FT-F

SUBJECT : ENGLISH (SET-II)

Time : 3 Hrs. **M.M.: 80**

General Instructions :

1. ***This paper is divided into three sections - A, B and C. All the sections are compulsory.***
2. ***Separate instructions are given with each question wherever necessary. Read these instructions carefully and follow them meticulously.***
3. ***Do not exceed the prescribed word limit while answering the questions.***

SECTION-A (READING)

(12)

Q1. Read the given passage carefully :

1. We often make all things around us the way we want them. Even during our pilgrimages we have begun to look for whatever makes our heart happy, gives comfort to our body and peace to the mind. It is as if external solutions will fulfill our needs and we do not want to make any special efforts even in our spiritual search. Our mind is resourceful - it works to find shortcuts in simple and easy ways.

2. Even pilgrimages have been converted into tourism opportunities. Instead, we must awaken our conscience and souls and understand the truth. Let us not tamper with either our own nature or that of the Supreme.

3. All our cleverness is rendered ineffective when nature does a dance of destruction. Its fury can and will wash away all imperfections. Indian culture, based on Vedic treatises, assists in human evolution, but we are now using our entire energy in distorting these traditions according to our convenience instead of making efforts to make ourselves worthy of them.

4. The irony is that humans are not even aware of the complacement attitude they have allowed themselves to sink to. Nature is everyone's Amma and her fierce blows with sooner or later corner us and force us to understand this truth. Earlier, pilgrimages to places of spiritual significance were rituals that were undertaken when people became free from their worldly duties. Even now some seekers take up this pious religious journey as a path to peace and knowledge. Anyone travelling with this attitude feels and travels with only a few essential items that his body can carry. Pilgrims traditionally travelled light, on foot, eating light, dried chickpeas and fruits, or whatever was available. Pilgrims of olden days did not feel the need to stay in special AC bedrooms, or travel by luxury cars or indulge themselves with delicious food and savouries.

5. Pilgrims traditionally moved ahead, creating a feeling of belonging towards all, conveying a message of brotherhood among all they came across whether in small caves, ashrams or local settlements. They received the blessings and congregations of yogis and mahatmas in return while conducting the dharma of their pilgrimage. A pilgrimage is like penance or sadhana to stay near nature and to experience a feeling of oneness with it, to keep the body healthy and fulfilled with the amount of food, while seeking freedom from attachments and yet remaining happy while staying away from relatives and associates.

6. This is how a pilgrimage should be rather than making it like a picnic by taking a large group along and living in comfort, packing in entertainment, and tampering with environment. What is worse giving a boost to the ego of having had a special darshan. Now alms are distributed, charity done while they brag about their spiritual experiences!

7. We must embark on our spiritual journey by first understanding the grace and significance of a pilgrimage and following it up with the prescribed rules and rituals - this is what translates into the ultimate and beautiful medium of spiritual evolution. There is no justification for tampering with nature.

8. A pilgrimage is a symbolic of contemplation and meditation and acceptance and is a metaphor for the constant growth or movement and love for nature that we should hold in our hearts.

9. This is the truth!

On the basis of your reading of the above passage, answer the following questions : (9x1=9)

(a) How can a pilgrim keep his body healthy?

(b) How do we satisfy our ego?

(c) What change has taken place in our attitude towards pilgrimages?

(d) What happens when pilgrimages are turned into picnics?

(e) Why are we complacent in our spiritual efforts?

(f) How does nature respond when we try to be clever with it?

(g) In olden days with what attitude did people go on a pilgrimage?

(h) What message does the passage convey to the pilgrims?

(i) Find words from the passage which mean the same as the following : (3x1=3)

(i) made/turned (para 3) (ii) very satisfied (para 4)

(iii) self-esteem (para 6)

Q2. Read the passage given below : (8)

The day the child is born, the parents dream of making him a doctor, engineer, architect or an IAS. As the child develops, the hopes and aspirations of parents also develop. They want to see their children earning a handsome amount of money.

Having an ideal career is a dream for all and as parents of a teenager, thoughts of your child's career may not be very far from your mind. Most youngsters at that age, however, wrongly believe that they are at the beginning of their career path. But they have been on that road for years - their school studies, recreational activities and hobbies help a child gravitate towards its interests. These interests must drive their ambitions. Gone are the days when one began and ended one's professional career at the same job. Getting a job is no longer as important as choosing the right career path - one that promises more personal satisfaction and growth, and of course earnings that will let them live a good life. So making a wise choice becomes all the more important. Developing a keen self-knowledge is essential to making the right career decisions. But all youngsters are not so self-aware. Infact many of them admit that they need help in planning their careers. Inexperienced, unsure and ill-informed, young people must turn to others for help. And though career counsellors at school are helpful, experts agree that parents are the number one influence on a child's choice of career. Sadly many parents are themselves very sure about how best they can help. Many parents mistakenly try to "tell" kids - directly or indirectly - about the kind of expectations they have with regard to the child's choice of career. The chances are that the child ends up following its parents' dream, not its own, will not be a happy, satisfied professional in its adult life. "A child relies on information from peers when it comes to career options. But a parent has many options to get and pass on details about various career options. Parents

must guide their wards and allow them to make an informed decision", says S.C. Moha, executive director of the All India Management Association (AIMA).

