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Mizoram Board
Question Paper

CLASS 12



2023

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 from the given options : 9×1=9

(a) The process of formation of gametes is called –

(i) embryogenesis (ii) isogametes

(iii) gametogenesis (iv) microsporogenesis

(b) Which part of the sperms contains the respiratory enzymes ?

(i) Head (ii) Neck

(iii) Middle piece (iv) Acrosome

(c) The primary Lymphoid organs are –

(i) Lymph node (ii) Spleen

(iii) Bone marrow (iv) Heart

(d) Which of the following diseases is caused by a DNA Virus ?

(i) AIDS (ii) Measles

(iii) Mumps (iv) Chicken pox

(e) A stronger species being benefitted at the cost of another weak species is an example of–

(i) Predation (ii) Parasitism

(iii) Competition (iv) Commensalism

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(f) The most important element of the protoplasm and the major constituent of carbohydrates, proteins, fats and nucleic acids of all the cells of an organism is –

(i) Nitrogen (ii) Carbon

(iii) Oxygen (iv) Calcium

(g) In human beings, sex of the child is determined by –

(i) both mother and father (ii) mother only

(iii) father using his 'Y' chromosome (iv) father by his 'X' chromosome

(h) Which of the following is correctly matched ?

(i) Wheat -Pusa komal (ii) Fish - Apiculture

(iii) Green revolution - Wheat (HYV) (iv) Bee keeping - Horticulture

(i) Rearing of birds to increase the yield of meat and eggs is known as –

(i) Agriculture (ii) Pisciculture

(iii) Poultry (iv) Horticulture

2. Fill in the blanks : 5×1=5

(a) _____ refers to breeding crop with higher levels of vitamins and minerals or higher proteins and healthier fats.

(b) Insect pollination is also called _____ .

(c) Menstrual cycle also known as Ovarian cycle lasts for about _____ days.

(d) The function of DNA ligase is _____ .

(e) Diabetes mellitus is characterised by hyper-glycemia and glycosuria. This is due to the deficiency of _____ .

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SECTION – B

3. (a) What is epistasis ? Distinguish between hypostatic gene and epistatic gene. 1+1=2

OR

(b) Define genetic code. What is starting codon ? Write *any one* stop codon. 1+½+½=2

4. What is single cell protein ? Write *two* significance of single cell protein. 1+½+½=2

5. What is statin ? Name the microbe that produces it. 1+1=2

6. Distinguish between sex chromosomes and autosomes. 2

7. How can bacteria and viruses be used as vectors to deliver genes of interest to human beings ? 1+1=2

8. Explain indicator species with example. 2

9. Write the effects of light on plants. 2

SECTION – C

10. (a) Define trophic level. Describe different trophic levels in a food chain. 1+2=3

OR

(b) Define conservation. What are the objectives of conservation ? 1½+1½=3

11. What is layering ? Briefly describe the *two* methods of layering. 1+1+1=3

12. What is pollination ? What are the *two* types of pollination ? Briefly describe self pollination in plants. 1+½+½+1=3

13. Explain ABO blood group system as an example of co-dominance. 3

14. What are the salient features of human genome ? Write *at least six points.* 3

15. How does change in the population of peppered moth, *Biston betularia* explain the impact of environment and natural selection in England ? 3

16. What is bioethics ? What are the major bioethical concerns pertaining to biotechnology ? 1+2=3

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17. How does restriction endonucleases cut DNA ? 3

18. To control overpopulation, one doctor suggests oral administration of pills rather than surgical methods. Justify your support for such a suggestion. 3

SECTION – D

19. (a) Explain Miller and Urey's experiment for organic synthesis. Write results of the experiment. 4+1=5

OR

(b) Explain the semi-conservative mode of DNA replication with labelled diagram. Why are both the strands of DNA not copied during transcription ? 3+2=5

20. (a) What is the full form of AIDS ? Illustrate the process of infection of AIDS by HIV. Write the mode of infection/spread of AIDS. ½+2½+2=5

OR

(b) What are biofertilizers ? Explain fungi as biofertilizers. Write *any two* advantages of biofertilizers. 1+2+2=5

21. (a) Define population. Illustrate different phases of growth in logistic growth curve or sigmoid growth curve depending on the environmental resistance. 1+4=5

OR

(b) What is deforestation ? Write *any four* causes of deforestation. Also write *any four* effects of deforestation. 1+2+2=5

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2023

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. Choose the correct answer from the given options –

(a) A compound formed by elements 'A' and 'B' crystallizes in a cubic arrangement in which 'A' atoms are at the corners of the cube and B atoms are at the face centres. What is the formula of the compound ? 1

(i) AB (ii) AB_2

(iii) AB_3 (iv) A_2B_3

(b) Isotonic solutions have – 1

(i) same boiling point (ii) same vapour pressure

(iii) same melting point (iv) same osmotic pressure

(c) The half-life period of a first order reaction depends upon – 1

(i) concentration of reactants

(ii) concentration of products

(iii) rate constant of a reaction

(iv) concentration of reactants and products

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(d) Which of the following noble gases is radioactive and used in the treatment of cancer ? 1

(i) Helium (ii) Neon

(iii) Argon (iv) Radon

(e) The IUPAC name of the complex $[Co(NH_3)_4Cl(NO_2)]Cl$ is – 1

(i) Nitrito-N-Chloridopentaamine-cobalt (III) chloride

(ii) Tetraamminechlorido nitritocobalt (III) chloride

(iii) Tetraamminechloridonitrito-N-cobalt (III) chloride

(iv) Tetraamminechloridonitrito-N-cobaltate (III) chloride

(f) The type of Isomerism exhibited by the isomers $[Co(NO_2)(NH_3)_5]Cl_2$ and $[Co(ONO)(NH_3)_5]Cl_2$ is – 1

(i) Linkage isomerism (ii) Hydrate isomerism

(iii) Coordination isomerism (iv) Ionisation isomerism

(g) The IUPAC name of the compound $CH_3-\underset{\displaystyle Br}{\underset{|}{CH}}-\overset{\displaystyle O}{\overset{\|}{C}}-CH_2-COOH$ is – 1

(i) 3 – Oxo – 4 – bromopentanoic acid (ii) 4 – Bromo – 3 – oxopentanoic acid

(iii) 2 – Bromo – 3 – oxobutanoic acid (iv) 2 – Oxo – 3 – bromopentanoic acid

(h) The IUPAC name of the compound 1

$$CH_3-\underset{\displaystyle CH_3}{\underset{|}{N}}-\underset{\displaystyle C_2H_5}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_2-CH_3$$ is –

(i) 2 – Methyl – N – methyl – N – ethylpentanamine

(ii) 2 – Methyl – N, N – dimethylbutanamine

(iii) 3 – Methyl – N, N – dimethylpentan – 3 – amine

(iv) 3 – Methyl – N, N – dimethylpentan – 2 – amine

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(i) Ethylamine and aniline can be distinguished by using which of the following tests ? 1

