

Total No. of printed pages = 6

TR/FST/ALT/21

ALTERNATIVE ENGLISH

Full Marks – 100

Time – Three hours

Candidates are required to answer the questions in their own words as far as practicable.

The figures in the margin indicate full marks for the questions.

1. Attempt a paragraph on any *one* of the following subjects (about 600 words) : 20
 - (i) Benefits of Social Media.
 - (ii) Global Warming.
 - (iii) Relevance of Recreational Parks.
2. (a) A seventeen years old girl, foils a child marriage at a village in South Tripura. The girl along with the members of a Local Child Protection Committee and the police arrived at the would be bride's home, few hours before the wedding. The mother gave an undertaking not to get her daughter

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(a girl of thirteen years) married till she is eighteen.

Write a news paper report on this incident (in about 300 words). 20

Or

- (b) A roadside accident you witnessed that could have been avoided with a better traffic management system. Write a report (in about 300 words). 20

3. (a) Write a letter of complaint to the concerning authority of Agartala Municipal Corporation – regarding accumulation of garbage in the bazaar of your locality with a request to remove the same, immediately and save people from the health hazard caused by it. (Word limit 200 words.) 15

Or

- (b) Some school students of your society have taken a drive to plant saplings in the area – so that it would add to the greeneries and keep the surroundings pollution free. Write a letter to your friend sharing this commendable campaign of the students. (Within 200 words). 15

4. Develop a complete story out of the given outlines (any one) : 15

(a) Two notorious thieves – consider themselves very clever – enter a rich man's house – find the safe open – happy at their unexpected luck – pile up everything – light comes on, and a man with a gun – it was trap.

(b) Mongoose in a garden – birds fly away from a nest – a cobra trying to climb a tree – mongoose rushes to the cobra – a fierce battle starts – cobra is tired – mongoose has a meal.

5. Expand the idea contained in any one of the following sayings within 150 words : 15

(a) Make hay while the Sun shines.

(b) Games are an effective anodyne against grief, a cure from boredom and a distraction from oneself.

6. Give a summary of the following passage : 15

(a) In many ways the old Indian civilization was already dead when Clive and Hastings discovered the riches of India. The long and disruptive reign of Aurangzeb, and the chaos

and internal wars that followed it, left India ripe for re-conquest ; and the only question open to manifest destiny was as to which of the modernized powers of Europe should become its instrument. The French tried, and failed ; they lost India, as well as Canada, at Rossbach and Waterloo. The English tried, and succeeded.

In 1498 Vasco da Gama, after a voyage of eleven months from Lisbon, anchored off Calicut. He was well received by the Hindu Raja of Malabar, who gave him a courteous letter to the King of Portugal : "Vasco da Gama, a nobleman of your household, has visited my kingdom, and has given me great pleasure. In my kingdom there is abundance of cinnamon, cloves, pepper, and precious stones. What I seek from your country is gold, silver, coral and scarlet." His Christian majesty answered by claiming India as a Portuguese colony, for reasons which the Raja was too backward to understand. To make matters clearer, Portugal sent a fleet to India, with instructions to spread Christianity and wage war. In the seventeenth century the

Dutch arrived, and drove out the Portuguese in the eighteenth century, the French and English came, and drove out the Dutch. Savage ordeals of battle decided which of them should civilize and tax the Hindus. And the English won.

Or

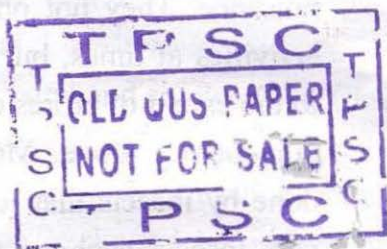
- (b) Insects are found almost everywhere – from steaming jungles to polar regions, in the soil, in the water and in the air. They seem to be able to live and thrive under almost any conditions. The energy of an insect is tremendous.

Anyone, who has stepped on a cockroach, been bitten by a mosquito or bothered by flies, will tell you that some insects are a nuisance. They not only interfere with our activities at times, but they also do damage to the extent of crores of rupees each year in our country alone. Most of the damage is done by insects that feed on plants that we use, insects such as the cotton-destroying boll weevil, the potato beetle and the tobacco hornworm. Flies carry diseases, and we try to control them on this account.

But not all insects are harmful. If all insects were to suddenly disappear from the earth, it would not be long before many other living things would vanish too, possibly even mankind.

Many vegetables and flowering plants would die, for these plants cannot bear fruits or seeds unless an insect transfers their pollens. Fishes or birds that feed on insects would vanish, and many of the animals that depend, in turn, on these fishes and birds for food would soon starve.

Once a link in nature's chain of life is broken or removed, the entire chain is in danger of falling apart.



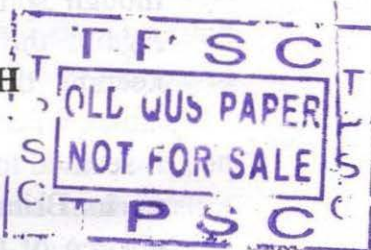
Total No. of printed pages = 12

TR/FST/ENG/21

GENERAL ENGLISH

Full Marks – 100

Time – Three hours



Candidates are required to answer the questions in their own words as far as practicable.

The figures in the margin indicate full marks for the questions.

1. Write an essay of about 700 words on any *one* of the following topics/ideas : 20
 - (a) The conservation of forest in India
 - (b) Environmental Pollution
 - (c) Wetlands of Tripura
2. Write a précis on any *one* of the following passages. Provide a suitable title as well.

17+3=20

The American revolution was started by trouble about taxes but the true cause went much deeper. Unlike the colonies of France and Spain the British colonies had, from the first, been very free. It is true that their trade and business were

[Turn over

controlled by the mother-country, but in those days that was looked upon as quite natural, though sometimes a little hard to put up with. Again, the British kings were responsible for keeping those under the British flag safe from attack wherever they were, even in America; and it seemed to them only right for Britons overseas, as in Britain, to make some payment for the upkeep of the necessary forces. To the colonies, however, the danger from the French seemed to be over after they had been crushed at Quebec. And when the attempt was made to put a tax on them for the purpose of keeping a small regular army ready against any future attack by the French, the old English cry went up, 'no taxes without representatives' — Though the three thousand miles of sea between England and America made the idea of America's having representatives in the British Parliament seem impossible. It was, however, a new thing for the colonies to be taxed by any one but themselves, and they made so much trouble that for a time the idea was dropped. But in 1773, when a new, though small tax was put on tea, violent protests, street fighting, and war came quickly one after the other. One night some men went to the tea-ships in Boston harbour, and the chests of tea were pushed into the Atlantic. That was the first act in one of the greatest revolutions in the history of ordered society.

Or

The oldest known metal to be adapted to human use was copper. We find it in a Lake-Dwelling at Robenhausen, Switzerland, ca. 6000 B.C.; in prehistoric Mesopotamia ca. 4500 B.C.; in the Badarian graves of Egypt towards 4000 B.C.; in the ruins of Ur ca. 3100 B.C.; and in the relics of the North American Mound-Builders at an unknown age. The Age of Metals began not with their discovery, but with their transformation to human purpose by fire and working. Metallurgists believe that the first fusing of copper out of its stony ore came by haphazard when a primeval camp fire melted the copper lurking in the rocks that enclosed the flames; such an event has often been seen at primitive camp fires in our own day. Possibly this was the hint which, many times repeated, led early man, so long content with refractory stone, to seek in this malleable metal a substance more easily fashioned into durable weapons and tools. Presumably the metal was first used as it came from the profuse but careless hand of nature—sometimes nearly pure, most often grossly alloyed. Much later, doubtless—apparently about 3500 B.C. in the region around the Eastern Mediterranean—men discovered the art of smelting, of extracting metals from their ores. Then, towards 1500 B.C., they proceeded

to cast metal: dropping the molten copper into a clay or sand receptacle, they let it cool into some desired form like a spear-head or an axe. That process, once discovered, was applied to a great variety of metals, and provided man with those doughty elements that were to build his greatest industries, and give him his conquest of the earth, the sea, and the air.

3. Study the passage given below and choose the correct option for the questions (i-x). Some words have been written in **bold letters** for ease of identification. $2 \times 10 = 20$

Duncan Phyfe made some of the most beautiful furniture found in America. His family name was originally Fife, and he was born in Scotland in 1768. In 1784, the Fife family immigrated to Albany, New York where Duncan's father opened a cabinetmaking shop. Duncan followed in his father's footsteps and was apprenticed to a **cabinetmaker**. After completing his training, Duncan moved to New York City.

Duncan Fife was first mentioned in the 1792 NYC Directory as a furniture "joiner" in business at 2 Broad Street. Two years later, he moved, expanded his business, and changed his name to Phyfe. He was a quiet-living, God-fearing young man who felt his new name would probably appeal to potential customers who were definitely anti-British in this post-Revolutionary War period.

Duncan Phyfe's name distinguished him from his contemporaries. Although the new spelling helped him better compete with French émigré craftsmen, his new name had more to do with hanging it on a sign over his door stoop.

The artisans and merchants who came to America discovered a unique kind of **freedom**. They were no longer restricted by class and **guild** traditions of Europe. For the first time in history, a man learned that by working hard, he could build his business based on his own name and reputation and quality of work.

Phyfe's workshop apparently took off immediately. At the peak of his success, Phyfe employed 100 craftsmen. Some economic historians point to Phyfe as having employed division of labour and an assembly line. What his workshop produced shows Phyfe's absolute dedication to quality in **workmanship**. Each piece of furniture was made of the best available materials. He was reported to have paid \$1,000 for a single Santo Domingo mahogany log.

Phyfe did not create new designs. Rather, he borrowed from a broad range of the period's classical styles, Empire, Sheraton, Regency, and French Classical among them. Nevertheless, Phyfe's high quality craftsmanship established him as America's patriotic interpreter of European

design in the late eighteenth and early nineteenth centuries.

Although the number of pieces produced by Duncan Phyfe's workshop is enormous, comparatively few marked or labelled pieces have been found extant. In antiques shops and auctions, collectors have paid \$11,000 for a card table, \$24,200 for a tea table, and \$93,500 for a sewing table.

(i) Based on the information in the passage, what can be inferred about Duncan Phyfe?

- (a) He was an excellent businessman with a good sense of craftsmanship and design.
- (b) He regretted that Great Britain no longer governed New York City.
- (c) He built all his furniture by himself in a workshop in Santo Domingo.
- (d) He joined the cabinetmakers' guild after he moved to Scotland in 1792.

(ii) According to the passage, which of the following does the author imply?

- (a) Duncan Fife and his father had the same first name.

(b) Duncan Fife worked for his father in Scotland.

(c) Duncan Fife and his father were in the same business.

(d) Duncan Phyfe made over 100 different kinds of tables.

