APPENDIX D

TEST BOOKLET USED IN THE INVESTIGATION

(a) INTELLIGENCE TEST

(b) INTEREST TEST

(c) APTITUDE TEST

(d) ACHIEVEMENT TEST IN PHYSICAL SCIENCE
APPENDIX D

(a) Intelligence Test Booklet
Calcutta University
Department of Education

Form for testing intelligence of pupils between ages 12 and 16.

<table>
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<tr>
<th>Nos.</th>
<th>Date</th>
<th>male/female</th>
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</table>

Name
School's name
Class age

General Instruction

1. Don't turn over pages until instructed. When instruction will be given start working after turning over pages.

2. Answer the questions one after another, beginning from the very first question.

3. Do not waste time if you do not know the answer of any question, try the next one.

4. Examples have been given how to answer each question; do accordingly.
Instruction and Example:

(a) On the right you will find three words. Underline the word which is opposite to the word on the left.

Example: Profit, Earning, Expenditure, Loss.

(b) In the example on the left you will find two words, closely related to each other. Underline the word which bears the same relation with the first word in the left from amongst the words on the right.

Example: Read - hair
Finger .............. writing, skin, nail.

(c) Four answers have been given to the question below. Underline the correct one.

Example: Water rolls downwards. Why?
1. Water turns into ice.
2. Water quenches thirst.
3. Water is a liquid substance.
4. Hydrogen and oxygen mix into water.

(d) Fill up the gap in the sentence below with any of the four words that suits most.

Example: A bird always has -
Singing, Nest, egg, wings
(e) Underline the word that suits best to the question choosing it from among the four words given below:
Example: which is the highest mountain in the world?
Andis, Khasia, Alps, Himalayas.

(f) Arrange the words to form a complete sentence and underline 'True' if it is true or 'false' if it is false:
Example: Many rivers can be had in deserts. True, false

(g) A few numbers are arranged below according to some order. One is omitted. Underline the exact number from amongst those given on the right.
Example: 2, 4, 6, 8, -, 12. 10, 13, 14

(h) Underline the word that does not fit in with others:
Example: Bird, Aeroplane, Kite, Picture.

(i) Two proverbs are given below. Underline like if the two are alike in sense, or opposite if the sense is opposite, or separate if the senses differ.
Example: Birds of a feather flock together \ Like,
To carry coals to new castle \ Opposite

(j) Underline the word that suits the gap in the sentence below:
Example: Your uncle is your father's -------
Grandfather, Teacher, brother, enemy.

Do not turn over pages until instructed
Group (A). Underline the opposite word:

1. High ... Sloping, low, equal
2. Rude ... Noble, gentle, educated
3. Humble ... High, obdurate, haughty
4. Union ... Division, connection, nutrition
5. Combustion ... burning, dancing, extinction
6. Gift ...... Handing, acceptance, difference, filling

Group (B). Underline the word that best fills the sentence:

1. As frock is related to a girl, so pantaloons are related to .......... cap, coat, tailor, boy.
2. As mother has relation with father, so aunt has relation with .......... sister, uncle, nephew, grandfather.
3. As food is related to eatables, so water is related to .......... bucket, desire, thurst, drinking.
4. Cannon is related to gun, great is related to ........ arm y, small, bullet, bomb.
5. 23 bears the same relation with 19, as the Bengali alphabet 'ঃ' bears with ....i, j, ৎ, ট, ো
6. Man bears the same relation with city, as tiger with .......... Lion, Den, Hunter, Jungle, Zoo.
1. Why do many people wear spectacles?
   (a) One looks fine
   (b) The price is low
   (c) Eye-sight is defective
   (d) Glasses are fitted in them.

2. What will you do if you injure your leg when getting down from cycle?
   (a) You will cry aloud.
   (b) Call in a van or a rickshaw
   (c) You will throw off dust from your clothes.
   (d) You will request some one to take you to a hospital.

3. Why do we drink milk?
   (a) It quenches thirst.
   (b) It is delicious to drink.
   (c) It is nutritious
   (d) Mother gives it to drink.