(i) Carbylamine test (ii) Tollen's test

(iii) Azo-dye test (iv) Hinsberg's test

(j) The compounds CH_3CH_2CHO and CH_3CH_2COOH cannot be distinguished by – 1

(i) Tollen's test (ii) Fehling's test

(iii) $NaHCO_3$ test (iv) Hinsberg's test

(k) Which of the following disaccharide is present in milk ? 1

(i) Sucrose (ii) Glucose

(iii) Lactose (iv) Cellulose

(l) Cyanocobalamine is the chemical name of which of the following vitamins ? 1

(i) Vitamin B_{12} (ii) Vitamin B_2

(iii) Vitamin A (iv) Vitamin C

(m) For a binary ideal liquid solution, the total pressure of the solution is given as – 1

(i) $P_{Total} = P^\circ_A + (P^\circ_A - P^\circ_B)\, x_A$

(ii) $P_{Total} = P^\circ_B + (P^\circ_A - P^\circ_B)\, x_A$

(iii) $P_{Total} = P^\circ_B + (P^\circ_B - P^\circ_A)\, x_A$

(iv) $P_{Total} = P^\circ_A + (P^\circ_B - P^\circ_A)\, x_A$

(n) A reaction involving two different reactants can never be – 1

(i) First order reaction (ii) Second order reaction

(iii) Unimolecular reaction (iv) Bimolecular reaction

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2. (a) Discuss the effectiveness of Zinc coating and Tin coating in preventing iron from rusting. 2

OR

(b) Discuss the advantages of fuel cells over ordinary cells. 2

3. Write notes on : 2

(a) Isoelectric points of amino-acids

(b) Nucleic acids

4. What are emulsions ? Write the main function of an emulsifier. 2

5. Write *four* differences between physical adsorption and chemical adsorption. 2

6. What is Sandmeyer reaction ? Give example. 2

7. Write the mechanism for Cannizzaro's reaction. 2

8. Write a reaction for the conversion of 1-Bromopropane to 2-Bromopropane. 2

9. Why do alcohols have lower boiling points than those of carboxylic acids ? 2

10. Why are nitrophenols more acidic than phenols ? 2

11. Explain Gattermann Koch reaction with suitable example. 2

12. Why are alkylamines stronger bases than ammonia ? 2

13. An element crystallizes in bcc lattices with cell edge of 3×10^{-8} cm. The density of the element is 6.98g cm^{-3}. Calculate molar mass of this element. 3

14. 18g of glucose, $C_6H_{12}O_6$ (Molar mass = 180gmol^{-1}) is dissolved in 1kg of water in a sauce pan. At what temperature will this solution boil ? (K_b for water = 0.52 k Kg mol^{-1} and boiling point of water = 373.15 K) 3

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15. Calculate e.m.f of the following cell at 298 K. 3

$Al(s) | (Al^{3+}(0.15M) || Cu^{2+}(0.025M) | Cu(s)$

Given

$E^{\circ}_{Al^{3+}/Al} = -1.66V$

$E^{\circ}_{Cu^{2+}/Cu} = +0.34V$

16. (a) The half life period for a radioactive decay of C–14 is 5730 years. An archaeological artifact containing wood had only 60 % of the C–14 found in a living tree. Estimate the age of the sample. 3

OR

(b) In general, it is observed that the rate of a chemical reaction becomes double with every 10° rise in temperature. If this generalisation holds for a reaction in the temperature range of 298K to 308K, what would be the value of activation energy for this reaction ? ($R=8.314 JK^{-1}mol^{-1}$) 3

17. Define the following terms of metallurgical processes – 3

(a) Froth Floatation (b) Calcination (c) Flux

18. What are condensation polymers ? Describe the preparation of Nylon–6,6. 3

19. What effects do the following drugs have in our body ? 3

(a) Tranquilizers

(b) Antibiotics

(c) Antipyretics

20. Using Valence Bond Theory, draw the stucture of $[Fe(CN)_6]^{3-}$ complex ion. Show its hybridisation scheme and predict its magnetic character. 3

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21. (a) (i) Why is nitrogen molecule less reactive at room temperature ? 2

(ii) Arrange the different halogen acids in increasing order of acidity and account for it. 3

OR

(b) (i) Explain why NCl_3 gets readily hydrolysed while NF_3 does not. 2

(ii) Describe the preparation of H_2SO_4 by contact process. 3

22. (a) (i) Why are Zn^{2+} salts colourless while Cu^{2+} salts are coloured ? 2

(ii) Compare the magnetic character of Mn^{2+} and Fe^{2+} ions. Calculate their magnetic moments. 3

OR

(b) (i) Why do transition elements form a large number of interstitial compounds ? 2

(ii) Describe the preparation of $K_2Cr_2O_7$ from Chromite ore. 3

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2023

COMPUTER SCIENCE

(Theory)

Full Marks – 70

Time : 3 hours

General instructions :

(i) All questions are compulsory.

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

(iii) Figures in the margin indicate marks.

(iv) Programming Language : Python.

1. Choose the correct answer : 7×1=7

(a) Which of the following is an invalid variable ?

(i) my_day_2 (ii) 2nd_day

(iii) Day_two (iv) _2

(b) Predict the output of the following Python code :

```
>>> City = "Aizawl"
>>> City [ : 2]
>>>
```

(i) Ai (ii) wl

(iii) zaw (iv) Aizaw

(c) Which of the following function call can be used to invoke the function definition below ?

```
def function(var1, var2, var3, var4) :
```

(i) function(5, 8, 9, 7) (ii) function(var1=5, 8, var3=9,7)

(iii) function(var1 = 5, 8, 9,7) (iv) function(var1=5, var2=8,9,7)

(d) Which of the following is the fastest media of data tansfer ?

(i) Co-axial Cable (ii) Untwisted Wire

(iii) Telephone lines (iv) Fibre optics

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(e) A relational database consists of a collection of –

(i) Tables (ii) Fields

(iii) Records (iv) Keys

(f) Consider the table with structure as :

student (ID, name, dept_name, tot_cred)

In the above table, which attribute will form the Primary key ?

(i) name (ii) dept_name

(iii) tot_cred (iv) ID

(g) Which of the following is not done by cyber criminals ?

(i) Unauthorised account access

(ii) Mass attack using Trojans as botnets

(iii) Email spoofing and spamming

(iv) Report vulnerability in any system

2. Fill in the blanks : 7×1=7

(a) In a recursive funtion, _____ case must always be reachable. (recursive / base / repetitive)

(b) In python, program execution begins with the first statement of _____ segment. (main/ function call / loop)

(c) To open a file d:\ test.txt for reading data, we use _____ .