(A) On the basis of your reading of the above passage, make notes on it, using headings and sub-headings. Use recognizable abbreviations (wherever necessary - maximum four) and a format you consider suitable. Also supply an appropriate title. (5)

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

SECTION-B (ADVANCED WRITING SKILLS)

Q3. You want to rent out your newly constructed flat in the heart of the city. Draft an advertisement in not more than 50 words to be published in 'The Deccan Herald', Bengaluru under the classified column. Give all the necessary details. You are Mohan/Mahima of Jaya Nagar, Bengaluru.

OR

Sarvodaya Education Society, a charitable organisation is coming to your school to distribute books among the needy students. As Head Boy/Head Girl, Sunrise Public School, Surat, write a notice in about 50 words asking such students to drop the lists of books they need in the box kept outside the Principal's office. You are Samay/Samaira. (4)

Q4. You are Swati Sahni of Kanpur. You find that garbage is being dumped in the park meant for the children to play. The foul smell and the unhygienic condition of the park has made it impossible for the residents to use it. Write a letter to the editor of a local newspaper highlighting the problem and its effects. Also give some suitable suggestions to improve the situation.

OR

Write a letter in about 150 words to the editor of 'The Mumbai Times', complaining against the menace of chain-snatching and poor security arrangements in your locality. You are Rahul Sharma of Civil Lines, Mumbai. (6)

Q5. You think differently from the way you parents think about food, clothing and lifestyle. Write an article on the topic 'Generation Gap - A Myth or Reality' in 150-200 words.

OR

You wish to deliver a speech on 'The Benefits of Reading' in the morning assembly. Write a speech in 150-200 words urging the students to spend some time on reading quality books and journals. (10)

SECTION-C (TEXT BOOKS AND LONG READING TEXT)

Q6. Read the following extracts and answer the questions that follow : (4)

Some twenty-thirty years later
She'd laugh at the snapshot. "See Betty
And Dolly", she'd say, "and look how they
Dressed us for the beach".

(a) Who is the speaker and whom is she addressing? (1)

(b) What had happened twenty-thirty years earlier? (1)

(c) What amused the speaker? (1)

(d) Identify the rhyme scheme of these lines. (1)

OR

(For song, issuing from its birth-place, after
fulfillment, wandering reck'd or unreck'd, duly
with love returns.)

(a) What does 'its' refer to? (1)

(b) Explain - 'Reck'd on unreck'd, duly with love returns'. (1)

(c) What two things have been compared in the above lines? (1)

(d) Why are the above lines put within brackets? (1)

Q7. Answer any four of the following questions in 30-40 words each : (4x3=12)

(a) How was Mourad a natural descendant of uncle Khosrove?

(b) How did Sue exhibit her courage and selflessness?

(c) What were Ranga's views on marriage?

(d) How was the narrator received by Mrs. Dorling?

(e) On 2nd January what were the indications of the approaching disaster?

(f) How does the earth benefit from rain?

Q8. Answer the following question in 120-150 words : (6)

Children's courage and optimism helped the parents to overcome dangers. Discuss with the reference to the chapter 'We're not afraid to die ... if we can all be together'.

OR

Animals are creations of god. They need to be loved and respected. Discuss with reference to the story 'The Summer of the Beautiful White Horse'.

Q9. Answer the following question in 120-150 words : (6)

What was Albert's plan about leaving school and how did things turn out to be different?

OR

The author's grandmother was religious, emotionally strong and caring. Elaborate.

Q10. Answer the following question in 120-150 words : (6)

What was the history behind the blood-stain? How did the Otis family react when the blood-stain appeared persistently?

Q11. Answer the following question in 120-150 words : (6)

Write a character sketch of Mr. Hiram B. Otis.

SUBJECT : COMPUTER SCIENCE (SET-I)

Time : 3 Hrs. **M.M.: 70**

General Instructions :

(i) All the questions are compulsory.

(ii) Programming language: C++

Q1. (a) Distinguish between Hardware and Software. (2)

(b) What are the software classifications? Discuss their functioning in brief. (2)

(c) Write any two weakness of a computer? (1)

(d) Write a short note on the programming in low level language. (1)

(e) (i) Convert following number from decimal to octal. (1)

735649

(ii) Convert octal to binary. (1)

76546.437

(iii) Convert binary to decimal. (1)

1110001110.101

(f) What is the difference between copy and move command? (1)

Q2. (a) (i) Write the difference between multiprogramming and Single programming OS? (2)

(ii) What is the use of Operating System? (1)

(b) What are Identifiers in C++? How Identifiers are different from Keywords? (2)

(c) (i) What kind of program elements are the following : (2)

373.33, "26", 25, "ABC" .