4. Why is gold more valuable than copper?
   (a) Because it is bright in colour
   (b) Because it is used for coins
   (c) Because it is rare
   (d) Because it is nice to see.
5. "To count the chickens before they are hatched".
   What do you mean by the proverb?
   (a) It is not proper to do things in haste.
   (b) To be inconsiderate.
   (c) Hoping against hope.
   (d) To depend upon one's fate.

6. What will you do if the drinking water of the town gets polluted?
   (a) You will take to tea.
   (b) You will drink less water.
   (c) You will drink water by boiling.
   (d) You will use more salt.

Group D. Underline the appropriate word.
1. Man always has - clothes, hands, shoes, money.
2. Flower always has - Insects, smell, charm, petals.
3. Book always has - knowledge, picture, themes, rhythm.
4. Anxiety always brings - Tiredness, grief, impatience, sleeplessness.
5. Newspaper always has - stories, poems, news, pictures.
6. Discovery always has -
   Machine, discoverer, newness, skill.

Group E. Underline the correct word.
1. Which is the greatest city in India?
   Delhi, Calcutta, Madras, Bombay.
2. Where is sponge available?
   In mine, on mountain, in forest, in sea.

3. Rugbi is a kind of -
   Food, disease, game, race.

4. Why is wood lighter than iron?
   (a) Because it floats on water.
   (b) Because there are pores in wood.
   (c) Because the specific gravity of wood is less.
   (d) Because fire burns wood.

5. Where is Rome situated?
   In France, England, Italy, Egypt.

6. To which country does Einstein belong?
   England, America, Germany, Belgium.

Group F. Arrange the words into a sentence and then underline.
'True' if it is true or 'False' if it is false.

1. Aunt your is mother's sister: True, False
2. Chandra discovered Jagadish Gramophone. True, False.
3. Very generally are persons weak intelligent. True, false.
5. Natural headache comes fever when is. True, false.
6. Divide Curzon to tried India Lord. True, false.
Group G. Underline the correct number from the right hand side, to fill up the gap in the left.

1. 6, 9, 12, ---, 18, 21
2. 2, 4, 8, 16, ---, 64
3. 27, 27, 23, 23, 19, 19, ---, 19, ---, ---, 7, 7, 10, 10, 15, 15
4. 7, 16, 19, 28, 31, ---, ---, 52
5. 3/16, 3/8, 3/4, 3/2, 3, ---, ---
6. 2, 6, 12, 20, ---, 42

Group H. Underline the word which does not fit in with the others.

1. Chair, Table, bench, pen
2. Steamer, ship, submarine, motor
3. Football, cricket, hockey, tennis
4. Pulbul, Potato, Bringal, Ladies finger
5. Calcutta, Bombay, Chittaganj, Karachi, Delhi

Group I. If the proverbs in pairs, mean the same, underline like, if they are alike; underline opposite, if they are so; underline different if they differ.

1. Might is right  Like, opposite, different
   The rod rules

2. To give every man his due  Like, opposite, different
   To give one's ear to others

3. To kill two birds with one stone  Like, opposite, different
   To serve mammon by one hand & god by the other
4. A burnt child dreads the fire Like, opposite, different
Red rag to a bull

5. To miss the tree in the wood Like, opposite, different
To caste pearls before swine

6. To many cooks spoil the broth Like, opposite, different
Many a little makes a mickle

Group J. Underline the correct word.
1. Who is the daughter of your mother's brother?
   Niece, sister, aunt, grandmother.

2. Which would be the last word of the following words in a Dictionary?
   Ajoy, Ananta, Amal, Aloke.

3. If Ajoy is older than Anil, but younger than Jyotin, Jyotin is-----than Anil.
   Older, younger, equal, unable to say.

4. A thing which lasts for a short time.
   Temporary, brittle, short-lasting, unreasonable.

5. Satis babu is Ram's elder brother and Shyam's uncle.
   Ram is Shyam's brother, uncle, nephew.

6. Underline the correct word to fill the gap.
   The foot-ball ground is one mile to the east of the tank, the school is one mile to the north of the tank, the post office is one mile to the east of the school; the post office is to the------of the foot-ball ground.
   North, south, east, west.
Group K. Underline the correct answer in the figures.