(file = open ("d:\test.txt", "w") / file = open ("d:\test.txt", "a") /file = open ("d:\test.txt", "r"))

(d) Network device that regenerates and retransmits the whole signal is _____. (modem/ hub/repeater)

(e) Internet is an example of _____ topology. (mesh / bus / star)

(f) _____ defines rules regarding the values allowed in columns and is the standard mechanism for enforcing database integrity. (Index / Constraint / Column)

(g) Methods used for interpretation of computer media for digital evidence are collectively known as _____. (Digital forensics / Digital clearing / e-forensics)

3. Answer the following questions : 13×2=26

(a) What is the difference between a local variable and global variable ? Also give a suitable Python code to illustrate both.

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(b) (i) Find the length of the tuple shown below

T=((('a', 1), 'b' , 'c'), 'd', '2'). 'e', 3)

OR

(ii) Write the output of the following Python code.

```
def func(message, num = 2):
    print(message * num)
func("Aizawl")
func("City", 1)
```

(c) Distinguish between worst-case and best-case complexity of an algorithm.

(d) Find and write the output of the following Python code :

```
def change (P, Q=30) :
    P= P+Q
    Q=P–Q
    print (P, "#", Q)
R= 150
S = 100
change (R, S)
print (R, "#", S)
```

(e) (i) Write the equivalent postfix expression for : 10 *3*(7–1) +23

OR

(ii) Write the equivalent prefix expression for : (A+(B * C))/(C–(D*B))

(f) (i) Differentiate between iteration and recursion. State one advantage and one disadvantage of using recursion over iteration.

OR

(ii) What is base case in a recursive program ? Why is base case so important in a recursive function ?

(g) What is the difference between message switching and packet switching technique ?

(h) What is a modem ? What is its function ?

(i) What is the purpose of using router ?

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(j) (i) What are views in SQL ? How are they useful ?

OR

(ii) Categorise the following commands into DDL and DML commands.

INSERT INTO, DROP TABLE,

ALTER TABLE, UPDATE ...SET

(k) Differentiate between candidate keys and an alternate key.

(l) What is the significance of GROUP BY clause in SQL query ?

(m) What are common gender and disability issues faced while teaching/using computer in classrooms ?

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

(a) Explain ***any three*** forms of *if.....else* statements with one example each.

(b) (i) Write a recursive function recurfactorial(n) in Python to calculate and return the factorial of a number n passed to the parameter.

OR

(ii) Is return statement optional ? Compare and comment on the following two return statements.

```
return      # statement 1
return val  # statement 2
```

(c) Write a program to get students' data (roll no, name and marks) from user and write onto a binary file.

(d) (i) Evaluate the following expression in tabular form showing stack status after each step :

5, 6, 2, +, *, 12, 4, /, –

OR

(ii) Consider the following stack of characters implemented as an array of 8 elements :

STACK : A, J, P, N

↑ top

Describe the stack as the following operations take place :

(a) POP (STACK, ITEM)

(b) PUSH (STACK, K)

(c) PUSH (STACK, S)

(d) POP (STACK, ITEM)

(e) PUSH (STACK, G)

(f) PUSH (STACK, L)

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(e) (i) Discuss the various types of networks.

OR

(ii) Explain the different types of networking/internet working devices.

(f) Differentiate between mobile computing and wireless communication.

(g) What are table constraints ? Give one example.

(h) Consider the following table "GAMES" and write SQL commands for the questions (i) to (iii).

TABLE : GAMES

GCode	Game Name	Number	PrizeMoney	Scheduled Date
101	Carrom Board	2	5000	23-01-2004
102	Badminton	2	12000	12-12-2003
103	Table Tennis	4	8000	14-02-2004
104	Tennis	3	15000	11-08-2004
105	Chess	4	9000	27-11-2003

(i) List the names of games with their Scheduled date in ascending order.

(ii) List the average Prize money of games whose number is less than 3.

(iii) Display GCode of games which have prize money more than 6000.

(i) What is secure data transmission ? What technical ways are used to ensure the secure data transmission ?

(j) Why should Intellectual property rights be protected ?

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2023
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 :

More and more as I near the end of my career as a heart surgeon, my thoughts have turned to the consideration of why people should suffer. Suffering seems so cruelly prevalent in the world today. My gloomy thoughts probably stem from an accident I had a few years ago. One minute I was crossing the street with my wife after a lovely meal together, and the next minute a car had hit me and knocked me and my wife. She was thrown into the other lane and was struck by a car coming from the opposite direction.

During the next few days in the hospital, I experienced not only agony but also fear and anger. Over and over I asked myself why should this happen to us ? There were patients waiting for me to operate upon them and my wife had a small baby to look after.

As a doctor, I have always found the suffering of children particularly heartbreaking especially beacause of their total trust in doctors and nurses. They believe you are going to help them. If you can't, they accept their fate.

What I witnessed in the hospital one morning opened my eyes to the fact that I was missing something in all my thinking about suffering. What happened that morning was that a

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nurse had left a breakfast trolley unattended. And very soon two children took charge of it - a driver and a mechanic. The mechanic provided motor power running along behind the trolley with his head down, while the driver seated on the lower deck, held on with one hand and steered by scrapping his foot on the floor. The choice of roles was easy. The mechanic was blind and the driver had only one arm. They put on quite a show that day. Judging by the laughter and shouts of encouragement from the rest of the patients, it was great entertainment.

Let me tell you about these two. The mechanic was all of seven years old. One night his mother threw a lantern at his father, it missed him and broke over the child's head and shoulders. He suffered severe third degree burns and lost his eyes. His face was a mass of flesh. When I stopped by him on that day, he said, "You know we won," he was laughing.

The driver of the trolley I knew better. A few years earlier, I had successfully closed a hole in his heart. He returned with a tumour of the bone. A few days earlier, his shoulder and arm were amputated. After that event that day, he proudly informed me that the race was a success.

The only problem was that the trolley's wheels needed to be oiled. Suddenly, I realised that these two children had given me a profound lesson in getting on with the business of living. This business of living is the celebration of being alive.

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

(a) What was the doctor's attitude to the suffering of children ?

(b) What was the problem with the driver ?

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

(a) When hospitalised, the doctor was worried about –

(i) his accident (ii) his patients

(iii) the mechanic (iv) the driver

(b) The children made the doctor realise –

(i) his duty as a doctor (ii) his duty as a father

(iii) his duty to celebrate being alive (iv) his duty as a husband

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1.3. Find words in the passage which convey similar meaning : 2×1=2

(a) depressing (b) destiny

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

Everyone needs a holiday, both to relax and to have a change of environment. The holiday makers feel relaxed and refreshed at the end of the holiday and look forward to the resumption of their duties, be it at school, office or factories, with renewed vigour. This is the reason why all establishments grant their employees annual leave. With the end of the academic year the schools and universities grant their pupils a long holiday during mid-summer. This will last until early September when the new school term starts. Of course the parents will like to take advantage of this and take their leave to coincide with the children's vacation. This has become a traditional holiday season in most European countries particularly in England.