(iii) Which sentence in paragraph 2 explains Duncan's name change?

- (a) The first sentence
- (b) The second sentence
- (c) The third sentence
- (d) None of the above

(iv) Which choice does the word "it" refer to in para. 3?

- (a) His spelling (b) His chair
- (c) His French (d) His name

(v) Which choice is closest in meaning to the word "guild" in para. 4?

- (a) Verdict of a jury
- (b) Organization of craftsmen

(c) Political party of émigrés

(d) Immigrant's club

(vi) Which of the following does the word "freedom" in para. 4 refer to?

(a) No longer restricted

(b) Restricted

(c) By working hard

(d) Took off

(vii) Where in the passage could the following sentence be added to the passage?

Every joint was tight, and the carved elements were beautifully executed.

(a) After the word "workmanship" in paragraph 5

(b) After the word "cabinetmaker" in paragraph 1

(c) After the word "stoop" in paragraph 3

(d) After the word "table" in the last paragraph

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(8)



(viii) In his business, Duncan Phyfe used all of the following EXCEPT:

(a) division of labor

(b) an assembly line

(c) continental designs

(d) the least expensive materials

(ix) Based on information in the passage, what can be inferred about Duncan Phyfe's death?

(a) He died in the eighteenth century.

(b) He died in Albany.

(c) He died in the nineteenth century.

(d) He died in Scotland.

(x) The author implies that

(a) furniture from Duncan Phyfe's workshop no longer exists

(b) furniture from Duncan Phyfe's workshop costs a lot of money today

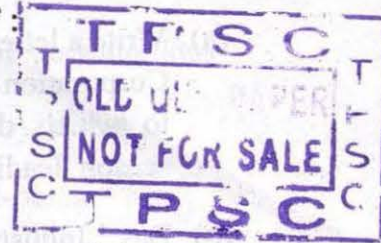
(c) furniture from Duncan Phyfe's workshop was ignored by New Yorkers

(d) furniture from Duncan Phyfe's workshop was made by his father

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(9)

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4. Answer any *one* of the following : $20 \times 1 = 20$

(a) Write a letter to the Chairperson of Municipal Corporation informing him of the reasons due to which drains get choked during rainy season leading to flash floods.

(b) Das Industries, a private enterprise in Melaghar, Sipahijala, Tripura, has written a proposal to the District Magistrate to establish a fleet of motor boats for tourists at Rudrasagar Lake. Write a reply why the proposal is not feasible at present.

5. Correct the following sentences : $1 \times 5 = 5$

(a) I have visited Neermahal last weekend.

(b) He as well as they were here for their dinner.

(c) May be I'm going to finish this today.

(d) Columbia is a South American country.

(e) Unless you do not labour hard you will not pass.

6. Choose the most appropriate meaning of the given words/phrases : $1 \times 5 = 5$

(i) Homesick

(a) nostalgic

(b) bromide

(c) clandestine

(d) lonely

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(10)

100

(ii) Stingy

(a) indigent

(b) parsimonious

(c) opulent

(d) careful

(iii) Sense of physical well-being

(a) euthanasia

(b) anaesthesia

(c) euphoria

(d) persiflage

(iv) Catlike

(a) leonine

(b) feline

(c) canine

(d) saline

(v) meat-eating :

(a) herbivorous

(b) voracious

(c) omnivorous

(d) carnivorous

7. Reorganise the words/phrases to form meaningful assertive sentences. $1 \times 5 = 5$

(a) My prior permission without go to that
place he cannot dare

(b) Who were injured in the accident each to
those relief payments of Rs. 4000 the
collector granted.

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(11)

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(c) healthy carriers spread of some diseases are  germs by

(d) To be mistrustful own child of your it is bad.

(e) to give up didn't have he other option but
any

8. Select the preposition from the brackets that best complete each sentence. $1 \times 5 = 5$

(a) The college term will end — a month.

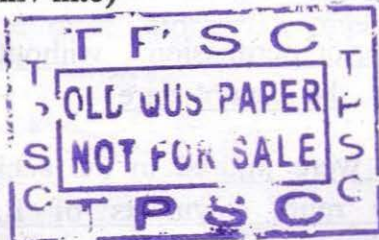
(in / for / within)

(b) I saw several baby birds — a nest in that tree. (at/behind/in)

(c) My brother stays — the factory until 6:00 p.m. (on/above/at)

(d) Conversation was carried on — whisper.
(with / along / through)

(e) I shall stand by you — thick and thin.
(for / in / into)



Total No. of printed pages = 4

TR/FST/BENG/21

BENGALI

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Candidates are required to give their answers in
their own words as far as practicable.

১. নিম্নলিখিত যে-কোনো একটি বিষয়ে প্রবন্ধ রচনা করো :
(৭০০ শব্দের মধ্যে) $২৫ \times ১ = ২৫$

(ক) আধুনিক ভারতীয় জনজীবনে পরিবেশ ভাবনা ও তার সংকট।

(খ) পর্যটন-উন্নয়ন বনাম বন-পরিবেশের ভারসাম্য।

(গ) অরণ্য ও অরণ্য-প্রাণী সংরক্ষণের প্রয়োজনীয়তা।

২. যে-কোনো একটি বিষয়ে পত্র রচনা করো : (২০০ শব্দের মধ্যে) $১৫ \times ১ = ১৫$

(ক) সড়ক নির্মাণে বড়ো গাছ বাঁচাতে পরিবেশ দপ্তরের কাছে আবেদন।

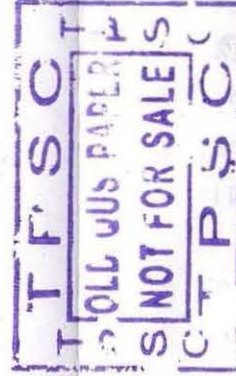
(খ) দিঘি ভরাট করে নির্মাণ-প্রকল্প বন্ধ করতে আর্জি জানিয়ে জেলা শাসকের কাছে অভিযোগ।

[Turn over

৩. শীর্ষ-নাম সহ যে-কোনো একটি সারসংক্ষেপ রচনা করো :

৫+১৫=২০

(ক) আমাদের মধ্যে বিলাসিতা বাড়িয়াছে বলিয়া অনেকে কল্পনা করেন যে ইহা আমাদের ধনবৃদ্ধির লক্ষণ। কিন্তু একথা বিচার করিয়া দেখিতে হইবে যে, পূর্বে যে অর্থ সাধারণের কার্যে ব্যয়িত হইত এখন তাহা ব্যক্তিগত ভোগে ব্যয়িত হইতেছে, শহরগুলি ফাঁপিয়া উঠিতেছে, কিন্তু পল্লীগুলিতে দারিদ্রের অবধি নাই। সমস্ত বাংলাদেশে পল্লীতে দেবমন্দির ভাঙিয়া পড়িতেছে, পুষ্করিনীর জল স্রাবের, পানের অযোগ্য হইতেছে, গ্রামগুলি জঙ্গলে ভরিয়া উঠিয়াছে, চিকিৎসাকেন্দ্র, বিদ্যালয়গুলি পরিত্যক্ত, জনসাধারণের ব্যবহারের অনুপযোগী এবং যে দেশ বারো মাসে তেরো পাবণে মুখরিত হইয়া থাকিত সে দেশ নিরানন্দ নিভৃদ্ধ হইয়া গেছে। দেশের অধিকাংশ অর্থ শহরে আকৃষ্ট হইয়া কোঠাবাড়ি, গাড়িঘোড়া, সাজসরঞ্জাম, আহার বিহারেই উড়িয়া যাইতেছে। অথচ যাহারা এইরূপ ভোগবিলাসে ও আড়ম্বরে আত্মসমর্পণ করিয়াছেন, তাহারা প্রায় কেহই সুখে স্বচ্ছন্দে নাই, তাহাদের অনেকেরই টানাটানি, অনেকেরই ঋণ, অনেকেরই পৈতৃক সম্পত্তিতে মহাজনের দায়মুক্ত করিবার জন্য চিরজীবন নষ্ট হইতেছে — কন্যার বিবাহ দেওয়া, পুত্রকে মানুষ করিয়া তোলা, পৈতৃক কীর্তি রক্ষা করিয়া চলা অনেকের পক্ষে বিশেষ কষ্টসাধ্য হইয়াছে। যে ধন সমস্ত দেশের বিচিত্র অভাবমোচনের চারিদিকে ব্যপ্ত হইত, সেই ধন সংকীর্ণ স্থানে আবদ্ধ হইয়া যে ঐশ্বর্যের মায়া সৃজন করিতেছে তাহা বিশ্বাসযোগ্য



নহে। সমস্ত শরীরকে প্রতারণা করিয়া কেবল মুখেই যাহা রক্তসঞ্চার হয়, তবে তাহাকে স্বাস্থ্য বলা যায় না। দেশের ধর্মস্থানকে, বন্ধুস্থানকে, জন্মস্থানকে কুশ করিয়া কেবল ভোগস্থানকে স্ফীত করিয়া তুলিলে বাহির হইতে মনে হয় যেন দেশের শ্রী বৃদ্ধি হইতে চলিল। সেইজন্য সেই ছদ্মবেশী সর্বনাশই আমাদের পক্ষে অতিশয় ভয়াবহ। মঙ্গল করিবার শক্তিই ধন, বিলাস ধন নহে।

(খ) বৈজ্ঞানিকের সঙ্গে সাহিত্যিকের একটি স্থানে মিল আছে। ইতর-সাধারণ সকলেই সম্মুখে যাহা পড়ে, তাহাই কুড়াইয়া লইয়া সেই কয়টা জিনিসকে জীবনের কাজে লাগাইয়া, যেন-তেন-প্রকারেণ তাড়াতাড়ি জীবনযাত্রায় দৌড়াইয়া চলিতেছে; আশেপাশে যাহা আছে, তাহার প্রতি মনঃসংযোগের অবকাশ পাইতেছে না। কিন্তু কয়েকজন লোক এই আশেপাশে চাহিয়া অন্যে যাহা দেখে না, তাহাই দেখেন এবং ইতর-সাধারণকে যখন দেখান, তখন তাহারা নূতন কি দেখিলাম বলিয়া চমকিয়া উঠে। বৈজ্ঞানিক বলেন — ‘দেখ, কত বাস্তবিক সত্য, তা তুমি এতদিন দেখ নাই, ইহা হইতে জীবনের কত প্রয়োজনসিদ্ধি, জীবন-যুদ্ধে কত সাহায্য ঘটিতে পারে।’ সাহিত্যিক বলেন — ‘দেখ, এত সুন্দর দৃশ্যের প্রতি তুমি এতকাল তাকাও নাই, ইহা হইতে কত আনন্দ মিলিতে পারে, জীবন-যুদ্ধের আনুষঙ্গিক দুঃখ কমাইতে পারা

