x$

(iii) $-3\cot 3x$ (iv) $3\cot 3x$

(f) The tangents to the curve $y = 2x^3 - 4$ at the points $x = 2$ and $x = -2$ are –

(i) parallel   (ii) perpendicular

(iii) intersecting   (iv) with slopes zero

(g) $\displaystyle\int e^x \left\{ \dfrac{1}{x} - \dfrac{1}{x^2} \right\} dx$ equals to –

(i) $e^x \left\{ \log x + \dfrac{1}{x} \right\} + C$ (ii) $xe^x - e^x + C$

(iii) $e^x \cdot \dfrac{1}{x} + C$ (iv) None of these

(h) $\displaystyle\int \dfrac{\sin^{-1} x}{\sqrt{1-x^2}}\, dx$ is –

(i) $\dfrac{1}{\sin^{-1} x} + C$ (ii) $\dfrac{\sin^{-1} x}{2} + C$

(iii) $\dfrac{(\sin^{-1} x)^2}{2} + C$ (iv) $\dfrac{1}{\sqrt{1-x^2}} + C$

(i) $\int_{0}^{\pi/4} \sqrt{1+\cos 2x} \ dx$ is –

(i) 1   (ii) $\sqrt{2}$

(iii) $\dfrac{1}{\sqrt{2}}$ (iv) 0

(j) The order and degree of the differential equation $x\left(\dfrac{d^3 y}{dx^3}\right)^2 + \left(\dfrac{dy}{dx}\right)^4 + y^2 = 0$ is –

(i) order = 3, degree = 4   (ii) order = 2, degree = 3

(iii) order = 3, degree = 2   (iv) order = 1, degree = 4

(k) If $|\vec{a}+\vec{b}| = |\vec{a}-\vec{b}|$, then –

(i) $|\vec{a}| = |\vec{b}|$ (ii) $\vec{a} \parallel \vec{b}$

(iii) $\vec{a} \perp \vec{b}$ (iv) None of these

(l) The unit vector perpendicular to both $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - \hat{k}$ is –

(i) $-4\hat{i} + 4\hat{j} + 4\hat{k}$ (ii) $\dfrac{1}{\sqrt{3}}(-4\hat{i} + 4\hat{j} + 4\hat{k})$

(iii) $-\hat{i} + \hat{j} + \hat{k}$ (iv) $\dfrac{1}{\sqrt{3}}(-\hat{i} + \hat{j} + \hat{k})$

(m) The intercepts made by the plane $\vec{r}.(2\hat{i} - 3\hat{j} + 4\hat{k}) = 12$ are –

(i) 2, –3, 4   (ii) –2, 3, 4

(iii) 6, – 4, 3   (iv) – 6, 4, –3

(n) The equation of the plane which is parallel to the plane $2x - 3y + z + 8 = 0$ and which passes through the point $(-1, 1, 2)$ is –

(i) $2x - 3y + z + 1 = 0$ (ii) $2x - 3y + z + 2 = 0$

(iii) $2x - 3y + z + 3 = 0$ (iv) $2x - 3y + z + 8 = 0$

(o) Let A and B be the events such that $P(A) = \frac{3}{10}$, $P(B) = \frac{1}{2}$ and $P(\frac{B}{A}) = \frac{2}{5}$, then, $P(A \cap B)$ is –

(i) $\frac{1}{5}$ (ii) $\frac{3}{20}$

(iii) $\frac{4}{5}$ (iv) $\frac{3}{25}$

(p) A can hit a target 4 times in 5 shots, B can hit a target 3 times in 4 shots, C can hit a target 2 times in 3 shots, then the probability that A, B and C all hit the target is –

(i) $\frac{2}{7}$ (ii) $\frac{1}{5}$

(iii) $\frac{1}{7}$ (iv) $\frac{2}{5}$

2. Show that the relation

R = {$(a, b) : a > b$} on N is transitive but neither reflexive nor symmetric.   2

3. Show that the function

$$f(x) = \begin{cases} 1 + x, & \text{if } x \le 2 \\ 5 - x, & \text{if } x > 2 \end{cases}$$

2

is not differentiable at $x = 2$.

4. Evaluate : $\int \dfrac{2x}{(x^2+1)(x^2+3)}dx$

2

5. Two unbiased dice are thrown. Find the probability that the sum of the numbers appearing is 8 or greater, if 4 appears on the first die.