With the coming of August, the traditional holiday season in Britain reaches its peak point and most of the holiday resorts are packed to capacity. In order to avoid the crowd, some prefer to take their holidays a little earlier if facilities so warrant. Those who have already taken their holidays can console themselves not only with reflections on the happy days spent in the country, at the seaside or abroad, but also with the thought that holiday expenses are over for the year and that by taking an earlier holiday they have missed the August rush.

The main thing, of course, is the weather and that it would be hazardous to prophesy. But whatever the weather is like, the essence of a holiday for most is the carefree atmosphere in which it can be enjoyed. "Take all you need but leave your worries behind" is the sound advice for the holiday maker. Private worries are not always easy to escape from. However, even the pessimist would admit that for the moment things appear brighter than they have been.

Holiday time is surely a time for shedding serious pre-occupations and seeking the pleasures that appeal to us. It is true that we may not always succeed in finding them; indeed there are people who maintain that the great thing about a holiday is that it gives you an ampler appreciation of home comforts - a view no doubt more widely held among the elderly than you.

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

(b) Write a summary of the above passage in not more than 80 words. 3

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(c) What did Dr. Sadao do with the unfinished report on the injured American ?

(i) He completed the report and sent it to the Chief of Police

(ii) He kept it on his desk

(iii) He kept it inside a secret drawer

(iv) He completed the report and sent it to the General

(d) How many times did the Wizard ask Roger to turn at the end of the lane ?

(i) 2 (ii) 3 (iii) 4 (iv) 5

(e) What were Derry and Mr Lamb victims of ?

(i) Vision impairment (ii) Physical impairment

(iii) War (iv) None

(f) The police laid their hands on Evans in a hotel named –

(i) The Lion's Den (ii) The Lion's Cage

(iii) The Golden Lion (iv) The Golden Web

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

(a) What oppression and discrimination did Zitkala Sa and Bama experience during their childhood ? How did they respond to their respective situations ? 5

OR

(b) "Take care of the small things and the big things will take care of themselves". What is the relevance of this statement in the context of the Antarctica environment ? 5

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SECTION – B : Writing *(25 marks)*

3. Your brother, Siammawia is going to marry Lalrinawmi (D/o Mr & Mrs Mawizuala, Salem Veng, Aizawl). Your parents Mr & Mrs Lalthanpuia have planned to hold the wedding at Baptist Church Salem Veng, on the 14th of March, 2023 at 2:00 p.m. Write a formal invitation, in not more than **50** words, on behalf of your parents, inviting guests. Give all necessary details. 5

4. You are a fitness trainer in a health club. Design a poster in not more than **50** words to emphasize the importance of exercise in maintaining mental and physical fitness. 5

5. (a) You are John / Mary of B-31/ Dawrpui, Aizawl. You are interested in doing a short term course in computer programming during your winter vacation. Write a letter to the Director, Computer World, Chanmari, Aizawl inquiring about the duration of such a course and the terms and conditions for admission. 10

OR

(b) You are Malsawma / Malsawmi, in charge of the library in your school. You have been asked to place an order for some books from M.K. Book Store, 37/1, MG Bazar, Kolkata – 15, West Bengal. Mention the names and quantity of all the books and ask for discounts available on the purchase. 10

6. (a) Members of the Social Activities Club of your school recently visited an orphanage run by a well-known NGO. Members of the club were greatly impressed with the atmosphere in the orphanage. Write a report in about **120** words, giving details such as clean surroundings, nice and caring staff, well-fed children with glowing faces, toys and games for kids. You are Nathan / Norah, President of your school's Social Activities Club. 5

OR

(b) You are Zorama / Zorami. Write an article in about **120** words for your school magazine on the topic - Life Without Modern Gadgets. 5

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SECTION – C : Literature *(40 marks)*

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

I. The polished traffic passed with a mind ahead,
Or if ever aside a moment, then out of sorts
At having the landscape marred with the artless paint
Of signs that with N turned wrong and S turned wrong
Offered for sale wild berries in wooden quarts

(a) The name of the poem and the poet is –
(i) A Roadside Stand by John Keats
(ii) A Roadside Stand by Robert Frost
(iii) An Elementary School Classroom in a Slum by Pablo Neruda
(iv) An Elementary School Classroom in a Slum by Stephen Splender

(b) The first line of the extract explains –
(i) magnificent cars with rich people
(ii) the farmers seated on the road
(iii) the landscape
(iv) the long winding road

(c) What mars the landscape ?
(i) the beauty of the landscape
(ii) the artless paint of signs on the roadside stand
(iii) North turned wrong and South turned wrong
(iv) a little new shed

(d) Things which were offered on sale –
(i) wooden quarts
(ii) wild berries
(iii) vegetables
(iv) souvenirs

OR

II. Those who prepare green wars,
wars with gas, wars with fire,
victory with no survivors,
would put on clean clothes
and walk about with their brothers
in the shade, doing nothing.

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

(i) Aunt Jennifer's Tiger by Adrienne Rich

(ii) A Thing of Beauty by John Keats

(iii) My Mother at Sixty-Six by Kamala Das

(iv) Keeping Quiet by Pablo Neruda

(b) What does the poet mean by green wars ?

(i) war with gas

(ii) war with fire

(iii) war with green crackers

(iv) war against nature

(c) Does the poet advocate total inactivity ?

(i) Yes

(ii) No

(iii) Sometimes

(iv) None of these

(d) What does the poet mean by 'would put on clean clothes'?

(i) to be angry

(ii) to be peaceful

(iii) to be hyperactive

(iv) None of these

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

(a) How are Aunt Jennifer's tigers different from her ?

(b) Bring out the contrast portrayed by the scene outside with the state of the poet's mother in the poem, 'My Mother at Sixty-Six'.

(c) How can you say that a thing of beauty is a joy forever ?

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

(a) Why do celebrity writers despise being interviewed ?

(b) Why did the author of Poets & Pancakes appear to be doing nothing at the studios ?

(c) What did Sophie imagine about her meeting with Danny Casey ?

(d) What explanation does the author of Lost Spring offer for the children not wearing any footwear ?

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

(a) In 'The Last Lesson', language is considered to be –

(i) the solution to everything

(ii) the most important thing in the world

(iii) means of communication

(iv) cultural identity of the people

(b) Gandhi was summoned by _____, the Lieutenant-Governor.

(i) Sir Edward Gait (ii) Sir Henry Gait

(iii) Sir Richard Andrews (iv) Sir Freer Andrews

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

(a) What does Douglas fear and how did he overcome his fear ?

(b) How does the peddler interpret the acts of kindness and hospitality shown by the cropter, the ironmaster and his daughter ?