যায়।' একজন যেখানে সত্যের, অন্যজন সেখানে সুন্দরের আবিষ্কার করেন। বিজ্ঞানের ও সাহিত্যের দৃষ্টি একই দিকে; আবার উভয়েই যখন সেই সত্যকে-সুন্দরকে, শিব রূপে প্রতিপন্ন করেন, তখন বিজ্ঞান ও সাহিত্য উভয়েই তত্ত্ববিদ্যার পরম প্রকোষ্ঠে উপনীত হয়।

৪. যে-কোনো একটি বিষয়ের ভাব সম্প্রসারণ করো : (১৫০ শব্দের মধ্যে) $২০ \times ১ = ২০$

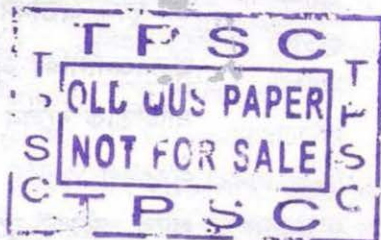
(ক) 'বন্যেরা বনে সুন্দর, শিশুরা মাতৃকোড়ে'।

(খ) পুষ্প আপনার জন্য ফোটেনা, পরের জন্য আপনার হৃদয় কুসুম প্রস্ফুটিত করে।

৫. যে-কোনো একটি বিষয়ে প্রতিবেদন রচনা করো : (৩০০ শব্দের মধ্যে) $২০ \times ১ = ২০$

(ক) সদ্য ঘটে যাওয়া বন্যায় কাজিরাঙ্গী রিজার্ভ ফরেস্টে পশু প্রাণীরা বিপন্ন, অনেক প্রাণী খাদ্যাভাবে মরণাপন্ন, অনেকে জঙ্গল ছেড়ে বেরিয়েছে বাইরে, কেউবা জলের তোড়ে ভেসে গেছে — এই বিষয়ে সংবাদপত্রে একটি প্রতিবেদন লেখ।

(খ) আন্তর্জাতিক মাতৃভাষাদিবস।



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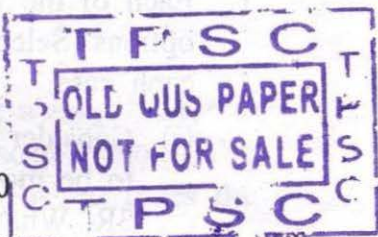
TR/FST/PHY/1/21

PHYSICS

Paper : I

Full Marks – 100

Time – Three hours



The figures in the margin indicate full marks for the questions.

Instructions :

1. Answer to Question No.1(i to xx) i.e., MCQ type questions under Section-A must be written in English only.

Example :

Question : The capital of India is

- | | |
|------------------|-------------------|
| (a) Delhi | (b) New Delhi |
| (c) Indraprastha | (d) None of these |

Answer : (b) New Delhi.

2. Answers to other questions except mathematical part must be written either in English or in Bengali. It must not be answered partly in English and partly in Bengali. This instruction must be followed scrupulously.
3. Candidates are required to give their answers in their own words as far as practicable.

[Turn over

SECTION - A

1. Each of the following questions is having four options. Select and write the correct answers in each case. $1 \times 20 = 20$

(i) Consider a satellite of mass m , which needs to be moved from an orbit of radius $2R$ to $3R$. What is the energy required. Mass and radius of earth are M and R .

(a) $\frac{GMm}{12R^2}$ (b) $\frac{GMm}{6R}$

(c) $\frac{GMm}{8R}$ (d) $\frac{GMm}{3R^2}$

(ii) When a metal wire is stretched by a load, the fractional change in its volume $\Delta \frac{V}{V}$ is proportional to

(a) $\Delta \frac{1}{l}$ (b) $(\Delta \frac{1}{l})^2$

(c) $\sqrt{\Delta \frac{1}{l}}$ (d) None of these

(iii) When a planet is moving in an elliptical orbit, which of the following quantity is a constant of motion?

(a) angular momentum

(b) velocity

(c) kinetic energy

(d) linear momentum

(iv) The excess pressure inside a soap bubble is twice that of a second soap bubble. The volume of the first bubble is 'n' times the volume of the second one where 'n' is

(a) 4 (b) 2

(c) 0.5 (d) 0.125

(v) Kinetic energy needed to project a body of mass 'm' from the earth surface to infinity is

(a) $\frac{1}{4} mgR$ (b) $\frac{1}{2} mgR$

(c) $2 mgR$ (d) mgR

(vi) The equation of a sound wave is given by $y = 5 \sin 2\pi(0.2t - 0.5x)m$

The wavelength of the wave is

(a) 1 m (b) 2 m

(c) 2.5 m (d) 3.0 m



(vii) Which of the following equations represent the equation of a progressive wave ?

- (a) $\frac{d^2y}{dx^2} = w^2y$ (b) $\frac{d^2y}{dt^2} + w^2y = 0$
 (c) $\frac{dy}{dx} = \frac{1}{c^2} \frac{dy}{dt}$ (d) $\frac{d^2y}{dt^2} = c^2 \frac{d^2y}{dx^2}$

(viii) Two waves represented by $y = a \sin(wt - kx)$, and $y = a \cos(wt - kx)$ are superimposed. The resultant wave will have an amplitude

- (a) a (b) $\sqrt{2}a$
 (c) $2\sqrt{a}$ (d) $2a$

(ix) The velocity of sound wave in a string is given by (where T is tension of the string and ρ is mass per unit length)

- (a) $v = \frac{\sqrt{T}}{\rho}$ (b) $v = \frac{T}{\sqrt{\rho}}$
 (c) $v = \sqrt{\frac{T}{\rho}}$ (d) $v = \frac{T}{\rho}$

(x) 'A gas behaves more closely as an ideal gas' – when the gas is at

- (a) low pressure and low temperature
 (b) low pressure and high temperature
 (c) high pressure and high temperature
 (d) high pressure and low temperature

(xi) Two bodies at different temperatures are kept in a calorimeter. Which of the following quantity remains conserved ?

- (a) Sum of the temperatures of the two bodies
 (b) Total heat of the two bodies
 (c) Total Internal energy of the two bodies
 (d) Internal energy of each body

(xii) The unit of coefficient of viscosity is

- (a) Newton/meter (b) Poise
 (c) Bar (d) Meter/sec

(xiii) For monoatomic gas, the ratio of heat

capacities $\left(\gamma = \frac{C_p}{C_v}\right)$ is

- (a) 1.67 (b) 1.40
 (c) 1.30 (d) 2.0

(xiv) According to the principle of equipartition of energy, the average kinetic energy per degree of freedom of a gas molecule is

- (a) 0 (b) KT
(c) $\frac{KT}{2}$ (d) $\frac{3}{2}KT$

(xv) If C_p is the specific heat of a gram molecule of a gas at constant pressure and C_v is that at constant volume, then

- (a) $C_p = C_v$ (b) $C_p > C_v$
(c) $C_p < C_v$ (d) $C_p = C_v = 0$

(xvi) A reversible engine converts $\frac{1}{6}$ th of the heat input into work. If T_1 and T_2 are the temperatures of the source and sink respectively, then the ratio of $\frac{T_1}{T_2}$ is

- (a) $\frac{6}{5}$ (b) $\frac{5}{6}$
(c) $\frac{1}{5}$ (d) $\frac{1}{6}$

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(6)



(xvii) In an irreversible process the change in entropy (ds) is

- (a) $ds = 0$ (b) $ds > 0$
(c) $ds < 0$ (d) None of these

(xviii) If p be the pressure and u be the energy density in an incident radiation, then the relation between p and u is –

- (a) $p = u$ (b) $p = \frac{1}{3}u$
(c) $u = \frac{1}{3}p$ (d) $p = \frac{3}{2}u$

(xix) Which of the following remains constant in Joule Thomson effect?

- (a) Pressure (b) Volume
(c) Enthalpy (d) All of these

(xx) A refrigerator is kept in a closed room with the door of the refrigerator open. Then the temperature of the room

- (a) rises (b) falls
(c) remains the same (d) None of these.

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(7)

[Turn over

SECTION – B

Answer any *six* of the following questions :

5×6=30

2. Find an expression for moment of inertia of a thin circular disc, when the axis of rotation passes through the centre and perpendicular to the plane of the disc. 5
3. A cylinder is released from rest from the top of an incline of inclination ' θ ' and ' l '. If the cylinder rolls without slipping, show that the speed of the cylinder when touches the ground is

$v = \sqrt{\frac{4}{3}gl\sin\theta}$, where g = acceleration due to gravity. 5

4. If the centripetal force is of the form $ma^av^br^c$. Find the values of a , b and c . 5
5. The ratio of specific heat capacities ' γ ' of oxygen and methane is 21:20. The ratio of their densities at the same pressure is 2:1. If velocity of sound in oxygen is 316 ms^{-1} , then find that in methane. 5
6. A tuning fork vibrates at 264 Hz. Find the length of the shortest closed organ pipe that will resonate with the tuning fork. Given, speed of sound in air is 350 m s^{-1} . 5

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100

7. Show that the work done in an isothermal expansion is given by $W = nRT \log_e \frac{V_2}{V_1}$. Symbols have their usual meaning. 5
8. State Newton's Law of cooling and hence derive this from Stefan-Boltzmann law. 1+4=5
9. (i) Calculate the change in entropy of a system containing 1 kg ice at 0°C , which melts at the same temperature. Latent heat of ice is 79.6 kcal/kg .
(ii) Explain why is the saw dust a better insulator than the wood from which the dust is prepared? 3+2=5

SECTION – C

Answer any *five* of the following questions :

10×5=50

10. State and prove Gauss's divergence theorem. 2+8=10
11. Establish a mathematical expression for the coefficient of viscosity. State and prove Bernoulli's theorem. 4+1+5=10

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(9)

[Turn over

12. Show that if the pressures inside and outside liquid membrane are p_1 and p_2 respectively, then

$$p_1 - p_2 = 2s \left(\frac{1}{r_1} + \frac{1}{r_2} \right)$$

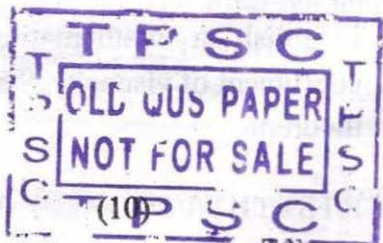
Where r_1 and r_2 are the principal radii of curvature. 10

13. On the surface of sea water, the distance between two consecutive crests of wave is 20 m and the velocity of the wave is 18 km.h^{-1} . The vertical displacement of a boat is 2 m due to the up and down motion of the wave. What is the maximum vertical velocity of the boat. 10

14. Establish Van-der-Waal's equation of state for real gases. 10

15. Show that $c_p - c_v = R$, where c_p and c_v are the specific heats of a gas at constant pressure and constant volume. What is Carnot cycle? State Carnot's theorem. 6+2+2=10

16. State Wien's displacement Law. Derive the law from thermodynamical consideration. 2+8=10



Total No. of printed pages = 10

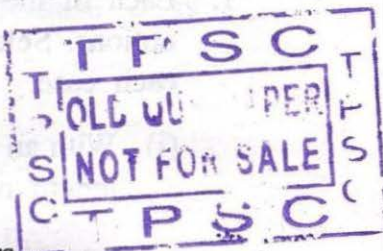
TR/FST/PHY/II/21

PHYSICS

Paper – II

Full Marks – 100

Time – Three hours



The figures in the margin indicate full marks for the questions.