2

6. Express the matrix A $= \begin{bmatrix} 1 & 3 & 5 \\ -6 & 8 & 3 \\ -4 & 6 & 5 \end{bmatrix}$ as the sum of a symmetric and a skew-symmetric matrix.

4

7. Using matrix, solve the following system of linear equations :

4

$$3x + 4y + 2z = 8$$
$$2y - 3z = 3$$
$$x - 2y + 6z = -2$$

8. Let R $= \{(a,b) : a,b \in Z$ and $a-b$ is divisible by 5$\}$. Show that R is an equivalence relation on Z.

4

9. (a) Find $\dfrac{dy}{dx}$, when $y = x^{\cos x} + (\sin x)^{\tan x}$.

4

OR

(b) If $x = a(\theta + \sin \theta)$ and $y = a(1-\cos \theta)$, find $\dfrac{d^2y}{dx^2}$ at $\theta = \dfrac{\pi}{2}$.

4

10. (a) Evaluate : $\int \dfrac{2x-1}{2x^2+2x+1}dx$

4

OR

(b) Evaluate : $\int \dfrac{x^2+1}{x^4+1}dx$

4

11. Solve : $(x^2 + 3xy + y^2)dx - x^2dy = 0$

12. (a) Find the image of the point (1, 6, 3) in the line

    $$\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$$

    OR

    (b) Find the equation of the plane passing through the point (2,– 3, 5) and parallel to the plane $3x - 7y - 2z = 5$. Also find the distance between the two planes. 4

13. Three urns A, B and C contain 6 red and 4 white; 2 red and 6 white; and 1 red and 5 white balls respectively. An urn is chosen at random and a ball is drawn. If the ball drawn is found to be red, find the probability that the ball was drawn from the urn A. 4

14. (a) Show that the semi-vertical angle of a right circular cone of a given surface area and maximum volume is $\sin^{-1}(\frac{1}{3})$. 6

    OR

    (b) Prove that the volume of the largest cone that can be inscribed in a sphere is $\frac{8}{27}$ of the volume of the sphere. 6

15. (a) Using integration, find the area of the region bounded by the triangle whose vertices are A (–1, 2), B (1,5) and C (3,4). 6

    OR

    (b) Find the area cut off from the parabola $4y = 3x^2$ by the straight line $3x - 2y + 12 = 0$. 6

16. Find the distance of the point $(-2, 3, -4)$ from the line $\dfrac{x+2}{3} = \dfrac{2y+3}{4} = \dfrac{3z+4}{5}$, measured

parallel to the plane $4x + 12y - 3z + 1 = 0$.　　　　6

17. A manufacturer produces nuts and bolts for industrial machinery. It takes 1 hour of work on machine A and 3 hours on machine B to produce a packet of nuts while it takes 3 hours on machine A and 1 hour on machine B to produce a packet of bolts. He earns a profit of Rs. 17.50 per packet on nuts and Rs. 7 per packet on bolts. How many packets of each should be produced each day so as to maximize his profit if he operates his machines for at the most 12 hours a day ? Also, find the maximum profit.　　　6

2021

MIZO

Full Marks – 80

Time – 3 Hours

Hriat turte :

(i)   *Zawhna zawng zawng hi chhan ngei ngei tur a ni.*

(ii) *Zawhna tin mark put zat chu a zawnah tarlan zel a ni.*

(iii) *Chhan dawnin zawhna nambar ziah zel tur a ni.*

ṬHEN KHATNA : HLA

1. A dik ber thlang chhuak rawh :   4×1=4

    (a)   _____ duh lawm lai chân chu lung kan rual ngei ang a. (Hrai / Lung /Tuai)

    (b)   Chung muvanlai _____ tawng lo nen. (kawplai /di /hrai)

    (c)   Chhun nipui sen sa hnuaiah, Thlir chang thinlai _____ . (hnemtu /tihlimtu/tihnimtu)

    (d)   Zorama leng chi tin hnam tin, _____ hraichawi kan ni. (Chhinlung /Zofa /Pi pute)

2. Hausiampa'n, 'Hawilo pâr an khâl e zîng phûlah' a tih hi eng tihna nge ?   2

3. 'Phengphe nunnem' tih hla phuahtu hian eng a thlirin nge 'hringnun hi ka ṭahpui ṭhin' a tih ?