(ii) Why we need to include iostream.h file in C++ program? (1)

(d) Write a program to find average of five float numbers. (2)

Q3. (a) Arrange the data types from largest to smallest based upon the size. (2)

long, double, char, int

(b) Write a program to input any number and to check whether given number is positive, negative or zero. (3)

(c) (i) Explain the concept of reference variable and its purpose. (2)

(ii) What are the similarity and difference between class and structure. (2)

(d) What will be the size of the following constants? (1)

(i) "RAHUL" (ii) 'A'

Q4. (a) What is meant by type casting? Explain with an example. (2)

(b) Construct logical expressions to represent the following conditions : (2)

(i) Rent is between 2000-4000 and members are equal to 5.

(ii) character variable 'K' is digit.

(c) WAP to Program to input a character and to print whether a given character is an alphabet, digit or any other character. (3)

(d) Write a program to input any number and to check whether the given number is prime or not. (3)

Q5. (a) (i) Explain logical errors with an example. (2)

(ii) Differentiate between break and continue. (2)

(b) (i) What is meant by exit control loop? Which C++ loop is exit control loop. (2)

(ii) Write an equivalent while loop for the following for loop. (2)

```
for (i = 2, s = 0, i < = 50; i + = 2)
{
   cout << i << "\t";
   s + = i;
}
cout << "\n sum =" << s;
```

(c) Find Two's complement of (-89) [use one byte memory] (2)

Q6. (a) Given the following fragment : (2)

```
int c = 25;
cout << ++ c << "\n" << c++ << "\n";
```

(i) What output does the above code fragment produce?

(ii) What is the effect of replacing c++ with c + 1?

(b) Rewrite the following program after removing the syntactical error(s) if any underline each correction. (2)

```
# include <iostream.h>
void main ( );
{
   int a; b;
   cout << 'enter any two numbers';
   cin >> a >> b;
   cout << [a + b];
}
```

(c) Rewrite the following code fragment using if. (2)

```
switch (status)
{
   case 'T' : cout << "Teacher";
      break;
```

```
        case 'M' : cout << "Manager";
            break;
        case 'P' : cout << "Principal";
            break;
        case 'S' : cout << "Superviser";
            break;
        default : cout << "none";
    }
```

(d)
```
int i = 0, sum = 0;
while (++ i < 5)
    sum + = i;
cout << "Sum =" << sum;
```

(i) Find the output of the above code and explain. (2)

(ii) How many times the above loop will execute. Explain. (2)

Q7. (a) Write a program to print the following format. (3)

```
1
1   2
1   2   3
1   2   3   4
1   2   3   4   5
```

(b) Write a program to find the sum of Fibonacci series i.e., 0 1 1 2 3 5 ..... n terms. (4)

(c) Write a program to check whether the reverse of the number is same as given number or not. (3)

SUBJECT : MATHEMATICS (SET-II)

Time : 3 Hrs. **M.M.: 100**

General Instructions :

(i) There are 26 questions divided into three sections.

(ii) All questions are compulsory.

(iii) Section-A comprises of 6 questions of 1 mark each, Section-B comprises of 13 questions of 4 marks each and Section-C comprises of 7 questions of 6 marks each.

(v) Use of calculators is not allowed.

SECTION-A

Q1. Define greatest integer function and draw its graph.

Q2. Find the value of cot (–1140°).

Q3. Evaluate : $\lim_{x \to 9} \frac{x^{3/2} - 27}{x - 9}$.

Q4. Write B = $\left\{1, \frac{1}{3}, \frac{1}{5}, \frac{1}{7}, \frac{1}{9}\right\}$ in set-builder form.

Q5. Find the 6th term in the expansion of $\left(\frac{x}{5} - \frac{5}{2x}\right)^9$.

Q6. How many numbers are there between 100 and 1000 such that 7 is in the unit's place.

SECTION-B

Q7. Solve the inequalities and represent the solution graphically on number line (if possible) :

$3x - 7 < 5 + x$, $11 - 5x \leq 1$

Q8. Let A = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} and R be a relation on A defined by R = {(x, y) : $x + 2y = 10$ & $x, y \in A$}, then

(a) Write R as a set of ordered pairs.

(b) find domain and range of R.

(c) Depict this relation using an arrow diagram.

Q9. Evaluate : $\lim_{x \to 2} \frac{x^2 - 4}{\sqrt{3x-2} - \sqrt{x+2}}$.