1. Answer to Question No. 1 (i to xx) i.e., MCQ type questions under Section-A must be written in English only.

Example : The capital of India is

- | | |
|------------------|-------------------|
| (a) Delhi | (b) New Delhi |
| (c) Indraprastha | (d) None of these |

Answer : (b) New Delhi.

2. Answers to other questions except mathematical part must be written either in English or in Bengali. It must not be answered partly in English and partly in Bengali. This instruction must be followed scrupulously.
3. Candidates are required to give their answers in their own words as far as practicable.

[Turn over

SECTION - A 1×20=20

1. Each of the following questions is having four options. Select and write the correct answers in each case.

(i) With an increase in refractive index the focal length of a convex lens

- (a) decreases (b) increases
(c) remains same (d) None of these

(ii) A straight hollow pipe 1m long is closed at both ends with glass plates of 1cm thick. If the pipe is evacuated what would be the optical path length between the two outer glass surfaces? ($\mu_g = 1.5$)

- (a) 1.02m (b) 1.53m
(c) 1.03m (d) None of these

(iii) The condition of achromatism for two thin lenses kept in contact is

- (a) $\frac{w_1}{f_1} = \frac{w_2}{f_2}$ (b) $w_1 = w_2$
(c) $w_1 + w_2 = 0$ (d) $\frac{w_1}{f_1} + \frac{w_2}{f_2} = 0$

(iv) The equivalent focal length 'F' of two thin lenses having second focal length ' f_1 ' and ' f_2 ' and kept separated by a distance 'd' is

(a) $\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 f_2}$

(b) $F = \frac{1}{f_1} + \frac{1}{f} + \frac{d}{f_1 f_2}$

(c) $F = f_1 + f_2 + \frac{d}{f_1 f_2}$

(d) $F = f_1 - f_2 + d(f_1 + f_2)$

(v) If the width of the slits is 1.2mm, and fringe spacing between two consecutive bright fringes is 0.5 mm on a screen kept at a distance 1m away from the slits in Young's double slit experiment, the wave length of the light employed in this experiment is

- (a) 60 nm (b) 0.6 nm
(c) 6000 nm (d) 600 nm

(vi) A quarter wave plate produces phase difference between O-ray and E-ray of

- (a) 0 (b) π
(c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

(vii) Paramagnetic materials have relative permeability

- (a) slightly less than unity
(b) equal to unity
(c) slightly more than unity
(d) equal to that of ferromagnetic materials

(viii) What is the torque acting on the bar magnet of moment M , which is placed in uniform field H making an angle of 30° with the field?

- (a) MH (b) $\frac{MH}{2}$
(c) $\frac{MH}{3}$ (d) $\frac{MH}{4}$

(ix) Work will be done to charge a capacitor having capacitance C and potential 'V' is

- (a) $W = CV^2$ (b) $W = C^2V^2$
(c) $W = \frac{1}{2}CV^2$ (d) $W = \frac{1}{2}C^2V^2$

(x) A capacitor stores 0.24 coulombs at 10 volts, its capacitance is

- (a) 0.8F (b) 0.6F
(c) 0.12F (d) 0.024F

(xi) A current of 1 amp is passing through a copper wire 10m in length and 0.08mm in diameter. If the resistivity of copper is 1.65×10^{-8} ohm.m. Calculated value of resistance (R) as

- (a) $R = 3.285$ ohm (b) $R = 0.3285$ ohm
(c) $R = 328.5$ ohm (d) $R = 32.85$ ohm

(xii) The time constant of a series RC circuit is given by

- (a) RC (b) $\frac{R}{C}$
(c) RC^2 (d) $\sqrt{RC}$

(xiii) If the resistance of the galvanometer is less than the critical damping resistance, then the galvanometer will be

- (a) Dead beat (b) Ballistic
(c) Tangent (d) None of these

(xiv) What happens to the magnetic field at the centre of a circular current carrying coil if we double the radius of the coil keeping the current unchanged?

- (a) doubled (b) quadrupled
(c) halved (d) remains same

(xv) Electrons are minority carriers in which type of semiconductor?

- (a) Extrinsic (b) Intrinsic
(c) p-type (d) n-type

(xvi) The spectral series of Hydrogen atom is

shown as $\frac{1}{\lambda} = R \left(\frac{1}{4^2} - \frac{1}{n^2} \right)$, where $n = 5, 6, 7, \dots$

The series is

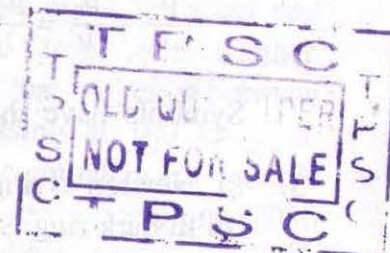
- (a) Balmer series (b) Paschen series
(c) P fund series (d) Brackett series

(xvii) If R be the nuclear radius and A be the mass member, then

- (a) $R \propto A$ (b) $R \propto A^{\frac{1}{2}}$
(c) $R \propto A^3$ (d) $R \propto A^{\frac{1}{3}}$

(xviii) In beta decay the total number of nucleons

- (a) decreases by four
(b) increases by one
(c) decreases by two
(d) remains same



(xix) The traditional unit of the activity of radio active sample is Curic (C_i). $1 C_i$ is

- (a) 3.70×10^{10} decays/s
(b) 3.70×10^8 decays/s
(c) 3.70×10^{12} decays/s
(d) 3.70×10^{11} decays/s

(xx) If the ionisation potential of Hydrogen atom is 13.6 volt, the energy required to remove an electron from the second orbit of hydrogen atom is

- (a) 0.54 eV (b) 3.4 eV
(c) 1.51 eV (d) 13.6 eV

SECTION – B

Answer any *six* of the following questions :

5×6=30

2. For refraction at concave spherical surface show that

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

Symbols have their usual meaning.

5

3. In Newton's ring experiment, the diameter of 'm'th dark ring is 8mm and that of (m+5)th dark ring is 12 mm. If the wavelength 400 nm is employed in the experiment, then find out the radius of curvature of the lower surface of the lens.

5

4. Explain how a nicol prism works as a polariser and an analyser.

5

5. When two coils of inductances L_1 and L_2 are connected in parallel and are placed at large distances, find out the equivalent inductance of the system.

5

6. Determine the electric field intensity at a point near a charged cylinder with the help of Gauss's theorem.

5

7. What is Lorentz force? Write an expression of it. What are the main differences between an ammeter and a galvanometer?

2+1+2=5

8. What are continuous and characteristic x-ray spectra? State Moseley's law? Give its mathematical form.

3+1=1=5

9. The rails of a railway tract are 1.5m apart and assumed to be insulated from one another. Calculate the e.m.f in volts that will exist between the rails if a train is passing at 100 km/hour. Assume that horizontal component of earth's magnetic field is 0.36 oersted and $\tan \theta = 1.036$ where θ is the angle of dip.

5

SECTION – C

Answer any *five* of the following questions :

10×5=50

10. Establish laws of refraction (Snell's law) at spherical surface from Fermat's principle.
- 10
11. Find the condition of achromatism of two lenses of focal length f_1 and f_2 kept at a certain distance apart. Give the merits and demerits of Ramsden's eye piece.
- 7+3=10
12. Determine the potential outside a charged conducting sphere by using Laplace's equation in spherical co-ordinate system.
- 10

13. A toroid is a long coil of wire wound over a circular air core, show that the coefficient of self induction L of the toroid of radius R containing

N turns each of radius r is $L = \frac{\mu_0 N^2 r^2}{2R}$ where

$R \gg r$. Assume that the field is uniform within the toroid. 10

14. The radius of a circular coil of wire is 25 mm and current in it is 750 mA. Calculate the intensity of magnetic field at the centre of the coil.

Prove that in a DC circuit containing a resistor R and an inductor L in series, the growth of current is exponential. What is the time constant of the circuit? 4+5+1=10

15. Show that the Faraday's laws of electromagnetic induction holds for circuits moving in uniform magnetic field $\vec{B}$. 10

16. Determine the energy of the electron in hydrogen atom while revolving in n th orbit. What do you mean by specific charge of electron?

The decay constant of a radioactive substance is 4.28×10^{-4} per year. Calculate mean life time of the substance. 6+2+2=10

Total No. of printed pages = 9

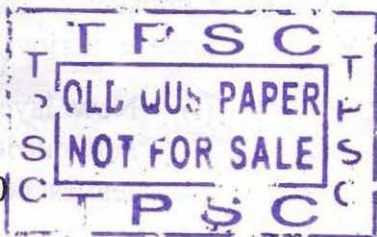
TR/FST/FOR/I/21

FORESTRY

Paper : I

Full marks – 100

Time – Three hours



The figures in the margin indicate full marks for the questions.

Instructions :

1. Answer to Question No. 1 (i to xx) i.e., MCQ type questions under Section – A must be written in English.

Example : The capital of India is

- (a) Delhi (b) New Delhi
(c) Indraprastha (d) None of these

Answer : (b) New Delhi.

2. Answers to other questions except mathematical part must be written either in English or in Bengali. It must not be answered partly in English and partly in Bengali. This instruction should be followed scrupulously.
3. Candidates are required to give their answers in their own words as far as practicable.

[Turn over

SECTION - A

1. Choose the correct answer and write it on the answer script : $1 \times 20 = 20$

(i) New layers of wood that transports water and nutrients in the tree from roots to the leaves comprises of

- (a) Pith (b) Softwood
(c) Sapwood (d) Cambium

(ii) Ecological succession on sand is termed as

- (a) Halosere (b) Xerosere
(c) Hydrosere (d) Psammomere

(iii) Crops growing in arid region soil suffer from deficiency of

- (a) Potassium (b) Magnesium
(c) Iron (d) Calcium

(iv) In which species early wood is weaker than latewood ?