                                                                                      2

4. 'Kar a hla' phuahtu Lalhmingthanga kha a ngaihzawng ngaia a lunglen dan tlangpui in zirlai
    behchhanin han ziak teh.   4

5. 'Pi pu chhuahtlang hlui' tih hla aṭang hian kan pi leh pute'n lungdawha an thil dah hrang hrangte
    leh lungdawh an hman aṭangkainate han sawi teh.   2+4=6

ṬHEN HNIHNA : THU

6. A dik ber hmangin a kar awlte dah khat rawh : 4×1=4

   (a) Mizo zinga hla phuah thiam mimal hming kan hriat hmasak ber chu _____ a ni.
   (Laltheri / Lalvunga / Lianchia / Pi Hmuaki)

   (b) In zirlai buin thinrimna hneh dan ṭha ber a tih chu _____ a ni. (ngawih reng / ring theih
   tawpa zai / inngaihtlawm leh mi ngaihdam)

   (c) Dam chhung mi hmuak apiang i_____ ni se. (thu / ta / tirh)

   (d) Vanneihna kailawn pawimawh tak pakhat chu _____ a ni. (rinawmna / taihmakna /
   dawhtheihna / huaisenna)

7. Heng zawhnate hi chhang rawh : 2×2=4

   (a) Dr. C. Lalhrekima'n 'Mipui thinrim pungkhawm zingah hian an inzep ve ṭhin' a tih kha
   eng nge ?

   (b) Khawvela hming inkawp fuh em em mai, pakhat sawi chuan a dang rilrua lo lang lo thei
   lo ṭhin *pahnih* sawi rawh.

8. C. Lalsiamthanga'n hnam pawi a khawih ngei ang a tih kha eng nge ni ? 4

9. Mizo thawnthu aṭangin pi leh pute thil ngaihdan, an thlir dan leh an suangtuahnate sawi rawh.

   6

ṬHEN THUMNA : LEMCHAN

10. A dik ber thlang chhuak rawh : 2×1=2

    (a) Thingsei aṭanga Lalhniangi te va pemna khua chu _____ a ni. (Maubuang / Neihbawi /
    Hmuifang)

    (b) 'Nui hnuhnung zawk zawng kan la awm chek ang' tih thu sawitu chu _____ a ni.
    (Thangzawra / Chawnghrima / Thangzuala)

11. Thangzawra'n vai run a châk chhan sawi la, silai neih belh a duh chhan sawi bawk rawh.

1+1=2

12. 'Ka pa... vanduaina hi a bân a sei mang e aw'. He thu hi tu sawi nge ? Eng vangin nge hetia a sawi ?

1+3=4

13. Thangzawra leh Lalhniangi te inkara hmangaihna thawnthu ngaihnawm, Chawnghrima a lo lan avanga lungchhiat thlak tak ni si kha ngaihnawm takin han sawi teh.

6

THEN LINA : GRAMMAR AND COMPOSITION

14. A dik zawk thlang chhuak rawh :

2×1=2

(a) Zawhte a rûm (ngal ngal / ngul ngul) mai.

(b) A hmai ava bawl nasa (ţak ţak / ţek ţuk) ve.

15. A hnuaia Tawng Upate zingah hian a thu awmze milpui thlang chhuak rawh :

2×1=2

(a) A tak tak ni lo, a behbawm.

(a kahna tawk a ţha /a phaw vuak /chhimbu dawi / mi inang sa inang)

(b) Nei ţeuh ; chang ţawk; mahni chauha chang bik.

(Lersia se chi ţha ang /phung sa serh sem ang / mi sa hmim tipuar / pusum tel)

16. 'Kaihza veng' tih hi a awmzia hrilhfiah la, a tifiah turin thu phuah rawh.

1+1=2

17. Lalmuanpuia, Zonuam veng i ni a. Misualin i dawr an rawk chungchangah Vaivakawn Police Station-a theh luh tur First Information Report (FIR) han ziak teh.

4

18. A hnuaia thupui i duh ber hmangin Essay thumal *250* velin han ziak teh :

6

(a) Hripui kara Zonun zemawi

(b) Ram leh hnam humhalh

(c) Kan ramin kan mualphopui

ṬHEN NGANA : RAPID READER

19. A dik ber thlang chhuak rawh :   2×1=2

   (a)   Sava chi khat, a hram chu pi leh puten chhiatna thlentu nia an ngaih chu _____ .

        (Chhimbuk / Awingek / Tuitu / Chingpirinu)

   (b)   Hrangchhuana ipte hrui kha eng mei nge?