Q10. Prove that : $4\sin\theta.\sin\left(\frac{\Pi}{3} + \theta\right).\sin\left(\frac{2\Pi}{3} + \theta\right) = \sin 3\theta$

Q11. Let A, B and C be the sets such that $A \cup B = A \cup C$ and $A \cap B = A \cap C$. Show that $B = C$.

Q12. If $\sin x = \frac{\sqrt{5}}{3}$ and x lies in 2nd quadrant, find the values of

$\sin\frac{x}{2}$, $\cos\frac{x}{2}$ and $\tan\frac{x}{2}$.

Q13. Find the domain and range of $f(x) = \frac{1}{\sqrt{9 - x^2}}$.

Q14. Let $f(x)$ be a function defined by $f(x) = \begin{cases} 4x - 5 & , \text{ if } x \leq 2 \\ x - \lambda & , \text{ if } x > 2 \end{cases}$

Find λ, if $\lim_{x \to 2} f(x)$ exists.

Q15. Solve : $\sin 2x - \sin 4x + \sin 6x = 0$

Q16. How many words, with or without meaning, can be formed using all the letters of the word EQUATION at a time so that the vowels do not occur together?

Q17. Write A = {x : x is a letter of the word 'INDEPENDENCE'} in roster form. Let B = {x : x is a consonant in the word 'INDEPENDENCE'}. Write P(B). List the values to be promoted to maintain our independence.

Q18. What is the number of ways of choosing 4 cards from a pack of 52 playing cards? In how many of these are :

(i) Cards of the same colour?

(ii) two red cards and two black cards?

Q19. Find a if 17^{th} and 18^{th} terms of the expansion of $(2 + a)^{50}$ are equal.

SECTION-C

Q20. Solve the following system of inequalities graphically :

$3x + 2y \leq 24,\ 3x + y \leq 15,\ x \geq 4,\ x, y \geq 0$

Q21. Using principle of mathematical induction, prove that

$4^n + 15n - 1$ is divisible by 9, for all $n \in N$.

Q22. Out of 6 boys and 4 girls, a committee of 5 is to be formed. In how many ways can this be done if

(i) atleast 2 girls are included?

(ii) atmost 2 girls are included?

(iii) no girl is included?

Should girls be given equal rights. What values are being promoted?

Q23. (i) Prove that : $\cos 6x = 32\cos^6 x - 48\cos^4 x + 18\cos^2 x - 1$

(ii) Convert 6 radians into degree measure. (4+2)

Q24. Using first principle, find the derivative of $f(x) = (x - 1)(x - 2)$.

Q25. Find the value of $\left(\sqrt{3} + \sqrt{2}\right)^6 - \left(\sqrt{3} - \sqrt{2}\right)^6$.

Q26. Find the derivative of : (3+3)

(i) $f(x) = \dfrac{4x + 5\sin x}{3x + 7\cos x}$

(ii) $f(x) = (x + \sec x)(x - \tan x)$

SUBJECT : BIOLOGY

Time : 3 hrs. **M.M. : 70**

General Instructions :

(i) There are 26 questions and 5 sections in the question paper. All questions are compulsory.

(ii) Section-A contains question number 1 to 5, very short answer type questions of one mark each.

(iii) Section-B contains question number 6 to 10, short answer type-I questions of 2 marks each.

(iv) Section-C contains question number 11 to 22, short answer type-II questions of 3 marks each.

(v) Section-D contains question number 23, value based question of 4 marks.

(vi) Section-E contains question number 24 to 26, long answer type questions of 5 marks each.

(vii) There is no overall choice in the question paper, however, an internal

(viii) There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and all three questions of 5 marks. An examinee is to attempt any one of the questions out of the two given in the question paper with the same question number.

SECTION-A

Q1. Name the structure that helps in motility of bacterial cells. (1)

Q2. Define critical concentration of elements with reference to plant nutrition. (1)

Q3. Mention the names assigned to male and female reproductive organs of Bryophyta. (1)

Q4. Two factors 'X' and 'Y' affect water potential. Identify 'X' and 'Y'. (1)

Q5. Nostoc and Anabaena have specialised cells which can fix atmospheric nitrogen. Name these cells. (1)

SECTION-B

Q6. Enlist the anatomical differences between a C_3 and a C_4 leaf. (2)

Q7. Transpiration has more than one purpose. Mention any four of them. (2)

Q8. Differentiate between the two types of endoplasmic reticulum present in a cell. (2)

Q9. Give the significance of mitosis in living organisms. (2)

OR

Describe the primary structure of proteins. (2)

Q10. Represent diagrammatically the coelom in a pseudo-coelomate.

SECTION-C

Q11. (a) Why are the reaction centres of photosystems named as P_{700} and P_{680}?