1. How much of 100 is ten plus ten - 1/10, 3/5, 1/5, 6/7.

2. A car requires 10 seconds to cover 400 yds; how long will it take in 7/8 sec.
   30, 15, 10, 20 yds.

3. 1/4 hours is required to cover 49 miles; how much time will be required to cover 14 miles?
   3, 5, 7, 4

4. A person spends 2/5 of his income for food, 1/5 for house rent, 1/5 for other expenditure, and keeps Rs. 40.00 only in his pocket. What is his income?
   Rs. 500, Rs. 200, Rs. 70, Rs. 55

5. How much of 3/5 of 15 should be added to make 15?
   4, 7, 6, 15

6. A person advances 10 steps but retreats 2 steps in one minute, how many steps will he cover in 10 minutes?
   100, 90, 80, 50.
(b) Vocational Interest Test Booklet (Adapted from Strong's vocational Interest test by

Dr. (Mrs) Maya Deb

of

Psychology Department

of

Calcutta University)
Section I. Vocational

Names of several professions are given below. Social prestige, salary or future prospect is not taken into consideration. You will accept the profession or you have educational qualification or physical and mental preparation - these questions are out of consideration. Say only if you like it.

If you like the profession put 0 round 'L'
If you dislike the profession put 0 round 'D'
& If you are indifferent of the profession put 0 round 'I'

1. Astrologer L I D
2. Writer of a book on Science or Industry L I D
3. Auto salesman L I D
4. Aviator L I D
5. Carpenter L I D
6. Consul L I D
7. Draftsman L I D
8. Explorer for discovery L I D
9. Manager of a factory L I D
10. Worker in a factory L I D
11. Inventor L I D
12. Laboratory technician L I D
13. Locomotive Engineer L I D
14. Mechanic L I D
15. Manufacturer  L  I  D
16. Marine Engineer  L  I  D
17. Mechanical Engineer  L  I  D
18. Office Manager  L  I  D
19. Radio Engineer  L  I  D
20. Sports Reporter  L  I  D
21. Research Scholar  L  I  D
22. School Teacher  L  I  D
23. Detective Police  L  I  D
24. Special Salesman  L  I  D
25. Statistician  L  I  D
26. Stock Broker  L  I  D
27. Toolmaker  L  I  D
28. Travelling Salesman  L  I  D
29. Clock maker  L  I  D

Section II. Educational: Like Section I put 0 around L I or D.

1. Algebra  L  I  D
2. Calculus  L  I  D
3. Dynamics  L  I  D
4. Geometry  L  I  D
5. Mathematics  L  I  D
6. Manual training  L  I  D
7. Mechanical drawing  L  I  D
8. Physics  L  I  D
9. Physiology L I D
10. Statistics L I D

Section III. Pastimes: Like Section I, put 0 around L I or D.

1. Driver L I D
2. Golf L I D
3. Mechanical puzzle L I D
4. Radio mechanic L I D

Section IV. Employment: Like Section I, put 0 around L I or D

1. Clock repairer L I D
2. Curburator L I D
3. Facing problem L I D
4. Investigator L I D
5. Electrical mechanic L I D
6. Interviewing client L I D
7. Donor L I D
8. Disguisor L I D
9. Researcher L I D
10. Methodist L I D
11. Entertainer L I D
12. Jocker L I D
13. Introducer L I D

Section V: Individual characteristic: Like Section I
put 0 around L I D.

1. Liberal minded man L I D
2. Chewing gum sucker L I D
3. A sword nosed person L I D
4. An athlete L I D
5. An optimist L I D
6. Independent politician L I D

Section VI: Fascination for works of the same type.

You will find two sets of questions set below. If you like the work on the left hand side put (√) tick mark in the brackets under 1; put (√) tick mark in the brackets under 3 if you like the work on the right hand side; put (√) tick mark in brackets under 2 if you like or dislike works on both sides.

   1  2  3
1. Police ( ) ( ) ( ) Fire brigade workman
2. Chief peon ( ) ( ) ( ) Superintendent of Light House
3. Canvasser ( ) ( ) ( ) Gardening
4. To chalk out plan ( ) ( ) ( ) To execute plan
5. Small pay with bright future prospect in the coming five years ( ) ( ) ( ) Fat salary without any prospect for learning anything in coming five years
6. Physical labourer ( ) ( ) ( ) Mental labourer
7. Listening to tales ( ) ( ) ( ) Story teller
8. Intimate to a few ( ) ( ) ( ) Intimate to many

Section VII: Standard of individual characteristics.