- (a) Hardwoods
(b) Softwoods
(c) Species
(d) Ring porous species

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(2)

(v) C_4 carbon fixation is one of the three known photosynthetic processes of carbon fixation and is found in the following trees

- (a) Cycas (b) Pinus
(c) Oaks (d) None of these

(vi) The discount rate at which NPV is zero is called

- (a) B-C Ratio
(b) GNP
(c) IRR
(d) Compound value

(vii) The first independent National Forest Policy (NFP) was enunciated during the year

- (a) 1952 (b) 1994
(c) 1989 (d) 1964

(viii) The first Indian Forest Act was enacted in the year

- (a) 1927 (b) 1865
(c) 1952 (d) 1894

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(3)

[Turn over

(ix) Thalloid and non-flowering plants are known as

- (a) Angiosperm (b) Thallophyta
- (c) Gymnosperm (d) Dicotyledons

(x) The male flowers found in oak trees are arranged in an inflorescence called

- (a) Male stobili
- (b) Terminal flowers
- (c) Catkins
- (d) Umbels

(xi) The juicy fruit of mango trees are sweet and tasty and retain all parts of the ovule from which they are derived is botanically called

- (a) Stone fruit (b) Drupe
- (c) Pome (d) Capsule

(xii) *Adina cordifolia* belongs to the family

- (a) Rubiaceae (b) Dipterocarpaceae
- (c) Rutaceae (d) Fabaceae

(xiii) Which of the following is the biggest Wildlife Sanctuary in India ?

- (a) Ranthambore (b) Kaziranga
- (c) Sariska (d) Tadoba

(xiv) The advanced stage of sheet erosion is

- (a) Rill erosion (b) Gully erosion
- (c) Splash erosion (d) None of these

(xv) How many wildlife sanctuaries currently exist in India ?

- (a) 566 (b) 218
- (c) 427 (d) 56

(xvi) Narrower C : N ratio leads to

- (a) Immobilization (b) Mineralization
- (c) Podzolization (d) Ammonification

(xvii) Which wood element differentiates softwoods from hardwoods ?

- (a) Presence of vessels
- (b) Presence of Parenchyma
- (c) Presence of tracheids
- (d) Presence of secondary wood

(xviii) The season for aerial photography in tropical evergreen and moist deciduous forests is

- (a) September to December
- (b) December to February
- (c) October to November
- (d) January to February

(xix) Match the following :

- | | | |
|------------|---|----------------|
| A. FRI | — | I. Vienna |
| B. IUFRO | — | II. Dehradun |
| C. CAFRI | — | III. Hyderabad |
| D. ICRISAT | — | IV. Jhansi |

- (a) A-I, B-III, C-I, D-IV
- (b) A-II, B-I, C-IV, D-III
- (c) A-III, B-II, C-IV, D-I
- (d) A-IV, B-III, C-II, D-I

(xx) The fertility level of any soil is generally determined by

- (a) Aeration and hydration
- (b) Humus and mineral contents
- (c) Humus, mineral and hydration contents
- (d) All of the above.

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(6)



SECTION – B

Answer any six questions :

5×6=30

- 2. Describe the binomial system of classification of forest trees and what is the importance of floral formula in a family ?
- 3. Compare the salient features of 1894, 1952 and 1988 Forest policies.
- 4. Write the salient features of the following Acts :
 - (a) Wildlife Protection Act
 - (b) Environmental Protection Act
- 5. Differentiate between the following :
 - (a) Hardwood and softwood
 - (b) Heartwood and sapwood
 - (c) Xylem and phloem
 - (d) Gymnosperm and angiosperm
 - (e) Annual ring and periodic rings

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(7)

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Total No. of printed pages = 10

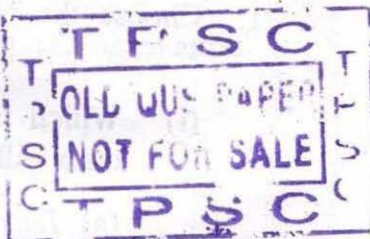
TR/FST/FOR/II/21

FORESTRY

Paper : II

Full marks – 100

Time – Three hours



The figures in the margin indicate full marks for the questions.

Instructions :

1. Answer to Question No. 1 (i to xx) i.e., MCQ type questions under Section – A must be written in English.

Example : The capital of India is

- (a) Delhi (b) New Delhi
(c) Indraprastha (d) None of these

Answer : (b) New Delhi.

2. Answers to other questions except mathematical part must be written either in English or in Bengali. It must not be answered partly in English and partly in Bengali. This instruction should be followed scrupulously.
3. Candidates are required to give their answers in their own words as far as practicable.

[Turn over

SECTION - A

1. Choose the correct answer and write it on the answer script : $1 \times 20 = 20$

(i) Which is the most suitable host plant for tasar silk ?

(a) *Terminalia arjuna*

(b) *Terminalia alata*

(c) *Morus alba*

(d) *Shorea robusta*

(ii) Lignotubers is a characteristic feature found in

(a) Subabul (b) Alder

(c) Eucalyptus (d) Poplar

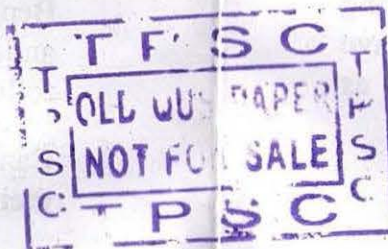
(iii) A bright red dye used for tanning clothes and leather is extracted from the wood of tree, which is called

(a) *Myrica nagi*

(b) *Pterocarpus santalinus*

(c) *Mallotus philippensis*

(d) *Toona ciliata*



(iv) Form class volume table is prepared based on

(a) Three variables (Height, diameter and form quotient)

(b) Two variables (Diameter and height)

(c) Two variables (Girth and diameter)

(d) One variable (Diameter alone)

(v) Stump analysis measurement is based on

(a) 2 radii (b) 4 radii

(c) 3 radii (d) 6 radii

(vi) The roots of the species yield an alkaloid which is an important gradient of cough syrups

(a) *Indigofera tinctoria*

(b) *Berberis aristata*

(c) *Lawsonia inermis*

(d) *Moringa oleifera*

(vii) The practices used in a forest to remove dead, diseased or infected trees to stop infection from spreading to other trees is

- (a) Clear cutting
- (b) Sanitation cutting
- (c) Rehabilitation cutting
- (d) Debris removal

(viii) Tufted bamboo is

- (a) *Melocanna bambusoides*
- (b) *Dendrocalamus giganteus*
- (c) *Arundinaria spathiflora*
- (d) *Oxytenanthera nigrociliata*

(ix) The process in which branches of the tree are cut off to produce flush of new shoots is referred to as

- (a) Pruning
- (b) Coppicing
- (c) Pollarding
- (d) Suckering

(x) When distortion of converted timber during seasoning occurs and face becomes concave or convex along the grain, its referred to as

- (a) Twist
- (b) Bowing
- (c) Cupping
- (d) Spiral

(xi) Scientific and modern basis of wood preservation was introduced by

- (a) Falkamesam
- (b) Sir Ralph Pearson
- (c) Falk
- (d) Dhilwan

(xii) The two way boom is inclined at an angle of

- (a) 60°
- (b) 20°
- (c) 40°
- (d) 90°

(xiii) The traditional method of assessing the volume of timber lengths, sawlogs, poles or billets was based on length and mid-diameter of the object as described by

- (a) Huber
- (b) Smith
- (c) Smalian
- (d) Newton

(xiv) Teak defoliator is caused by

- (a) *Eutectona macheralis*
- (b) *Hyblaea purea*
- (c) *Pulvinaria maxima*
- (d) *Celosterna scrabator*

(xv) In woody plants, sometimes there is a bladder-like distension of a parenchyma cell into the lumen of adjacent vessels referred to as

- (a) Insertions (b) Ingrowth
(c) Tyloses (d) Terminal intrusion

(xvi) Surface of the tree receiving direct sunlight can lead to appearance of wounds on the tree surface and its referred as

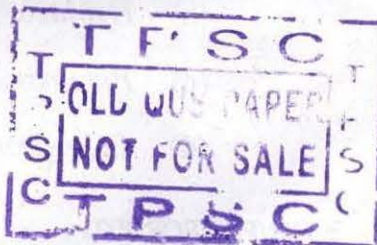
- (a) Sun stroke (b) Sun wound
(c) Sun scorch (d) Sun injury

(xvii) The line joining points of equal elevation in the ground is called as

- (a) Contour interval
(b) Horizontal interval
(c) Contour
(d) Leveling

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(6)



(xviii) Yield regulation in French method of 1883 is based on

- (a) Increment
(b) Volume
(c) Volume and increment
(d) None of the above

(xix) Which of the following working plan maps gives the details of distribution of forest types, main forest species, non-forest areas, blanks etc ?

- (a) Enumeration map
(b) Stock map
(c) Reference map
(d) Regeneration survey map

(xx) Match the following pair :

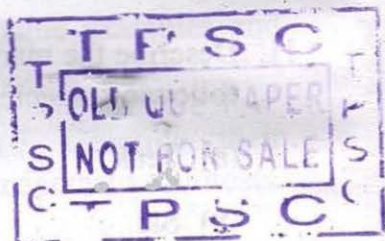
Forest fire	Details
A. Creeping fire	I. Burns the upper canopy of forest
B. Counter firing	II. Destroys grasses and leaf litter
C. Crown fire	III. Evergreen species
D. Firebreaks	IV. Back firing

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(7)

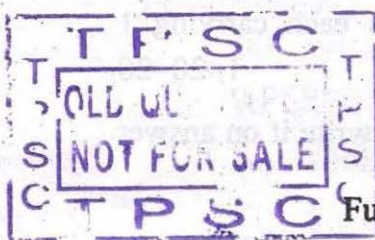
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12. Discuss the silviculture practices adopted for the bamboos of the North-East Himalayas.
13. Discuss the status and development of the following industries in India :
 - (a) Veneer and plywood industries
 - (b) Paper and pulp industries.
14. What is yield regulation ? Discuss in detail the methods of yield regulation based on volume of growing stock only used in regular shelter wood system.
15. What is forest inventory ? Discuss in detail the various types and kinds of inventory.
16. Write salient features of the following silvicultural system :
 - (a) Shelter Wood system
 - (b) Selection system
 - (c) Coppice with standards
 - (d) Conversion system.



Total No. of printed pages = 8

TR/FST/ZOO/II/21



ZOOLOGY

Paper – II

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Instructions :

1. Answer to Question No. 1 (i to xx) i.e., MCQ type questions under Section-A must be written in English only.

Example : The capital of India is –

- (a) Delhi (b) New Delhi
(c) Indraprastha (d) None of these

Answer : (b) New Delhi.

2. Answers to other questions except mathematical part must be written either in English or in Bengali. It must not be answered partly in English and partly in Bengali. This instruction must be followed scrupulously.
3. Candidates are required to give their answers in their own words as far as practicable.