        (Ngau / Keite / Zawng / Hauhuk)

20. Chawngmawii'n Siaia a ngaihzawn der chhan kha sawi rawh.   2

21. Khuai lui kha eng lui nge an tih bawk kha? Lui pawimawh tak a nihna chhan han sawi teh.

                                                           1+1=2

22. Hrangchhuana te in aṭanga Chawngmawii thil hawn hlut dan kha sawi rawh.   2

23. Khuai ur nan Aidu ro hman a ṭhatna leh Tum hnah erawh a ṭhat loh dan kha han sawi teh.   2

24. Siaia'n Hrangchhuana laka tlawm hliah hliaha a inhriatna chhan kha sawi rawh.   4

2021
PHYSICS
(Theory)
Full Marks – 70
Time – 3 Hours

General Instructions :

(i)   *All questions are compulsory.*

(ii) *Marks for each question are indicated against it.*

(iii) *Use log table, if necessary.*

(iv) *Use of calculator is not allowed.*

1.   What is the equivalent capacitance of the following circuit ?   1
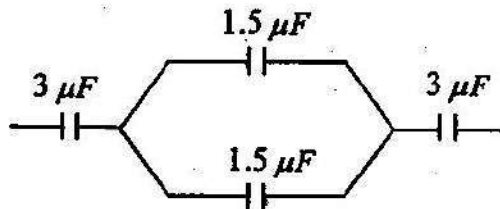
(a) $1 \mu F$ (b) $2 \mu F$

(c) $1.5 \mu F$ (d) $3 \mu F$

2.   When air is replaced by a dielectric medium of dielectric constant (k), the maximum force of attraction between two charges separated by a distance –   1

(a)   decreases k times

(b)   remains unchanged

(c)   increases k times

(d)   decreases k^2 times

3.   The specific resistance of a conductor increases with –   1

(a)   increase in temperature

(b)   increase in cross-sectional area

(c)   decrease in length

(d)   decrease in cross-sectional area

4. A current flows in a conductor from east to west. The direction of the magnetic field at a point above the conductor is –   1

   (a) towards west
   (b) towards south
   (c) towards east
   (d) towards north

5. A charge 'q' moves in a region where electric field $\vec{E}$ and magnetic field $\vec{B}$ both exist. Then the force on it is –   1

   (a) $q(\vec{v} \times \vec{B})$
   (b) $q\vec{E} + q(\vec{v} \times \vec{B})$
   (c) $q\vec{E} + q(\vec{B} \times \vec{v})$
   (d) $q\vec{B} + q(\vec{E} \times \vec{v})$

6. If $\vec{E}$ and $\vec{B}$ are electric and magnetic field vectors of an electromagnetic wave, then the direction of propagation of electromagnetic wave is –   1

   (a) $\vec{E} \times \vec{B}$
   (b) $\vec{E}$
   (c) $\vec{B}$
   (d) $\vec{B} \times \vec{E}$

7. The velocity of electromagnetic waves in free space is given by –   1

   (a) $\sqrt{\epsilon_0 \mu_0}$
   (b) $\dfrac{1}{\sqrt{\epsilon_0 \mu_0}}$

   (c) $\dfrac{\epsilon_0}{\mu_0}$
   (d) $\sqrt{\epsilon_0 / \mu_0}$

8. Electron volt is a unit of –   1

   (a) charge
   (b) momentum
   (c) potential difference
   (d) energy

9. The mass of a photon at rest is –   1

   (a) zero
   (b) 1.67×10^{-35} Kg
   (c) 1 amu
   (d) 9×10^{-31} Kg

10. According to Bohr's principle, the relation between principal quantum number (n) and radius (r) of orbit is –   1

   (a) $r \alpha n$
   (b) $r \alpha n^2$

   (c) $r \alpha \dfrac{1}{n}$
   (d) $r \alpha \dfrac{1}{n^2}$

11. What is missing in the following nuclear reaction?   1

$$_1H^2 + _1H^2 \rightarrow _2He^3 + \underline{\hspace{2cm}} .$$

  (a) meson   (b) electron

  (c) positron   (d) neutron

12. The refractive index of water is 1.33. What will be the speed of light in water?   1

  (a) 3×10^8 ms^{-1} (b) 2.26×10^8 ms^{-1}

  (c) 4×10^8 ms^{-1} (d) 1.33×10^8 ms^{-1}

13. Reverse bias applied to a junction diode –   1

  (a) raises the potential barrier

  (b) increases the majority carriers of current

  (c) increases the minority carriers of current

  (d) lowers the potential barrier

14. To obtain a p-type germanium semiconductor, it must be doped with –   1

  (a) Arsenic   (b) Antimony

  (c) Indium   (d) Phosphorus

15. (a) A current of 5A is flowing east to west in an infinitely long wire kept along east-west direction. Find the magnetic field at a point 50 cm below the wire.   2

OR

  (b) Define magnetic elements. The vertical component of earth's magnetic field at a place is $\sqrt{3}$ times the horizontal component. What is the value of angle of dip at this place?