12. Answer the following questions in about **30** words : 2×2=4

(a) Why was Dr. Sadao kept in Japan and not sent abroad with the troops ?

(b) How does Mr. Lamb reassure Derry that he can do better than all the rest ?

13. Choose the correct answer from the given options : 6×1=6

(a) Sam's letter to Charley was dated –

(i) June 11, 1894 (ii) July 11, 1894

(iii) June 18, 1894 (iv) July 18, 1894

(b) Why was the Maharaja so anxious to kill the 100th tiger ?

(i) To prove his strength

(ii) To ensure his safety and to prove prediction wrong

(iii) To prove his hunting skill

(iv) To prove his power

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2023

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 from the given options : 14×1=14

(a) Study of the structural features of the rocks, their distribution and genesis is called –

(i) Structural geology (ii) Tectonics

(iii) Dynamic geology (iv) Kinetic geology

(b) A fault that dips more than 45° is called –

(i) reverse fault (ii) thrust fault

(iii) over thrust (iv) inclined fault

(c) The folds with multiple hinges are –

(i) monoclinal (ii) anticlinal

(iii) polyclinal (iv) heteroclinal

(d) A conglomerate horizon is always present at the bottom of younger set of beds in –

(i) unconformity (ii) fold

(iii) joints (iv) fault

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(e) The horizontal component of apparent displacement of fault is called –

(i) Net Slip (ii) Gape

(iii) Strike (iv) Throw

(f) Lamellibranchia belongs to the phylum of –

(i) Mollusca (ii) Annelid

(iii) Arthropod (iv) Chordata

(g) In gastropods, a successive whorl that lies in mutual contact along a line is –

(i) Apex (ii) Spire

(iii) Columella (iv) Suture

(h) Foot prints that are made by animals are called –

(i) moulds (ii) tracks

(iii) trails (iv) burrows

(i) The cavity opening at the base of the shell in gastropods is called –

(i) umbilicus (ii) operculum

(iii) whorls (iv) discoidal

(j) Metasomatic replacement deposits are formed under the condition of –

(i) hypothermal (ii) epithermal

(iii) mesothermal (iv) xenothermal

(k) Water which is entrapped in the sedimentary rocks during their deposition is called –

(i) connate water (ii) juvenile water

(iii) meteoric water (iv) vadose water

(l) The capacity of a stone to retain its original size, strength and appearance for a long period is called –

(i) permeability (ii) strength

(iii) durability (iv) heat resistance

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(m) The instrument used for reading the intensity of earthquake waves is –

(i) hygrometer (ii) anemometer

(iii) seismograph (iv) seismogram

(n) The propagation of P-waves is –

(i) longitudinal (ii) transverse

(iii) linear (iv) periodic

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

(a) What is Diapiric fold ?

(b) Give a definition of Strike.

(c) What is Taxodont of bivalves ?

(d) What is Gangue minerals ?

(e) What is Organic mineral deposit ?

(f) What is Mechanical concentration ?

(g) What is Precipitation ?

3. Write short notes on Thrust fault with a diagram. 2+1=3

4. What is the difference between Fold and Fault ? 3

5. Explain the types of fold based on interlimb angle with the help of a diagram. 1½+1½=3

6. Write down *six* types of dentition found in Pelecypods. 3

7. What are Index fossils ? 3

8. Write short notes on the metamorphic process of mineral deposits. 3

9. What kinds of surveys are required for constructing a tunnel ? 3

10. Define porosity in movement of ground water. 3

11. What is an Epicenter ? 3

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12. (a) What are the morphological characters of Brachiopods ? Show it with a neat figure. 4+1=5

OR

(b) Explain the morphological characters of gastropods with a neat labelled diagram. 4+1=5

13. What are the different stages of formation of coal ? Write *four* uses of coal. 3+2=5

14. (a) Write the origin, mode of occurrence and distribution of iron mineral deposits in India. 1+2+2=5

OR

(b) What is Oxidation and Supergene enrichment ? 2½+2½=5

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2023

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 is a 3-rowed square matrix and $|A| = 4$, then *adj* (*adj A*) is equal to –

(i) 4A (ii) 16A

(iii) 25A (iv) 64A

(b) If A and B are symmetric matrices of the same order, then $(AB - BA)$ is always –

(i) symmetric matrix (ii) skew-symmetric matrix

(iii) zero matrix (iv) identity matrix

(c) Let S be the set of all straight lines in a plane. Let R be a relation on S defined by $(a,b) \in R$ such that $a \perp b$. Then R is –

(i) reflexive but neither symmetric nor transitive

(ii) symmetric but neither reflexive nor transitive

(iii) transitive but neither reflexive nor symmetric

(iv) an equivalence relation

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(d) Let $*$ be a binary operation on the set of all non-zero real numbers, defined by $a * b = \frac{ab}{5}$. The value of x given that $2 * (x * 5) = 10$ is –

(i) 25 (ii) 30

(iii) 40 (iv) 50

(e) The value of $\sin^{-1}(\sin \frac{2\pi}{3})$ is –

(i) $\frac{2\pi}{3}$ (ii) $\frac{5\pi}{3}$

(iii) $\frac{\pi}{3}$ (iv) $\frac{\pi}{2}$

(f) $\tan^{-1} \frac{1}{2} + \tan^{-1} \frac{1}{3}$ equals to –

(i) $\frac{\pi}{3}$ (ii) $\frac{\pi}{4}$

(iii) $\frac{\pi}{2}$ (iv) $\frac{2\pi}{3}$

(g) The function $f(x) = |x|$ for all $x \in R$ is –

(i) continuous and differentiable at $x = 0$

(ii) continuous but not differentiable at $x = 0$

(iii) differentiable but not continuous at $x = 0$

(iv) neither continuous nor differentiable at $x = 0$

(h) If $y = \cot^{-1}\left(\frac{1}{x}\right)$ then $\frac{dy}{dx}$ is equal to –

(i) $\frac{-x^2}{1+x^2}$ (ii) $\frac{x^2}{1+x^2}$

(iii) $\frac{-1}{1+x^2}$ (iv) $\frac{1}{1+x^2}$

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(i) The equation of the tangent to the curve $y = x^4 - 6x^3 + 13x^2 - 10x + 5$ at the point (1, 3) is –

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

(iii) $2x - y + 1 = 0$ (iv) $2y - x + 1 = 0$

(j) The radius of a circle is increasing at the rate of 0.7 cm/s. The rate of increase of its circumference is –

(i) 7.1cm / s (ii) 4.0 cm / s

(iii) 3.9 cm / s (iv) 4.4 cm / s

(k) $\int e^x (\sin x + \cos x)\, dx$ is equal to –

(i) $e^x \sin x + c$ (ii) $e^x \cos x + c$

(iii) $e^x \tan x + c$ (iv) $e^x \cot x + c$

(l) $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} (x^3 + x\cos x + \tan^5 x + 1)dx$ is equal to –