Indicate your characteristic speciality. Read the following particulars. If these tally with your own. Put (√) tick mark in
brackets under 'yes'; if they do not tally, put (✓) tick mark in brackets under 'no'; if you are uncertain about it put (√) tick mark in brackets under '?'.

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>?</th>
<th>No</th>
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<tbody>
<tr>
<td>1. I can endure all criticism about me without being annoyed</td>
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<tr>
<td>2. I can rectify other's faults without offending him</td>
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<td>3. I possess mechanical ingenuity</td>
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<td>4. I can get a subordinate work properly</td>
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Put (✓) tick mark in brackets under 1, 2 or 3 on the right hand side to show which of the particulars (1st, 2nd or 3rd) tallies with your own.

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<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td>5. (1) Very sensitive</td>
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<tr>
<td>(2) Sometimes sensitive</td>
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<td>(3) Not at all sensitive</td>
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<td>6. (1) Other's orders</td>
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<tr>
<td>I carry out if required</td>
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<tr>
<td>(2) Other's orders</td>
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<tr>
<td>I carry out without feeling</td>
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<tr>
<td>(3) Work according to plan</td>
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<tr>
<td>earnestly</td>
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<td>7. (1) I can listen to objections patiently</td>
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<tr>
<td>(2) Sometimes I feel at fault</td>
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<tr>
<td>(3) Sometimes I loose patience</td>
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<td>8. (1) I very often incur loans</td>
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<tr>
<td>(2) I incur loans very rarely</td>
<td></td>
<td></td>
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<tr>
<td>(3) I do never incur loans</td>
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</tbody>
</table>
9. (1) For a mistake I remain often anxious
(2) I remain anxious rarely
(3) I do never feel anxious ( ) ( ) ( ) ( )
APPENDIX D

(C) Scientific Aptitude Test Booklet

General Instructions

(a) Don't write anything on the question paper. Use separate answer scripts supplied by the examiner.

(b) Answers should be given quickly according to the instructions and examples.

(c) Answers should be given groupwise one after another.

(d) Priority should be given to the comparatively easy questions; stiff questions should be answered last.

(e) Try to answer all the questions.

(f) Imaginary answers should be avoided.

(g) No query should be entertained when the test starts.

Division I

Instructions:

Several answers are given to each of the questions set below. Put a (√) mark in the square against the appropriately lettered question of the answer paper.
1. Ram is older than Shyam by five years; Shyam is younger than Hari and Jadu is still younger than Shyam. Which of the four is the oldest?

(a) Shyam, (b) Ram, (c) Hari, (d) Jadu, (e) Cannot be said exactly.

2. Radio is becoming popular so much so that in the coming 100 years it seems that -

(a) Each family will have a Radio set.
(b) A group of five families will have a radio set.
(c) A group of ten families will have a radio set.
(d) A group of 100 people will have a radio set.
(e) Cannot be said exactly.

3. An unknown gentleman who has come to your locality, very often keeps out of home. He may be -

(a) a Railway employee.
(b) a touring salesman
(c) a Detective Policeman
(d) an Aeroplane Pilot
(e) cannot be said correctly.

4. Starting from Burdwan at 6 in the morning and walking 5 miles per hour, when will a person reach Calcutta?

(a) At about 2 P.M.
(b) At about 5 P.M.
(c) At about sun-set
(d) At about 8 P.M.
(e) Cannot be said exactly.

5. A scientist, to ascertain the weight of a chemical substance, weighed it for several times. At each time the following weights were seen on the scale.

(a) 5.18 gms; (b) 5.15 gms; (c) 5.19 gms; (d) 7.15 gms;
(e) 5.17 gms; (f) 6.16 gms.

What would be the exact weight?

(a) 5.15 gms; (b) 5.16 gms; (c) 5.17 gms; (d) 5.18 gms;
(e) cannot be said exactly.