[Turn over

SECTION - A

Twenty (20) MCQ Type questions each carrying 1 (one) mark. $1 \times 20 = 20$

1. Choose the correct answer and write it on answer script :

(i) Correct sequence of taxonomic hierarchy in eukaryotes is :

- (a) Phylum → class → order → genus → species → family
- (b) Phylum → class → family → order → genus → species
- (c) Phylum → class → order → family → genus → species
- (d) Phylum → class → family → order → species → genus

(ii) Egg of frog is

- (a) Centrolecithal (b) Microlecithal
- (c) Polylecithal (d) Mesolecithal

(iii) Luminous animals are mostly found in — zone.

- (a) Littoral (b) Pelagic
- (c) Benthic (d) All of these

(iv) Genetically related species which cannot interbreed are called

- (a) Allopatric species
- (b) Non-sister species
- (c) Sibling species
- (d) Sympatric species

(v) Baleen is present in

- (a) Birds (b) Whale
- (c) Crocodile (d) Elephant

(vi) Organ of flight in bat is

- (a) Wings (b) Feather
- (c) Patagia (d) Cuticular flaps

(vii) The most toxic metal pollutant of automobile exhaust is

- (a) Hg (b) Cd
- (c) Cu (d) Pd

(viii) Theory of pangenesis was proposed by

- (a) Lamarck (b) Darwin
- (c) Hugo de Vries (d) Weismann

(ix) Balbiani rings are a structural feature of

- (a) Lampbrush chromosomes
- (b) Polytene chromosomes
- (c) Allosomes
- (d) Autosomes

(x) Diameter of DNA strand is

- (a) 2 nm (b) 20 nm
- (c) 0.2 nm (d) 3.4 nm

(xi) Spermiogenesis is a process of converting

- (a) Spermatids to spermatozoa
- (b) Spermatogonia to spermatids
- (c) Spermatogonia to secondary spermatocytes
- (d) All of these

(xii) Which is true in male *Drosophila* based on the genic balance theory of sex determination ?

- (a) $X/A = 1$ (b) $A/X = 1$
- (c) $X/A = 0.5$ (d) $X/A = 0.25$

(xiii) Which one is an endangered species ?

- (a) Red Panda
- (b) Dodo
- (c) Great Indian Bustard
- (d) Snow Leopard

(xiv) Extinction rate is high at

- (a) Main lands
- (b) Large islands
- (c) Small islands near main lands
- (d) Small islands far from main lands

(xv) India's first biosphere reserve was established at

- (a) Corbett National Park
- (b) Manas
- (c) Nanda Devi
- (d) Nilgiri

(xvi) Acoustico-lateralis system is present in

- (a) Amniotes (b) Anamniotes
- (c) Arthropods (d) Echinoderms

(xvii) Patau syndrome occurs due to

- (a) Trisomy to 13th chromosome
- (b) Trisomy to 18th chromosome
- (c) Trisomy to 20th chromosome
- (d) Trisomy to 22th chromosome

(xviii) Fusion of sperm and ovum pronuclei is

- (a) Karyokinesis (b) Amphimixis
- (c) Parthenogenesis (d) Oogenesis

(xix) Biomagnification refers to increase in concentration of toxicant at

- (a) different tissues/organ level
- (b) different organism
- (c) different trophic level
- (d) different biosphere level

(xx) The neutral theory of molecular evolution was first put forward by

- (a) Darwin (b) Hugo de Vries
- (c) Mendel (d) M. Kimura

SECTION – B

Attempt any *six* (6) questions : $5 \times 6 = 30$

2. (a) State the differences between monophyletic and paraphyletic groups.
(b) What is a polyphyletic group ?
(c) What is type ? $2+1+2=5$
3. Explain the merits and demerits of Darwinism.
4. Write a note on Binomial nomenclature of animals.
5. Elaborate adaptational characteristics of volant animals. 5
6. Write a note on nucleosome model of DNA packaging. 5
7. (a) What is endemic species ?
(b) Describe the role of keystone species in an ecosystem. $3+2=5$
8. Describe molecular events in “block to polyspermy” in fertilization. 5
9. Write a note on food chain with suitable examples. 5

SECTION – C

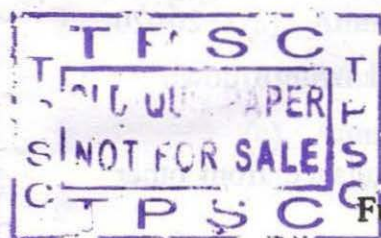
Attempt any *five* (5) questions : $10 \times 5 = 50$

10. What is fate map ? Describe the process of gastrulation in chick embryo. $2+8=10$

11. Define "pollutant". Discuss the different sources of air pollution. Briefly describe the Kyoto protocol. $2+5+3=10$
12. Define interference and coefficient of coincidence (in light of linkage mapping). Briefly describe the process of sex determination in human. Write a note on Down Syndrome. $2+4+4=10$
13. What is an ecosystem ? Describe the structure and functions of pond ecosystem. 10
14. Describe any two zoogeographical realms with reference to fauna. 10
15. (a) What is genetic drift ? 2.
(b) Write short notes on any *two* of the following : $4+4=8$
- (i) Neo-Darwinism
 - (ii) Industrial Melanism
 - (iii) Homologous organ vs Analogous organ
 - (iv) Theory of organic evolution
 - (v) Founder effect and Bottleneck phenomenon.
16. (a) Write the differences between flagship and umbrella species,
(b) Describe the strategies of *in situ* and *ex situ* conservation. $5+5=10$

Total No. of printed pages = 9

TR/FST/ZOO/I/21



ZOOLOGY

Paper - I

Full Marks - 100

Time - Three hours

The figures in the margin indicate full marks for the questions.

Instructions :

1. Answer to question No. 1 (i to xx) i.e., MCQ type questions under Section-A must be written in English only.

Example : The capital of India is -

- (a) Delhi (b) New Delhi
(c) Indraprastha (d) None of these

Answer : (b) New Delhi.

2. Answers to other questions except mathematical part must be written either in English or in Bengali. It must not be answered partly in English and partly in Bengali. This instruction should be followed scrupulously.
3. Candidates are required to answer the questions in their own words as far as practicable.

[Turn over

SECTION - A

Answer all questions :

1×20=20

1. Choose the correct answer and write it down on the answer script.

(i) Poriferans can be distinguished from other animals in having

- (a) Choanocytes
- (b) Water circulation system
- (c) Spicules
- (d) All of the above

(ii) Heart of fishes is

- (a) Two chambered and mixed
- (b) Two chambered and venous
- (c) Three chambered and mixed
- (d) Three chambered and venous

(iii) Jacobson's organ present in many vertebrates is a sensory organ detecting

- (a) Sound
- (b) Smell
- (c) Taste
- (d) Both smell and taste

(iv) The embryonic membrane in birds is/are :

- (a) Amnion only
- (b) Amnion and allantois
- (c) Amnion, allantois and yolk sac
- (d) Amnion, allantois, yolk sac and chorion

(v) Kidney of adult frog is

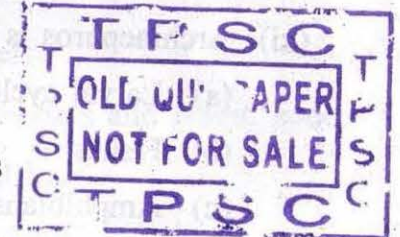
- (a) Pronephros
- (b) Mesonephros
- (c) Metanephros
- (d) Ophisthonephros

(vi) Petromyzon is a predator feeding mainly on

- (a) Arthropods
- (b) Molluscs
- (c) Small cartilaginous fishes
- (d) Bony fishes

(vii) In *Paramoecium* the organelles for offence and defence are :

- (a) Trichocyst
- (b) Cilia
- (c) Kinetosomes
- (d) Nematocyst



(viii) Which is a freshwater sponge ?

- (a) Sycon
- (b) Euplectella
- (c) Euspongia
- (d) Spongilla

(ix) An acoelomate animal with bilateral symmetry is

- (a) Jelly fish
- (b) Crab
- (c) Liver fluke
- (d) Roundworm

(x) Outermost thick layer of Ascaris egg is made of

- (a) Lipid
- (b) Protein
- (c) Phospholipid
- (d) Chitin

(xi) Archinephros is found in

- (a) Larval cyclostomes
- (b) Fishes
- (c) Amphibians
- (d) Reptiles

(xii) Pigment haematocyanin is found in

- (a) Echinodermata
- (b) Chordata
- (c) Mollusca
- (d) Annelida

(~~xiii~~) (xiii) Intestine is 9-10 times longer than the body in

- (a) Herbivores
- (b) Carnivores
- (c) Omnivores
- (d) None of the above

(xiv) Prawn carries

- (a) Oxygenated blood
- (b) Mixed blood
- (c) Deoxygenated blood
- (d) No blood

(xv) *Wuchereria bancrofti* are commonly found in

- (a) Blood vessels
- (b) Lymphatic vessels and lymph nodes
- (c) Urinogenital tract
- (d) Respiratory tract

(xvi) Hirudin is a/an

- (a) Hormone
- (b) Enzyme
- (c) Anticoagulant
- (d) Antimetabolite

(xvii) Mode of respiration in mollusca is

- (a) Pulmonary
- (b) Branchial
- (c) Cutaneous
- (d) All of the above

(xviii) The connective link between Echinoderm and Chordates is

- (a) Urochordata
- (b) Agnathans
- (c) Cyclostomes
- (d) Hemichordate

(xix) Which of the following is not a vertebrate but a chordate?

- (a) *Catla*
- (b) *Hemidactylus*
- (c) *Hippocampus*
- (d) *Amphioxus*

(xx) Notochord is found only in the larva of

- (a) *Herdmania*
- (b) *Balanoglossus*
- (c) *Amphioxus*
- (d) *Cephaloglossus*

SECTION - B

Answer any six questions :

5×6=30

2. Briefly describe the flow of water in water vascular system of star fish. 5
3. Describe polymorphism in termites. 5
4. What are corals ? Write a note on ecological importance of coral reefs. 2+3=5
5. What is shellac ? Mention two host plants of lac insect. Write down the economic importance of lac culture. 1+1+3=5
6. What are distinctive characters of nematodes ? Write a note on importance of *C. elegans* in developmental studies. 2+3=5
7. Mention the different types of caudal fins in fishes with diagrams. 5

8. Describe the life history of honey bee. Add a note on its economic importance. $2+3=5$
9. Differentiate progressive and retrogressive metamorphosis with examples. $3+2=5$

SECTION - C

Answer any five questions : $10 \times 5 = 50$

10. Mention the salient features of (any five) : $2 \times 5 = 10$

- (a) Branchiostoma
- (b) Petromyzon
- (c) Protopterus
- (d) Calotes
- (e) Ichthyophis
- (f) Sphenodon
- (g) Scoliodon.