(i) 0 (ii) 2

(iii) π (iv) 1

(m) If $|\vec{a} \times \vec{b}| = |\vec{a}.\vec{b}|$, then the angle between $\vec{a}$ and $\vec{b}$ is –

(i) $\frac{\pi}{2}$ (ii) $\frac{\pi}{3}$

(iii) $\frac{\pi}{4}$ (iv) $\frac{\pi}{6}$

(n) If a line makes angles α, β and γ with the x-axis, y-axis and z-axis, then $(\sin^2\alpha + \sin^2\beta + \sin^2\gamma)$ is equal to –

(i) 1 (ii) 2

(iii) 3 (iv) $\frac{1}{2}$

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(o) If θ is the angle between the planes $2x-y+2z=3$ and $6x-2y+3z=5$, then $\cos\theta$ is equal to –

(i) $\frac{11}{20}$ (ii) $\frac{12}{23}$

(iii) $\frac{17}{25}$ (iv) $\frac{20}{21}$

(p) The line $\frac{x-3}{2}=\frac{y-4}{-3}=\frac{z-1}{5}$ crosses the xy plane at –

(i) $\left(\frac{13}{5},\frac{23}{5},0\right)$ (ii) $\left(\frac{13}{5},0,\frac{23}{5}\right)$

(iii) $\left(0,\frac{13}{5},\frac{23}{5}\right)$ (iv) $\left(\frac{13}{5},\frac{23}{5},\frac{33}{5}\right)$

2. If $A=\begin{bmatrix}3 & -2\\ 4 & -2\end{bmatrix}$, find k so that $A^2=kA-2I$ 2

3. For any three vectors $\vec{a},\vec{b}$ and $\vec{c}$, prove that $\left[\vec{a}+\vec{b}\ \ \vec{b}+\vec{c}\ \ \vec{c}+\vec{a}\right]=2\left[\vec{a}\ \vec{b}\ \vec{c}\right]$. 2

4. Ten eggs are drawn successively with replacement from a lot containing 10 % defective eggs. Find the probability that there is at least one defective egg. 2

5. A card is drawn from a well-shuffled deck of 52 cards and without replacing this card, a second card is drawn. Find the probability that the first card is a club and the second card is a spade. 2

6. Find the domain and range of the real function defined by $f(x)=\frac{x^2}{(1+x^2)}$. 4

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7. (a) If $x = 2\cos\theta - \cos 2\theta$ and $y = 2\sin\theta - \sin 2\theta$, show that 4

$$\frac{dy}{d\theta} = \tan\frac{3\theta}{2}$$

OR

(b) Find the intervals on which the function $f(x) = (\sin x + \cos x)$, $0 < x < 2\pi$ is strictly

(i) increasing

(ii) decreasing 4

8. Prove that $\int_0^{\pi} \frac{x\tan x}{(\sec x \operatorname{cosec} x)}dx = \frac{\pi^2}{4}$ 4

9. Evaluate : $\int x\sin^{-1} x\,dx$ 4

10. (a) Solve the differential equation : 4

$$(\cos^2 x)\frac{dy}{dx} + y = \tan x$$

OR

(b) Show that the differential equation $x\frac{dy}{dx} = y - x\tan\frac{y}{x}$ is homogeneous and solve it. 4

11. (a) Express the vector $\vec{a} = (6\hat{i} - 3\hat{j} - 6\hat{k})$ as sum of two vectors such that one is parallel to the vector $\vec{b} = (\hat{i} + \hat{j} + \hat{k})$ and the other is perpendicular to $\vec{b}$. 4

OR

(b) Find the length and the foot of the perpendicular drawn from the point $(2, -1, 5)$ to the line $\frac{x-11}{10} = \frac{y+2}{-4} = \frac{z+8}{-11}$. 4

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12. Show that the lines $\frac{x-1}{2}=\frac{y-3}{4}=\frac{z}{-1}$ and $\frac{x-4}{3}=\frac{y-1}{-2}=\frac{z-1}{1}$ are coplanar. Also, find the equation of the plane containing these lines. 4

13. Two groups are competing for the positions on the board of directors of a corporation. The probabilities that the first and the second groups will win are 0.6 and 0.4 respectively. Further, if the first group wins, the probability of introducing a new product is 0.7 and when the second group wins, the corresponding probability is 0.3. Find the probability that the new product introduced was by the second group. 4

14. (a) Using properties of determinants, prove that : 6

$$\begin{vmatrix} (b+c)^2 & a^2 & a^2 \\ b^2 & (c+a)^2 & b^2 \\ c^2 & c^2 & (a+b)^2 \end{vmatrix} = 2(abc)(a+b+c)^3$$

OR

(b) By using elementary row transformations, find the inverse of the matrix 6

$$A=\begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$$

15. An open box with a square base is to be made out of a given cardboard of area c^2(square) units. Show that the maximum volume of the box is $\frac{c^3}{6\sqrt{3}}$ (cubic) units. 6

16. (a) Find the area of the region bounded by the curve $y=x(4-x)$, the x-axis and the lines $x=0,\ x=5$. 6

OR

(b) Using integration, find the area of the region enclosed between the circles $x^2+y^2=4$ and $(x-2)^2+y^2=4$ 6

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17. A factory owner purchases two types of machines A and B for his factory. The requirements and the limitations for the machines are as follows : 6

Machine	Area Occupied	Labour force on each Machine	Daily Output
A	1000 m^2	12 men	60
B	1200 m^2	8 men	40

He has maximum area of 9000 m^2 available and 72 skilled labourers who can operate both the machines. How many machines of each type should he buy to maximize the daily output?

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HSS/003

2023

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 zât chu a zâwnah tarlan zel a ni.

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

ṬHEN KHATNA – HLA

1. Kualkhung chhunga thute hi a dik ber thlang chhuak la, a kar awlte hi dah khat rawh : 4×1=4

   (a) Chhung kim _____ lai a hlimthla.(pâr ang lawm / lenlai nite / sakhmel mawi)

   (b) Kan dam chhûng, _____ ni. (kan vanglai / kan dam lai / kan hlim lai)

   (c) 'Pi pu chhuahtlâng hlui' hlaa kawtchhuaha an zar ṭhin a tih chu_____ a ni. (mangpuan / puankawp / pawnpui)

   (d) 'Kâr a hla' tih hla phuahtuin 'Thleng zo ang maw ka di rûnah' a tih chu _____ a ni. (lunglên / thaikawi bawngtê / palai)

2. Hausiampa'n a hlaah 'Sârah ka zâm ngei ang' a tihna chhan kha han sawi teh. 2

3. Lalsangzuali Sailo hian, 'Kaina rûn a ngui lêngdâwn an dang' a tih chhan kha han sawi teh. 2

4. 'Zoram ka ram' tih Kaphleia hla aṭangin Kaphleia'n Mizoram leh hnam tana Pathian a ngenna hrang hrangte kha han sawi teh. 4