6. Rambabu bought a new car last week. He must have got the money from -

(a) a Lottery; (b) his salary; (c) a loan; (d) a loan on instalment basis; (e) cannot be said exactly.

Division II

Below you will find two groups of questions. In each group, sentences marked a, b, c, d, e are some scientific laws or principles; and sentences marked 1, 2, 3, 4 ...... 9 are occurrences connected with the above principles in some way or other.

Read the principles and occurrences carefully. Put the appropriate letter against the sentences marked 1, 2, 3, 4 .... 9 showing relations.
Principles:

(a) To keep the body sound, various elements in the food should be well-balanced.

(b) Diseases originate because of the different parts of the body not functioning properly.

(c) Physical make up of the different animals are due to different environments.

(d) Diseases are very often caused when germs enter into man's body.

(e) Response to stimulation is the characteristic of a creature.

Occurrences:

1. The roots of water plants are comparatively soft and hollow to facilitate respiration and floating.

2. Symptoms of small pox are manifested on the body after the germs have entered into it.

3. All aquatic animals have gills.

4. Earthworms fly away if light is flashed on body.

5. Sensitive creeper blushes at the touch of hands.

6. Rickets, Beri-beri and eye diseases originate for want of vitamin-B in the food.

7. Obstruction in the flow of blood at heart, cerebrum or blood circulatory artery is called Thrombosis of that part of the body.
8. Carnivorous animals have sharp teeth to cut lump of flesh.

9. Human body moves at the slight touch of electricity.

**Group B**

**Principles:**

(a) Heat generates or loses at every chemical action.

(b) Properties exist in a fixed proportion in compound materials.

(c) It is the characteristic of electricity to heat a metal as it passes through the metal.

(d) A matter changes by the application of heat.

(e) Chemical analysis takes place when electricity passes through a liquid.

**Occurrences:**

1. Corks tight-fitted in a bottle loosen when the bottle is heated.

2. When electricity passes through water mixed with slight acid, there remains hydrogen on one side and oxygen on the other.

3. When lime is mixed with a quantity of water in a test tube, the tube becomes sufficiently hot.

4. It has been proved that three parts of hydrogen and one part of nitrogen form Ammonia in a chemical mixture.

5. When water is analysed two parts of hydrogen and one part of oxygen are found according to quantity.
6. The metal wires of electric stoves become gradually red because of the heat.
7. Methilated spirit evaporates in the air.
8. Amonium chloride cools the water.

Division III

Instructions:

For each question, set below, you will find five pictures marked a, b, c, d and e. Compare them and write 1, 2, 3, 4 or 5 in the squares against the pictures according to their size. If any two pictures seem equal in size put the same number in two squares.

1. Compare the five pictures of arcs marked a, b, c, d and e. Put appropriate number in the squares against each, according to their size.

2. Compare the heights of five straight lines a, b, c, d and e according to their length.

3. Among five straight lines a, b, c, d, e of which 'f' is the extended part?

4. Among the five arrows a, b, c, d, e. Put 1, 2, 3, 4, 5 according to their length.

5. Among the five dotted lines a, b, c, d, e. Put 1, 2, 3, 4, 5, marks according to their length.

6. There are five diagonals a, b, c, d, e mark 1, 2, 3, 4, 5 according to the size of their length.
7. A, B, C, D, E, are five rectangles. Mark them 1, 2, 3, 4, 5 in order to their size.

Division IV (A)

Instructions:

On the left you will find numbers arranged on some principles and at the end there is a number omitted. You are to fill up the empty place with a number taken from the numbers on the right. You are to put a (√) tick mark on the appropriate number on the right.

Example: 32, 16, 8, 4, 2, 1, 2, 3, 4, 6

Thus there are eight lines of numbers.

Division IV (B)

Instructions:

Five numbers marked a, b, c, d, and e, are arranged according to some principle; but there is, in each row a number which does not fit in with that principle. Find out that number and put a (√) tick mark on the a, b, c, d, or e mark on the answer script.

Example: (a) 4; (b) 8; (c) 10; (d) 17; (e) 20.