11. What are endocrine glands. Explain the structure and functions of endocrine pancreas. $5+5=10$

12. Distinguish between : $2 \times 5 \times 4 = 10$

- (a) Protozoa and Metazoa
- (b) Coelomate and Acoelomate
- (c) Protostome and Deuterostome
- (d) Chondrichthyes and Osteichthyes.

13. Classify these organisms upto class (any five) : $2 \times 5 = 10$

- (a) Mosquito
- (b) Liver fluke
- (c) Ascaris
- (d) Hydra
- (e) Squid
- (f) Aurelia
- (g) Physalia
- (h) Loa loa.

14. Describe life cycle, pathogenicity and control of *Plasmodium Vivax*. $4+3+3=10$

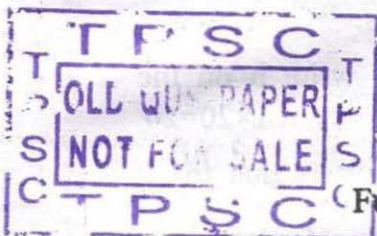
15. What are pesticides ? Describe the various types of pesticides with suitable examples. Add a note on their merits and demerits. $2+3+5=10$

16. Write characteristic features of : $5+5=10$

- (a) Class-insecta
- (b) Class-cyclostomata.

Total No. of printed pages = 10

TR/FST/CHEMIS/I/21



CHEMISTRY

Paper : I

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Instructions :

1. Answer to Question No.1(i to xx) i.e., MCQ type questions under Section – A must be written in English only.

Example : The capital of India is

- | | |
|------------------|-------------------|
| (a) Delhi | (b) New Delhi |
| (c) Indraprastha | (d) None of these |

Answer : (b) New Delhi.

2. Answers to other questions except mathematical part must be written either in English or in Bengali. It must not be answered partly in English and partly in Bengali. This instruction must be followed scrupulously.
3. Candidates are required to give their answers in their own words as far as practicable.

[Turn over

SECTION - A

Answer *all* questions.

1. Choose the correct answer and write it on the answer script : $1 \times 20 = 20$

- (i) The orange colour of $\text{Cr}_2\text{O}_7^{2-}$ is due to
- (a) Metal to ligand charge transfer transition
 - (b) Ligand to metal charge transfer transition
 - (c) Crystal field transition
 - (d) Charge-transfer complex formation
- (ii) The energy of an electron in a hydrogenic atom with nuclear charge Z varies as
- (a) Z
 - (b) Z^2
 - (c) $1/Z$
 - (d) $1/Z^2$
- (iii) The softest acid among the following is
- (a) Al^{3+}
 - (b) Li^+
 - (c) Ca^{2+}
 - (d) Ag^+
- (iv) Tollen's test will be negative for
- (a) Glucose
 - (b) Mannose
 - (c) Sucrose
 - (d) Galactose

- (v) The metal present in carbonic anhydrase is

- (a) Mn
- (b) Zn
- (c) Cu
- (d) Fe

- (vi) Iron-sulphur clusters in biological systems are involved in

- (a) proton transfer
- (b) atom transfer
- (c) group transfer
- (d) electron transfer

- (vii) The metal ion of an enzyme involved in hydration of CO_2 is

- (a) Cu(II)
- (b) Fe(II)
- (c) Mg(II)
- (d) Zn(II)

- (viii) The "styx" code for diborane is

- (a) 2002
- (b) 2020
- (c) 2200
- (d) 0220

- (ix) The most basic amino acid among the following is

- (a) tyrosine
- (b) methionine
- (c) arginine
- (d) glutamine

(x) Indicator used in redox titration is

- (a) Eriochrome black T
- (b) Methyl orange
- (c) Phenolphthalein
- (d) Methylene blue

(xi) The number of manganese ions in tetrahedral and octahedral sites, respectively in Mn_3O_4 are

- (a) one Mn^{2+} and two Mn^{3+}
- (b) one Mn^{3+} and two Mn^{2+}
- (c) two Mn^{3+} and one Mn^{2+}
- (d) two Mn^{2+} and one Mn^{3+}

(xii) The order of polarity of NH_3 , NF_3 and BF_3 is

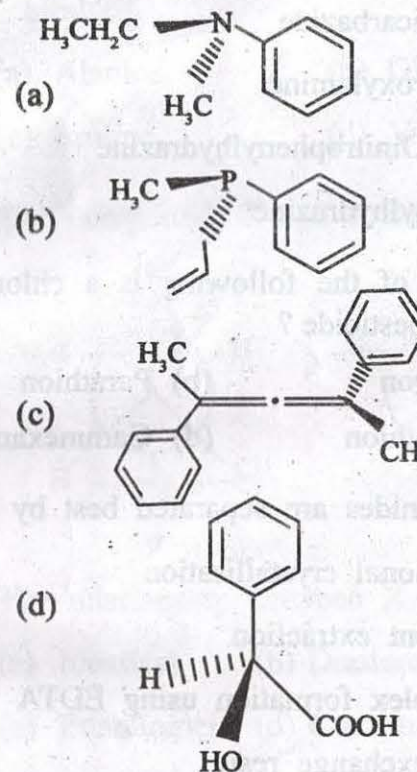
- (a) $NH_3 < NF_3 < BF_3$
- (b) $BF_3 < NF_3 < NH_3$
- (c) $BF_3 < NH_3 < NF_3$
- (d) $NF_3 < BF_3 < NH_3$

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(4)



(xiii) The optically inactive compound is



(xiv) Which one of the following represents the correct order of acidity of water and alcohols ?

- (a) $H_2O > RCH_2OH > R_2CHOH > R_3COH$
- (b) $RCH_2OH > R_2CHOH > R_3COH > H_2O$
- (c) $H_2O < RCH_2OH < R_2CHOH < R_3COH$
- (d) $RCH_2OH < R_2CHOH < R_3COH < H_2O$

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(5)

[Turn over

(xv) Brady's reagent is

- (a) Semicarbazide
- (b) Hydroxylamine
- (c) 2,4-Dinitrophenylhydrazine
- (d) Phenylhydrazine

(xvi) Which of the following is a chlorinated organic pesticide?

- (a) Baygon
- (b) Parathion
- (c) Malathion
- (d) Gammexane

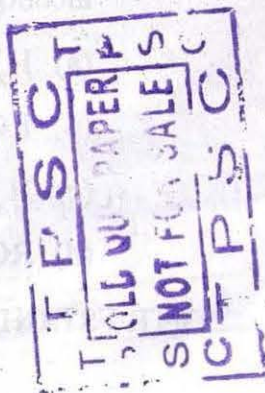
(xvii) Lanthanides are separated best by

- (a) fractional crystallisation
- (b) solvent extraction
- (c) complex formation using EDTA
- (d) ion exchange resin

(xviii) The blue color developed in Lassaigne's test for the detection of nitrogen is

- (a) Ferricferrocyanide
- (b) Potassiumferrocyanide
- (c) Sodium ferrocyanide
- (d) Ferrichiocyanate

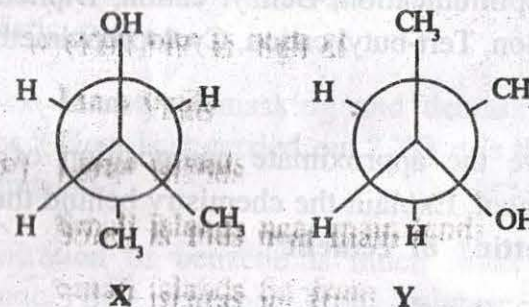
13/TR/FST/CHEMIS/I/21 (6)



(xix) Which one of the following amino acids is achiral?

- (a) Alanine
- (b) Glycine
- (c) Proline
- (d) Valine

(xx) Two compounds X and Y are given below:



The relationship between X and Y is

- (a) Identical
- (b) Diastereomers
- (c) Enantiomers
- (d) Constitutional isomers.

SECTION - B

Answer any six questions : 5×6=30

2. What are reducing and non-reducing sugars? Give one example of each and draw their chemical structures. 2+3=5

13/TR/FST/CHEMIS/I/21 (7) [Turn over

3. Optically active (R)-phenylethanol reacts separately with (i) only SOCl_2 (ii) SOCl_2 -pyridine. What are the configurations of the product?

5

4. Arrange the following compounds in the increasing order of carbocation stability, give reasons. Tropilliumcation, Benzyl cation, Diphenylmethyl cation, Tert-butyl cation, Cyclopropylmethylcation.

5

5. Give the approximate composition of Portland cement. Explain the chemistry behind the process "setting of cement".

1+4=5

6. Distinguish chemically :

(i) o-Phenylenediamine and m-phenylenediamine

(ii) Methyl nitrite and nitromethane.

5

7. "Hofmann rearrangement and Lossen Rearrangement are mechanistically allied" – Justify.

5

8. Define hormone. Classify hormones on the basis of chemical composition and give one example each mentioning their functions.

1+4=5

9. Using MO theory explain the observation that the bond length of N_2^+ is greater than N_2 , while the bond length in NO^+ is less than NO .

5

SECTION – C

Answer any five questions :

10×5=50

10. (a) Pyrrole-2-aldehyde does not undergo Cannizzaro Reaction whereas furan-2-aldehyde does. Explain.

(b) Discuss Fischer indole synthesis with mechanistic prove.

4+6=10

11. What is meant by masking and demasking of cations? How is it carried out? What is the aim of doing so?

4+3+3=10

12. (a) Nitration of benzene is much faster when conc. HNO_3 and conc. H_2SO_4 mixture is used than conc. HNO_3 alone. Explain with comments.

(b) How would you carry out following transformations : (i) Benzene to Salicylaldehyde, (ii) Toluene to 4-Aminobenzoic acid and (iii) Benzaldehyde to Benzil.

4+3×2=10

13. (i) When 2-fluoropentane undergoes an E_1 reaction, does the major product is the one predicted by Zaitsev's rule? Explain.

(ii) The commonly observed oxidation state of lanthanoids in aqueous solution is +3. Comment.

5+5=10

14. Explain why :

- (i) Acidity of aqueous solution of boric acid increases in presence of glycerol.
- (ii) Although iodine has low solubility in water, it dissolves readily in aqueous solution of KI.
- (iii) PCl_5 is a stable compound although PH_5 is non-existent.
- (iv) The boiling point of SiCl_4 is lower than that of CCl_4 . $2\frac{1}{2} \times 4 = 10$

15. (i) All Bronsted Lowry acids are Lewis acids also. But all Lewis acids are not Bronsted-Lowry acids. Explain.

(ii) Explain the basicity of the following acids :

- (a) Orthophosphoric acid
- (b) Pyrophosphoric acid
- (c) Meta phosphoric acid

Justify by drawing their chemical structures.

$$5+5=10$$

16. (i) Discuss the Werner's theory of co-ordination compound.