5. Durra Chawngthu-in 'Nêmrâng puan min zâwn rawh' a tih hi tu nge a nih sawi la, hetiang taka a rilru luahtu ṭhatna hi a hla aṭang hian han sawi zau teh. 1+5=6

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ṬHEN HNIHNA – THU

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

   (a) Zikpuii Pain zirlaite hnena a chah duh chu _____ a ni. (huaisenna/tlawmngaihna/rinawmna)

   (b) Mihringin a dam hun chhunga a neih theih hlu tak pakhat chu _____ a ni. (taimakna/rinawmna/dawhtheihna)

   (c) Mihring thil neih zinga hlu ber chu _____ a ni. (nunna / finna / remhriatna)

   (d) Vunsenhovin Pathian biak in tualzawl ang veka zahawm nia an hriat chu _____ a ni. (leilunga thil awm zawng zawng / inthawina maicham / sakawr thlan rim)

7. Hla phuah thiamte zinga 'Fiara tui' phuahtu danglamna mak tak kha eng nge ni ? 2

8. Thanpuii Pain 'huaisenna' a tih leh 'mi dawihzep thawmhnaw' a tih kha engte nge sawi rawh. 1+1=2

9. 'Tawrhna' ziaktuin nunna a lo awm theihna tura nun hloh a ṭul dan a sawi kha han sawi chhawng teh. 4

10. 'Lung in malsawmna thuruk' ziaktuin lung ina malsawmna a hmuhte kha han sawi teh. 6

ṬHEN THUMNA – LEMCHAN

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

   (a) Sentlang lal hming chu _____ a ni. (Suakpuilala / Kalkhama / Lalchhunga)

   (b) Thangzawra'n 'Tlang nunrawng' a tih chu _____ a ni. (Neihbawi / Lungleng / Hmuifang)

12. Thangzawra nu-in, 'Nula ṭha leh fel tak takte pawh an tam alawm le' a tih khan Thangzawra'n engtin nge a chhan ? 2

13. Thangzawra lemchan hi tragedy nge a nih comedy sawi la, a chhan han sawi teh. 2

14. Thingsei khaw tlangval ral rûna kalten an haw kawnga vanduaina an tawh dan kha han sawi teh. 4

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ṬHEN LINA – THAWNTHU

15. A dik ber thlang chhuak rawh : 1+1=2

(a) Dama te kawngbo riahna hmun chu _____ a ni. (Rih Dil kam / Âwksa tlâng / Thantlâng)

(b) Mizorama khaihlum hmasak ber chu _____ a ni. (Lamsuaka / Chaltea / Taikhama)

16. Lal hlau lo ṭhi awmzia sawifiah rawh. 2

17. Lo sûl haw tlangvalte leh paho danglamna han ziak teh. 2

18. Rih Dil kama ṭhian pathumte thawm hriat mak deuh deuh kha han sawi teh. 4

ṬHEN NGANA – GRAMMAR & COMPOSITION

19. A hnuaia thute hi eng adverb nge an nih ziak rawh : 2×1=2

(a) Ruah a sur buan buan mai.

(Adjectival Adverb / Double Adverb / Emphatic Adverb)

(b) Ka ziak ve nial nual.

(Adjectival Adverb / Double Adverb / Emphatic Adverb)

20. A hnuaia thute hi ṭawng upain engtin nge an sawi ? 2×1=2

(a) Ring taka ṭawng, ṭawng lawng lawng. (Kel bang liak / Ngawi hêm ṭawng / Thi thu namin)

(b) Chhungkhat laina hnai nei lo. (Vân laia tla ang / Mahni seh seh mual hrangah / Delh hlum sa ei tum ang)

21. 'Fa lu hlohva lêng' tih awmzia hi sawi la, a tichiang turin thu phuah rawh. 2

22. Lianbuanga, Zarkawt venga awm i ni a, misualin i motor an rûk chungchangah Aizawl Police Station-a thehluh tur First Information Report (FIR) han ziak teh. 4

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23. A hnuaia thupui tarlan zinga i duh ber hmangin Essay, thumal 250 velin han ziak teh. 6

(a) Ruihhlo, zirlaite hmelma

(b) Zirlaite leh infiamna

(c) Zo nun mawi

ṬHEN RUKNA – RAPID READER

24. Kum khat chhunga khuai zu nei chi lâkna atâna hun ṭha bera an ngaih kha eng thla nge ? Eng nge a chhan ? 1+1=2

25. Hrângchhuana an man chhuah dan leh an thah dan kha han sawi teh. 6

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2023

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. Electric potential at any point is $V=-5x+3y+\sqrt{15}z$, then the magnitude of electric field is – 1

(a) $3\sqrt{2}$ (b) $4\sqrt{2}$

(c) $5\sqrt{2}$ (d) 5

2. If a certain piece of copper is to be shaped into a conductor of minimum resistance, its length (L) and cross - sectional area (A) shall respectively be – 1

(a) L, 2A (b) $\frac{L}{2}$, 2A

(c) 2L, 2A (d) 2L, $\frac{A}{2}$

3. The magnetic field $d\vec{B}$ due to a small current element $d\vec{l}$ at a distance of $\vec{r}$ and element carrying current I is – 1

(a) $d\vec{B}=\frac{\mu o}{4\pi}\times\frac{Id\vec{l}\times\vec{r}}{r}$ (b) $d\vec{B}=\frac{\mu o}{4\pi}\times\frac{Id\vec{l}\times\vec{r}}{r^2}$

(c) $d\vec{B}=\frac{\mu o}{4\pi}\times\frac{Id\vec{l}\times\vec{r}}{r^3}$ (d) $d\vec{B}=\frac{\mu o}{4\pi}\times\frac{Id\vec{l}\times\vec{r}}{r^4}$

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4. Torque acting on electric dipole of dipole moment $\vec{p}$ placed in uniform electric field $\vec{E}$ is – 1

(a) $\vec{p} \times \vec{E}$ (b) $\vec{p} . \vec{E}$

(c) $\vec{p} \times (\vec{E} \times \vec{p})$ (d) $E . \frac{\vec{p}}{p^2}$

5. If N is the number of turns in a coil, the value of self inductance varies as – 1

(a) N^0 (b) N

(c) N^2 (d) N^{-2}

6. Which of the following rays are not electromagnetic waves ? 1

(a) γ - rays (b) β -rays

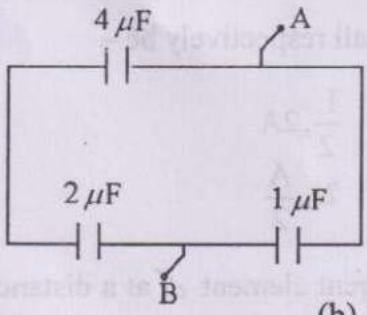
(c) X-rays (d) Heat rays

7. According to the new cartesian sign conventions, the distance measured against the direction of light is – 1

(a) negative (b) positive

(c) negative and positive (d) None of these

8. For the arrangement of the capacitors as shown in figure, the net capacitance between points A and B is – 1



(a) $1.7 \mu F$ (b) $2.33 \mu F$

(c) $2.8 \mu F$ (d) $7 \mu F$

9. For an angle of incidence 'i' on an equilateral prism of refractive index $\sqrt{3}$, the ray refracted is parallel to the base inside the prism. The value of 'i' is – 1