(b) How does PSII supply electrons continuously? (3)

Q12. What is meant by cytoskeleton in a cell? State the functions that it performs. (3)

Q13. Describe competitive inhibition with an example. (3)

Q14. Define cytokinesis. How is it accomplished in plant and animal cells? (3)

Q15. Explain the process of nitrogen fixation in leguminous plants. Where does it occur? (3)

Q16. (a) What is the role of accessory pigments during photosynthesis?

(b) Name the primary acceptor of CO_2 in C_3 plants.

(c) What is photophosphorylation? (3)

Q17. Name the two pathways through which water moves in roots. Explain any one of them. (3)

Q18. Describe any two taxonomical aids used by taxonomists to identify or verify certain species. (3)

Q19. Differentiate between Phycomycetes, Ascomycetes and Basidiomycetes on the basis of : (3)

(a) asexual spores produced by them.

(b) type of mycelium.

Q20. Mention any three economic importance of Pteridophytes. (3)

Q21. Differentiate between chondrichthyes and osteichthyes.

OR

Enlist the distinguishing features of animals belonging to Class Reptilia. Give two examples. (3)

Q22. Draw a well labelled diagram of a chloroplast. (3)

SECTION-D

Q23. Seema and her friend Arti went to the market to buy cosmetics. Seema wanted to buy oil based cosmetics but Arti insisted on buying herbal products as the oil based cosmetics were generally made form whale oil.

(a) What values were potrayed by Arti?

(b) How is the marine ecology harmed due to whale hunting?

(c) To which phylum and class does whale belong? (4)

SECTION-E

Q24. Specify how C_4 photosynthetic pathway increases CO_2 concentration in bundle sheath cells of sugarcane. Represent the Hatch & Slack pathway schematically.

OR

Describe the mechanism of translocation of sugars in plants as hypothesised under mass flow hypothesis. (5)

Q25. (a) Explain the changes occuring in a cell during Gas/phase, S phase and Gap 2 phase of cell cycle.

(b) Mention any two characteristics of Metaphase.

OR

Describe any 4 classes of enzymes. Make a distinction between prosthetic group and coenzyme. (5)

Q26. (a) Differentiate between gametophyte and sporophyte of plants. What is meant by alternation of generation?

(b) What are methanogens? Where are they found?

OR

(a) Schematically represent the haplodiplontic life cycle.

(b) Name the amphibians of plant kingdom. Why are they named so? (5)

SUBJECT : PHYSICS (SET-II)

Time : 3 Hrs. M.M.: 70

General Instructions :

(i) All questions are compulsory.

(ii) Question numbers 1 to 5 are very short answer questions carrying 1 mark each.

(iii) Question numbers 6 to 10 are short answer questions carrying 2 marks each.

(iv) Question numbers 11 to 22 are also short answer questions carrying 3 marks each.

(v) Question number 23 is a value based question carrying 4 marks.

(vi) Question numbers 24 to 26 are long answer questions carrying 5 marks each.

(vii) There is no overall choice but an internal choice is given in 1 question of 2 marks, 1 question of 3 marks and all questions of 5 marks.

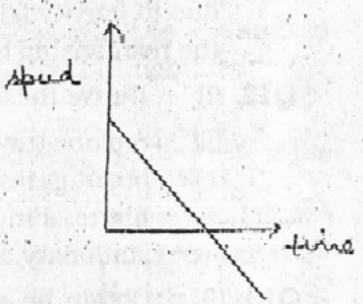
(viii) You may use the following constants :

$M_e = 6.4 \times 10^{24}$ Kg $\qquad R_e = 6.4 \times 10^6$ m

Q1. Find the angle which $\hat{i} + \hat{j}$ makes with z-axis.

Q2. A ball of mass 200g hits a wall normally with speed 5m/s and then reflects back with same speed. What is the change in momentum of the ball?

Q3. Is the following speed-time graph possible for a one dimensional motion. Why?



Q4. Find the dimension of a/b in the relation :

$$E = \left(\frac{a - x^2}{t^2 - b}\right) m;$$ where

E is the energy, x is the distance, t is time & m is the mass.

Q5. Give an example of a motion in which momentum changes but kinetic energy remains constant.

Q6. Define acceleration due to gravity.
Establish a relation between 'g' and 'G'.

Q7. A body of mass 2 kg is resting on a smooth horizontal surface. 20N force is applied on it for 10s, parallel to the surface. Calculate (i) work done by the applied force in 10s (ii) change in kinetic energy of the object in 10s.