(ii) Tetrahedral Co^{2+} complexes are not uncommon whereas corresponding Ni^{2+} complexes are rare. Explain. $6+4=10$

Total No. of printed pages = 12

TR/FST/CHEMIS/II/21

CHEMISTRY

Paper : II

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks for the questions.

Instructions :

1. Answer to Question No.1(i to xx) i.e., MCQ type questions under Section – A must be written in English only.

Example : The capital of India is

- | | |
|------------------|-------------------|
| (a) Delhi | (b) New Delhi |
| (c) Indraprastha | (d) None of these |

Answer : (b) New Delhi.

2. Answers to other questions except mathematical part must be written either in English or in Bengali. It must not be answered partly in English and partly in Bengali. This instruction must be followed scrupulously.
3. Candidates are required to give their answers in their own words as far as practicable.

[Turn over

SECTION - A

Answer *all* questions.

1. Choose the correct answer and write it on the answer script : $1 \times 20 = 20$

(i) The correct arrangement of Cr_2O_3 , CrO_3 , MgO and MnO in increasing order of their base strength is

- (a) $\text{MnO} < \text{MgO} < \text{CrO}_3 < \text{Cr}_2\text{O}_3$
(b) $\text{CrO}_3 < \text{Cr}_2\text{O}_3 < \text{MnO} < \text{MgO}$
(c) $\text{Cr}_2\text{O}_3 < \text{CrO}_3 < \text{MnO} < \text{MgO}$
(d) $\text{MnO} < \text{Cr}_2\text{O}_3 < \text{CrO}_3 < \text{MgO}$

(ii) Which one of the following is an amphoteric metal hydroxide ?

- (a) KOH (b) $\text{Ba}(\text{OH})_2$
(c) $\text{Pb}(\text{OH})_2$ (d) $\text{Mg}(\text{OH})_2$

(iii) How many α -particles and β -particles are emitted in passing from ${}_{90}\text{Th}^{232}$ to ${}_{82}\text{Pb}^{208}$?

- (a) 4α , 4β (b) 4α , 6β
(c) 6α , 6β (d) 6α , 4β

(iv) Radiation having a high penetration power and not deflected by a magnetic field is

- (a) α rays (b) β rays
(c) γ rays (d) neutrons

(v) The variation of enthalpy of reaction with temperature is given by

- (a) Arrhenius equation
(b) Kirchoff's equation
(c) Hess's law equation

(d) Claussius Clapeyron equation

(vi) The density of a solution prepared by dissolving 129g of urea in 1000g of water is 1.15 g/ml. The molarity of this solution is

- (a) 1.78M (b) 1.02M
(c) 2.05M (d) 0.50M

(vii) Which of the following behaves as both oxidising and reducing agents?

- (a) H_2SO_4 (b) SO_2
(c) H_2S (d) HNO_3

(viii) 2g of a radioactive isotope after 24 hours reduced to 0.5 g. Its half life period is

- (a) 5 hrs. (b) 3 hrs.
(c) 8 hrs. (d) 6 hrs.

(ix) According to the latest convention, the emf of cell may be expressed in terms of the reduction potential as

- (a) $E_{\text{cell}} = E_{\text{R}} - E_{\text{L}}$ (b) $E_{\text{cell}} = E_{\text{L}} - E_{\text{R}}$
(c) $E_{\text{cell}} = E_{\text{R}}/E_{\text{L}}$ (d) $E_{\text{cell}} = E_{\text{R}} + E_{\text{L}}$

(x) Which one of the following decay takes place in phosphorescence?

- (a) $\text{S}_1 \rightarrow \text{S}_0$ (b) $\text{T}_2 \rightarrow \text{S}_1$
(c) $\text{T}_1 \rightarrow \text{S}_0$ (d) $\text{T}_2 \rightarrow \text{S}_1$

(xi) Which macromolecule catalyses chemical reactions, thus be considered an enzyme?

- (a) deoxyribonucleic acids
(b) lipids
(c) polysaccharides
(d) proteins



(xii) What is the relation between the specific heat of gas at constant pressure (C_p) and the specific heat of gas at constant volume (C_v) at the absolute zero point?

- (a) $C_p > C_v$ (b) $C_p < C_v$
(c) $C_p = C_v$ (d) Unpredictable

(xiii) Ziegler-Natta catalysis is associated with

- (a) alkene hydrogenation
(b) alkene polymerization
(c) hydroformylation of alkenes
(d) alkyne metathesis

(xiv) The reaction $^{27}\text{Al}_{13} + \dots \rightarrow ^{27}\text{Mg}_{12}$ is of the type of

- (a) n, α (b) n, p
(c) n, d (d) n, β

(xv) The law which relates the solubility of a gas to its pressure is called

- (a) Raoult's law
(b) The Distribution law
(c) Henry's law
(d) Ostwald's law

(xvi) Osmotic pressure of a solution is 0.0821 atm at a temperature of 300 K. The concentration in moles/litre will be

- (a) 0.330 (b) 3.000
(c) 0.660 (d) 0.003

(xvii) The number of degrees of freedom in the homogeneous liquid region of a two component system with a eutectic point, at one atmosphere pressure, is

- (a) 0 (b) 1
(c) 2 (d) 3

(xviii) The ionic strength of 0.1 M aqueous solution of $\text{Fe}_2(\text{SO}_4)_3$ is

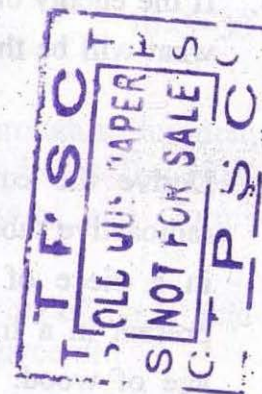
- (a) 0.1 M (b) 0.65 M
(c) 1.3 M (d) 1.5 M

(xix) Magnetic moment 2.84 BM given by (Atomic number of Ni=28, Ti=22, Cr=24 and Co=27)

- (a) Ni^{2+} (b) Ti^{3+}
(c) Cr^{3+} (d) Co^{2+}

(xx) K_{sp} for $\text{Mg}(\text{OH})_2$ is 5.61×10^{-12} . The solubility of $\text{Mg}(\text{OH})_2$ is therefore

- (a) $1.18 \times 10^{-6} \text{ mol.dm}^{-3}$
(b) $2.37 \times 10^{-6} \text{ mol.dm}^{-3}$
(c) $1.12 \times 10^{-4} \text{ mol.dm}^{-3}$
(d) $1.78 \times 10^{-4} \text{ mol.dm}^{-3}$



SECTION - B

Answer any six questions :

5×6=30

- Derive an expression for work done in isothermal reversible expansion of a gas. What is the Carnot efficiency of heat engine operating between 400°C and 100°C ?
3+2=5
- State Hund's rule and find the number of unpaired electron present in elements having atomic no. 24 and 29. The first ionisation energies increase in general as we go across the second period with the exception of B and O-Explain.
5
- If the energy of the first Bohr orbit is -13.58 eV, what will be the energy of the third Bohr orbit ?
5
- Derive the equation of half-life period for a radioactive substance. The amount of ${}^{14}_6\text{C}$ isotope in a piece of wood is found to be one-sixth present in a fresh piece of wood. Calculate the age of wood. Half-life of ${}^{14}_6\text{C}$ = 5577 yrs. 5
- Obtain the relation $TV^{\gamma-1} = \text{Constant}$.

- Derive mathematical relation for elevation of boiling point using Raoult's law. 5
- For a chemical reaction involving no change in volume, the equilibrium constants K_p and K_c are equal. -Explain.
Predict the effect of temperature and pressure on this reaction.
 $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) \Delta H = -17 \text{ kcal/mol.}$
2+3=5
- Define Hardy-Schulze rule. Arrange the Sols, ZnCl_2 , $\text{Al}_2(\text{SO}_4)_3$ and K_3PO_4 in decreasing order of their flocculation value. 5

SECTION - C

Answer any five questions :

10×5=50

- What are superacids ?

When Fe^{2+} reacts with SCN^- through sulfur atom and $[\text{Fe}(\text{SCN})]^+$ ion is formed, whereas Cr^{3+} bonds through nitrogen atom and forms $[\text{Cr}(\text{NCS})]^{2+}$. Explain.

Why acidity of aqueous solution of boric acid increases in the presence of glycerol ?

What is the pH of a buffer prepared with 0.40M $\text{HC}_2\text{H}_3\text{O}_2$ and 0.20M $\text{C}_2\text{H}_3\text{O}_2^-$ if the K_a of acetic acid is 1.8×10^{-5} ?
2+4+2+2=10

11. Describe the electroneutrality principle.

$[\text{Ni}(\text{CN})_4]^{2-}$ is diamagnetic whereas $[\text{NiCl}_4]^{2-}$ is paramagnetic in nature, explain with the help of VBT.

Why the bond angle in PF_3 is greater than PH_3 ?
 $2+4+4=10$

12. (i) Discuss the application of Kohlrausch law towards

(a) Calculation of the degree of dissociation.

(b) Calculation of the solubility of a sparingly soluble salt.

(ii) Calculate the molar conductance of NH_4OH at infinite dilution (λ_m° for $\text{Ba}(\text{OH})_2$, BaCl_2 and NH_4Cl are 457.6, 240.6 and 129.8 $\text{Ohm}^{-1} \text{cm}^2 \text{mol}^{-1}$ respectively).

Explain the buffer action of a mixture of acetic acid and sodium acetate. $3+3+4=10$

13. (a) The equivalent conductances at infinite dilution are sodiumbenzoate = 82.4, HCl = 426.2 and NaCl = 126.5. Calculate Λ° for benzoic acid.

(b) Explain why

(i) the ionization potential of inert gases are very high while alkali metals have low ionization potential

(ii) fluorine is more electronegative than chloride but electron affinity of chlorine is more than that of the fluorine.

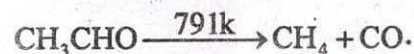
$2+4+4=10$

14. (a) Prove that for gas obeying van der Waals' equation, $\text{PcVc} = 3/8\text{RTc}$. when R is gas constant.

(b) Argon has $T_c = -122^\circ\text{C}$ and $P_c = 48 \text{ atm}$. Estimate the radius of the argon atom.

$6+4=10$

15. Discuss the kinetics of the following reaction



Formulate the general relation between half-life period and order of a reaction. Predict the molecularity and order of the following reaction :



16. Draw the Jablonski diagram and explain the term internal conversion, inter system crossing, fluorescence and phosphorescence.

"Phosphorescence is called delayed fluorescence" – Explain.

Calculate the transmittance, absorbance and absorption co-efficient of a solution which absorbs 90% of a certain wavelength of light beam passed through a 1 cm cell containing 0.25 M solution.

$$5+2+3=10$$