(a) 30° (b) 45°

(c) 60° (d) 90°

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10. If the momentum of a particle is doubled, then its de-Broglie wavelength will – 1

(a) remain unchanged (b) become four times

(c) become two times (d) become half

11. In a given reaction : ${}_{Z}X^{A} \rightarrow {}_{Z+1}Y^{A} \rightarrow {}_{Z-1}K^{A-4} \rightarrow {}_{Z-1}K^{A-4}$, the radioactive radiations are emitted in the sequence of – 1

(a) α, β, γ (b) γ, α, β

(c) β, α, γ (d) γ, β, α

12. A semi conductor doped with a donor impurity is – 1

(a) p-type (b) n-type

(c) n-p-n type (d) p-n-p type

13. Which of the following is not a transducer ? 1

(a) Loudspeaker (b) Amplifier

(c) Microphone (d) All of these

14. In communication system, noise is most likely to affect the signal – 1

(a) at the transmitter

(b) in the transmission medium

(c) in the information source

(d) at the destination

15. (a) Show that no work is done in moving a test charge over an equipotential surface. 2

OR

(b) Show that electric lines of force are always perpendicular to the equipotential surface. 2

16. An electron is projected with a velocity of 10^5 m/s at right angles to a magnetic field of 0.019G. Calculate the radius of the circular path described by the electron, if $e=1.6\times10^{-19}$C, $m = 9.1\times10^{-31}$ Kg. 2

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17. The electric mains in a house are marked 220V, 50Hz. Write down the equation for instantaneous voltage. 2

18. Define electromagnetic waves. Which of the following has the shortest frequency-microwaves, X-rays, ultra violet rays? 2

19. (a) Give *two* differences between fringes formed in a single slit diffraction and Young's double slit experiment. 2

OR

(b) State Huygen's principle. 2

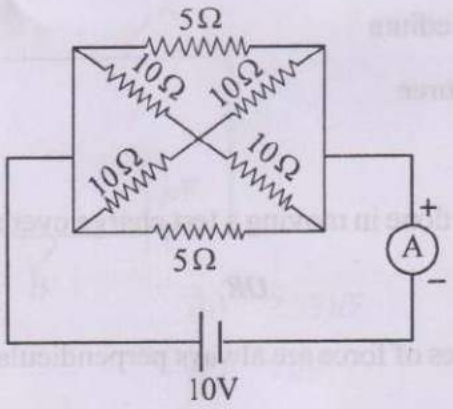
20. A slit of width 0.15 cm is illuminated by light of wavelength 5×10^{-5} cm and a diffraction pattern is obtained on a screen 2.1 m away. Calculate the width of the central maximum. 2

21. The electron in hydrogen atom is initially in the third excited state. What is the maximum number of spectral lines which can be emitted when it finally move to the ground state? 2

22. Calculate the potential at a point due to a charge of 4×10^{-7}C located 9 cm away. Hence, obtain the work done in bringing a charge of 2×10^{-9} C from infinity to that point. 1½+1½=3

23. Using Kirchhoff's law, derive the condition for balance of a wheatstone bridge circuit. 3

24. (a) Calculate the current shown by the ammeter A in the circuit diagram. 3



OR

(b) A battery of e.m.f 12 V and internal resistance 5 Ω is connected to resistor. If the current through the circuit is 0.3A, what is the resistance of the resistor? What is the terminal voltage of the battery when the circuit is closed? 3

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25. What is the effect on the interference fringes in a Young's double slit experiment due to each of the following operations ? 1+1+1=3

(a) The screen is moved away from the plane of the slits.

(b) The source is replaced by another source of shorter wavelength.

(c) The separation between the two slits is decreased.

26. Derive Einstein's photoelectric equation in terms of frequency. 3

27. (a) Define the terms decay constant and half-life of a radioactive sample. Derive the relation between them. ½+½+2=3

OR

(b) What is mass defect ? The mass of $_3Li^7$ nucleus is 0.042 a.m.u less than the sum of masses of its nucleons. Find the binding energy per nucleon. 3

28. On the basis of energy bands, distinguish between conductors, insulators and semiconductors. 3

29. Give the logic symbol, truth table and Boolean expression for AND gate. 3

30. A TV antenna has a height 'h'. Derive an expression for the maximum distance upto which the signals can be received on earth. 3

31. (a) Derive an expression for force experienced by a current-carrying straight conductor placed in a magnetic field. Under what conditions is this force (i) zero and (ii) maximum. 4+1=5

OR

(b) What is magnetic dipole ? Obtain an expression for strength of magnetic field at a distance r from its centre on the axial line of the dipole. 1+4=5

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32. (a) State Faraday's laws of electromagnetic induction. A magnetic field of flux density 10T acts normal to a coil of 50 turns having 100 cm^2 area. Find the emf induced if the coil is removed from the magnetic field in 0.2 s. 3+2=5

OR

(b) Define rms value of alternating current. Derive an expression for rms value of alternating current. 1+4=5

33. (a) Derive the expression –

$$-\frac{\mu_1}{u}+\frac{\mu_2}{v}=\frac{\mu_2+\mu_1}{R}$$

when refraction occurs from rarer to denser medium at convex spherical refracting surface ($\mu_1 < \mu_2$). 5

OR

(b) Derive an expression for fringe width in Young's double slit experiment for interference of light. 5

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Physical constants :

$\frac{1}{4\pi\varepsilon_0}$	=	$9 \times 10^9\ Nm^2C^{-2}$
ε_0	=	$8.854 \times 10^{-12}\ C^2\ N^{-1}m^{-2}$
c	=	$3 \times 10^8\ ms^{-1}$
e	=	$1.6 \times 10^{-19}C$
m_e	=	$9.1 \times 10^{-31}\ Kg$
m_p	=	$1.67 \times 10^{-27}\ Kg$
h	=	$6.6 \times 10^{-34}Js$
G	=	$6.67 \times 10^{-11}\ Nm^2\ Kg^{-2}$
g	=	$9.8\ ms^{-2}$
$1\mathring{A}$	=	$10^{-10}m$
1 amu	=	931 MeV
μ_0	=	$4\pi \times 10^{-7} TA^{-1}m$

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