Q8. Find the angle between vectors $\vec{A}$ and $\vec{B}$ if $|\vec{A}| = 2$, $|\vec{B}| = 7$ and $\vec{A} \times \vec{B} = 3\hat{i} + 2\hat{j} + 6\hat{k}$

OR

Find a vector perpendicular to the vector $\vec{A}$ and $\vec{B}$, where $\vec{A} = 4\hat{i} - \hat{j} + 3\hat{k}$ & $\vec{B} = 2\hat{i} + \hat{j} - 2\hat{k}$

Q9. A long playing record revolves with a speed of 33 rev/min. It has a radius of 15 cm. Two coins are placed at 4 cm & 14 cm away from the centre. If the coefficient of friction between the coins & the record is 0.15, find which coin will revolve with the record.

Q10. The speed of an object varies with time as $v = -5 + 2t$. Find its acceleration & draw the velocity-time graph.

Q11. The velocity (v) of water waves depends on the wavelength (λ) of the waves, density (ρ) of water and the acceleration due to gravity (g). Deduce by the method of dimensions the relationship between these quantities.

Q12. (i) Derive the 3rd equation of motion.

(ii) A plane travelling at a speed of 450 km/h ejects the burnt gases at a speed of 1200 km/h relative to the plane. Find the speed of burnt gases w.r.t. a stationary observer on earth.

Q13. (i) Obtain an expression for the variation of 'g' with depth below the surface of earth.

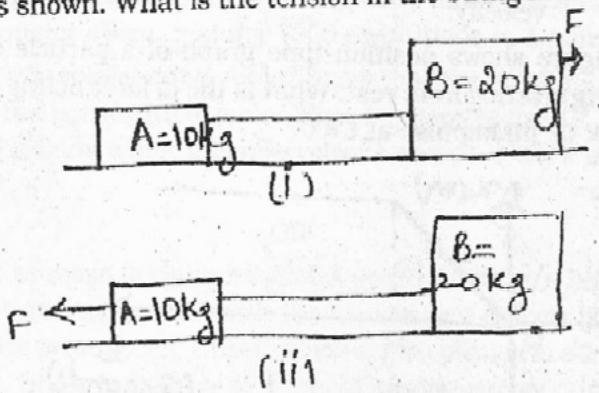
(ii) Two planets A and B of same size have densities in the ratio 1:8. Obtain the ratio of escape velocities from their surface.

Q14. A bob of mass M is suspended by a thread of length L. It is given a horizontal velocity V_0 at its lowest point, such that it completes semi-circular trajectory in the vertical plane with the string becoming slack only at the top most point. Obtain the expression for

(i) V_0 and speed at top most point.

(ii) ratio of KE at the lowest and topmost points.

Q15. Two bodies of masses 10 kg and 20 kg kept on a smooth horizontal surface and tied to the ends of a light string as shown. A horizontal force, F = 600N is applied to (i) B (ii) A as shown. What is the tension in the string in each case?



Q16. Derive an expression for the esacpe velocity of an object from the surface of a planet. Why moon has no atmosphere ?

Q17. State and prove the principle of conservation of energy.

Q18. (i) Show that the maximum fractional error in the product of two quantities is equal to the sum of fractional errors in the individual quantities.

(ii) A physical quantity X is given by $X = \frac{a^3b^3}{\sqrt{cd^3}}$. if the percentage errors in a, b, c and d are 2%, 1%, 2% and 2% respectively, then find the percentage error in X.

Q19. Show various forces on a vehicle negotiating a turn on a rough banked road. Hence find the maximum safe velocity with which it can negotiate the circular turn.

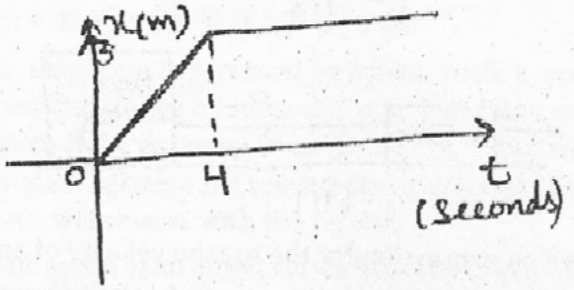
(i) Explain why it is easier to pull a lawn roller than to push it using suitable diagram.

(ii) Explain why, the apparent weight of a mass in a life accelerating upwards increases.

Q20. (i) Find the value of x so that the given vector $(\bar{A})$ is a unit vector $\bar{A} = x\hat{i} + 0.4\hat{j} + 0.5\hat{k}$.

(ii) The horizontal component of a velocity of 10 m/s is $5\sqrt{2}$ m/s. Find the vertical component of the velocity.

Q21. Figure shows position-time graph of a particle of mass 4kg starting from rest. What is the (i) force acting on it for $t < 0$? (ii) impulse at $t = 0$?



Q22. (i) Find the magnitude and direction of $\hat{i} + \hat{j}$.

(ii) Find the component of $\bar{a} = 2\hat{i} + 3\hat{j}$ along $\hat{i} + \hat{j}$.