                                                                       2

16. Write the general equation for instantaneous emf of 50 Hz generator whose peak voltage is 200 V.   2

17. A lamp of 100 W works at 220 Volt. What is its resistance and current capacity?   2

18. What are electromagnetic waves? Name the part of the electromagnetic spectrum which is suitable for radar system used in aircraft navigation.   2

19. (a) The light of wavelength 6000 Å falls normally on a slit of width 2 mm. Calculate the linear width of central maximum on a screen kept 2 m away from the slit. 2

OR

(b) Write *any two* differences between interference and diffraction. 2

20. What is total internal reflection ? Under what conditions does total internal reflection take place ? 1+1=2

21. Explain with the help of a circuit diagram how a junction diode acts as a half wave rectifier. 2

22. Define potential gradient. Obtain the relation between electric field and potential gradient at a point in the electric field. 1+2=3

23. How does resistivity depend on temperature of the conductor ? A wire of resistance 1 Ohm is stretched to double its length. What is the new resistance ? 1+2=3

24. (a) Obtain the condition of balanced wheatstone bridge using Kirchoff's law. 3

OR

(b) Define drift velocity. Derive the relation between drift velocity and electric current. 3

25. A magnetic field of flux density 10 T acts normal to a coil of 50 turns having 100 cm² area. Find the *emf* induced if the coil is removed from the magnetic field in 0.2 s. 3

26. Using Biot-Savart's law, derive an expression for magnetic field at the centre of a current carrying loop. 3

27. (a) What is dispersion of light ? Explain why, in a spectrum, violet light suffers greater deviation than red light. 1+2=3

OR

(b) When a ray of light passes through a prism, show that the sum of the angle of prism and the angle of deviation is equal to the sum of the angle of incidence and the angle of emergence. 3

28. What is photoelectric effect ? How is the photoelectric current affected on increasing the (i) frequency and (ii) intensity of incident radiation ? $1+1+1=3$

29. Explain what will happen to the focal length of a convex lens of refractive index 1.2, if it is immersed in a liquid of refractive index 1.3. $\triangleleft$ 3

30. If the energy of an electron in the nth orbit is given by $E_n = -\dfrac{13.6}{n^2}$ eV, determine the energy required to excite an electron from ground state to the second excited state. 3

31. (a) Define electric field intensity. Derive an expression for electric field on equitorial line of an electric dipole. $1+4=5$

OR

(b) What is Gaussian surface ? Derive an expression for electric field due to an infinitely long line charge having uniform charge density . $1+4=5$

32. (a) State the principle, construction and working of a transformer. Why is the core of a transformer laminated ? $1+3+1=5$

OR

(b) Define impedance of an LCR series circuit. Derive an expression for impedance of LCR series circuit. $1+4=5$

33. (a) Derive lens maker's formula for a thin convex lens stating the sign conventions used. $4+1=5$

OR

(b) Deduce the condition for constructive and destructive interference in Young's double slit experiment. 5

Physical constants :

$$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \text{ N m}^2\text{C}^{-2}$$

$$\varepsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 \text{ N}^{-1}\text{m}^{-2}$$

$$c = 3 \times 10^8 \text{ ms}^{-1}$$

$$e = 1.6 \times 10^{-19}\text{C}$$

$$m_e = 9.1 \times 10^{-31} \text{ Kg}$$

$$m_p = 1.67 \times 10^{-27} \text{ Kg}$$

$$h = 6.62 \times 10^{-34}\text{Js}$$

$$G = 6.67 \times 10^{-11} \text{ Nm}^2 \text{ Kg}^{-2}$$

$$g = 9.8 \text{ ms}^{-2}$$

$$1\overset{\circ}{\text{A}} = 10^{-10}\text{m}$$

$$1 \text{ amu} = 931 \text{ MeV}$$

$$\mu_0 = 4\pi \times 10^{-7}\text{TA}^{-1}\text{m}$$