Q23. On a foggy day, Mr. Vinod was driving his car at a high speed of 72 km/h. Mr. Vijay coming from the opposite direction at a speed of 54 km/h realises that Mr. Vinod is not slowing down his car. When their distance is 80m, Mr. Vijay applies brakes to retard at 10 m/s^2 to come to rest. Will he be able to avoid collision? What values are associated to Mr. Vijay?

Q24. (i) A projectile is thrown upwards with an initial speed 'u' at an angle θ with the horizontal. Obtain expressions for its time of flight and maximum height attained.

(ii) Find the change in momentum of a projectile thrown upwards with initial speed u at an angle θ with horizontal between its initial positions and highest positions.

OR

Prove that a uniform circular motion is an accelerated motion; and hence find the magnitude and direction of the acceleration of an object undergoing a circular motion of radius r with speed v. Calculate the linear velocity and centripetal acceleration of a 10kg body moving in a circle of diameter 40cm, making 1000 revolutions in 1 minute.

Q25. What are conservative force? Show that the gravitational force is a conservative force. What happens to the KE and PE of a body when a conservative force does work on a body?

OR

A ball of mass 200g moving at a speed of 20 m/s hits a wall at an angle of 30° with the normal and reflects back with the same speed. Check whether the collision is elastic or not. Show that there is a loss of kinetic energy during one-dimensional unelastic collision.

Q26. State and prove the triangle law of vector addition. What should be the angle between two equal vectors so that their resultant is equal to the magnitude of the vector itself?

OR

To a stationary person, rain appears to fall at 60° with the vertical. If the person starts walking at 10m/s, rain appears to fall vertically downwards. Find -

(i) speed of rain w.r.t. the ground

(ii) speed of rain w.r.t. the moving person

(iii) what will be the relative velocity of rain w.r.t. man if now, the man starts moving in the opposite direction?

SUBJECT : CHEMISTRY (SET-I)

Time : 3 Hrs. **M.M.: 70**

General Instructions :

i) ***All questions are compulsory.***

ii) ***Question numbers 1 to 5 are very short answer type questions carrying 1 mark each.***

iii) ***Question numbers 6 to 10 are short answer type questions carrying 2 marks each.***

iv) ***Question numbers 11 to 22 are also short answer type questions carrying 3 marks each.***

v) ***Question numbers 23 is a value based question carrying 4 marks.***

vi) ***Question numbers 24 to 26 are long answer type questions carrying 5 marks each.***

vii) ***Use log tables, if necessary. Use of calculators is not allowed.***

Q1. Why is moist air lighter than dry air?

Q2. Write the number of significant figures in 0.00601.

Q3. Explain, why the energy of an electron is negative?

Q4. Would you expect the first ionization enthalpy for two isotopes of the same element to be the same or different? Justify your answer.

Q5. What is the value of ΔG when ice and water are in equilibrium?

Q6. (a) Write the general electronic configuration of d-block elements.

(b) Why electron gain enthalpy of noble gases is almost zero.?

Q7. Define electron gain enthalpy. How does it vary along the period and down the group?

Q8. How many grams of chlorine are required to react completely with 0.40 g of Hydrogen (H_2) to yield hydrochloric acid (HCl) according to the reaction :

$$H_2 + Cl_2 \rightarrow 2HCl$$

Also calculate the amount of HCl formed.

Q9. An element with mass number 81 contains 31.7% more neutrons as compared to protons. Assign the atomic symbol.

Q10. Draw the Born-Haber cycle for calculation of lattice enthalpy of KCl.

OR

Derive the reaction $C_P - C_V = R$

Q11. Calculate the empirical and molecular formula of the compound having the following percentage composition :

Mg = 20%, S = 26.66%, O = 53.34%.

The molecular mass of the compound is 120 a.m.u. (Given atomic mass of Mg = 24, S = 32, O = 16u)

Q12. Calcium carbonate reacts with aqueous HCl according to reaction $CaCO_{3\,(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2\,(aq)} + CO_{2(g)} + H_2O_{(l)}$

(a) Name the limiting reagent.

(b) What mass of $CaCl_2$ will be formed when 250mL of 0.76M HCl reacts with 1000g of $CaCO_3$?

Q13. Give reason for the following :

(i) First ionization enthalpy of boron (Z = 5) is slightly less than that of beryllium (Z = 4)

(ii) Electron gain enthalpy of F is less negative than chlorine.

(iii) The size of an anion is always larger than that of parent atom.

Q14. What transition in the hydrogen atom would have the same wavelength as the Balmer transition n = 4 to n = 2 of the He^+ spectrum?

OR

What is the wavelength of light emitted when the electron in a hydrogen atom undergoes transition from an energy

level with n = 4 to an energy level with n = 2?

(Given $E_n = \frac{-2.18 \times 10^{-18}}{n^2}$ J/atom)

Q15. Define hybridisation. Explain the structure of C_2H_2 with orbital diagram.

Q16. 3.7g of a gas at 25°C occupied the same volume as 0.184g of H_2 gas at 17°C and at the same pressure. What is the molar mass of gas?

Q17. The first (IE_1) and the second (IE_2) ionization enthalpies (KJ mol^{-1}) of three elements X, Y and Z are given below :

Element	IE_1	IE_2
X	2372	5251
Y	520	7300
Z	1680	3380

Which of the above elements is likely to be (i) a reactive metal (ii) a reactive non-metal (iii) a noble gas.

Q18. 3.0g of H_2 react with 29.0g of O_2 to yield H_2O.

(i) Which is the limiting reagent?

(ii) Calculate the maximum amount of H_2O that can be formed.

(iii) Calculate the amount of one of the reactant which remains unreacted.

Q19. Why do gases deviate from ideal behaviour? Write Vander Waal's equation for real gases stating significance of each term involved.

Q20. Calculate the enthalpy change for the reaction :

$$4NH_3\,(g) + 3O_2\,(g) \rightarrow 2N_2\,(g) + 6H_2O\,(l)$$

The enthalpy of formation of NH_3 (g) and H_2O (l) at 298 K are –46.0 and –286.0 KJ mol^{-1} respectively.

Q21. Arrange the following species in order of their increasing stability (on the basis of bond order) and indicate their magnetic behaviour : O_2 , O_2^+ , O_2^-

Q22. (a) Define Dalton's law of partial pressures.

(b) What is critical temperature? What is its importance in liquefaction of gases?

Q23. Reema takes an open pan to cook vegetables and pulses at a hill station while Diya cooks pulses and vegetables in pressure cooker at the same place. The gas cylinder of Reema lasts for only 15 days whereas Diya used one gas cylinder per month.

(i) Who will cook vegetables and pulses faster and why?

(ii) What is the reason for delay in cooking by Reema?

(iii) What values are possessed by Diya?

Q24. (a) The threshold frequency for a metal 'X' is $7.0 \times 10^{14}\ s^{-1}$. Calculate the kinetic energy of an electron emitted when radiation of frequency $1.0 \times 10^{15}\ s^{-1}$ strikes the metal.

(b) Which of the following are isoelectronic species :

Na^+, K^+, Ca^{2+}, Mg^{2+}, S^{2-}, Ar

(c) What are the values of n, l and m_l for 3p-orbitals?

OR

(a) The velocity associated with a proton moving in a potential difference of 1000V is $4.37 \times 10^5\ ms^{-1}$. If the hockey ball of mass 0.1 kg is moving with this velocity, calculate the wavelength associated with this velocity. (Given $h = 6.626 \times 10^{-34}$ Js)

(b) Can we apply Heisenberg's uncertainty principle to a stationary state?

(c) Which of the following orbitals has the lowest energy:

4d, 4f, 5s, 5p

(d) How many electron in an atom may have the following quantum numbers : $n = 4$ $m_s = -\frac{1}{2}$

Q25. (a) At what temperature does the reduction of lead oxide to lead by carbon becomes spontaneous according to the reaction :

$$PbO + C \rightarrow Pb + CO$$

For the reaction ΔH and ΔS at 25°C are 108.4 KJ mol^{-1} and 190 $JK^{-1}\ mol^{-1}$ respectively.

(b) Define the following :

(i) State variables/State functions

(ii) molar heat capacity

(c) For the reaction N_2 (g) + $3H_2$ (g) → $2NH_3$ (g), $\Delta_r H^\circ$ = –92.4 KJ. What is the standard enthalpy of formation of NH_3?

OR

(a) Calculate the internal energy change for a process in which 62 J of work is done on the system and 128 J of heat is transferred to the surroundings.

(b) Define entropy and predict the sign of entropy change for the following cases :

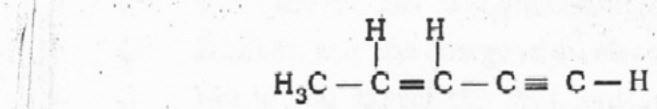
(i) A liquid substance crystallizes into a solid

(ii) $AgNO_3$ (s) → $AgNO_3$ (aq)

(c) What do you mean by an adiabatic process?

Q26. (a) CO_2 is non-polar while H_2O is polar. What conclusion do you draw about their structures from these observations?

(b) What is the total number of sigma and pi-bonds in the following molecule :



(c) Explain the important characteristics of resonance with reference to CO_3^{2-} ion.

OR

(a) Discuss the shapes of the following molecules on the basis of VSEPR theory :

(i) PF_5 (ii) NH_3

(b) Define electronegativity. How does it differ from electron affinity?

(c) Explain, why HF is a liquid and HCl is a gas?