Here a, b, c, & e, are even numbers but only 17 is odd which is marked (d). Thus there are eight lines of numbers.
Division IV (C)

Instructions:

There is a relation between the upper and the lower numbers inside the small squares of the set below. On the right hand side there are five equations, marked a, b, c, d and e. Put a (√) tick mark inside the square of the answer script against the correct letter.

Example:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>5</th>
<th>13</th>
<th>45</th>
<th>91</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>3</td>
<td>7</td>
<td>15</td>
<td>47</td>
<td>93</td>
</tr>
</tbody>
</table>

(a) $x - y = 2$;  (b) $x = y - 2$;  (c) $x^2 = y - 1$;  (d) $x^2 = y - 1$;  (e) $y^2 - 2x = 1$

Thus there are eight questions.

Division IV (D)

Instructions:

Five answers have been given to each of the questions set below. Read the questions carefully. Put a (√) tick mark inside the square against the correct answer marked with appropriate letter.

Example: What is the perimeter of an equilateral triangle of which one side is $x$ inches?

Answers: (a) $3x$; (b) $3x^2$; (c) $5x$; (d) $2x^2$; (e) $x^3$

Here (√) mark should be put inside the square marked against (a).

1. If one of the angles of an equilateral triangle is $x^o$, then what would be sum of the three angles?
(a) $3x = 180^\circ$; (b) $3x^2 = 180^\circ$; (c) $x = 60^\circ$; (d) $x = 180^\circ$; (e) $3x^2 - 180^\circ = 0$.

2. The sum of the ages of a father and his son is 60 years. Twice the age of the father is 12 years more than four times that of the son. If the age of the father is $x$ years, then what would be the equation to represent the relation between the father and the son?

(a) $2x = (60-x) + 12$; (b) $(60-x)-12=2x$; (c) $2x = \frac{1}{4}(60-x) + 12$; (d) $x = \frac{4}{60-x}$; (e) $60 = \frac{1}{60-x}$

3. If the unequal side of an isosceles triangle is half of each of the equal sides and is $x''$ inches in length, then what would be measurement of the equal sides?

(a) $3x''$; (b) $5x''$; (c) $2x''$; (d) $2x^2$; (e) $\frac{3x''}{2}$

4. The length of the base of a triangle is double its altitude. If the altitude is $x''$ inches, what would be area of the triangle?

(a) $2x$; (b) $x^2$; (c) $2x^2$; (d) $2x$; (e) $2x$.

5. The angles at the base of an isosceles triangle measure $x^\circ$ each, what would be measurement of the vertical angle?

(a) $(180-2x)^\circ$; (b) $3x = 180^\circ$; (c) $x = 80^\circ$; (d) $(18-5x)^\circ$; (e) $(180-3x)^\circ$

6. A piece of cloth measuring $x$ yards shrinks down to $y$ yds, after washing, what would be the length of another piece of cloth of the same quality measuring 30 yds?

(a) $\frac{30x}{x-y}$; (b) $\frac{x}{30(x-y)}$; (c) $\frac{x}{30(y-x)}$; (d) $\frac{(y-x)30}{x}$; (e) $\frac{30(x-y)}{x}$. 

- 180 -
7. The temperature of a brass-rod x" inch long is 30°C under normal condition. When heated it increased to y" inch, in length under 70°C. How much has the rod increased under each centri-grade of heat?

(a) \frac{h_0 y}{x}; (b) \frac{h_0 x}{y}; (c) \frac{x-y}{y_0}; (d) \frac{y-x}{y_0}; (e) \frac{x+y}{y_0}

8. The length and the breadth of a rectilineal figure is respectively 3 yds and 2 yds shorter than each side of a square, equal in area to the rectilineal figure. Each side of the square measures 'x' yds. What will be the relation between the areas of the square and the rectangular?

(a) (x+2) (x-3) = x^2; (b) (x+3) (x-2) = 2x;
(c) (x+3) (x-2) = x^2; (d) x^2 = 6x^3; (e) x^2 - 6 = 4x^4

Division IV (E)

Instruction

Each figure, below, is made of blocks equal in area. How many blocks are there in each figure?

Write down the answers in appropriate places of the answer-script.

Example: Correct answers of figures A and B are given in the answer paper. Follow them and try to answer other eight figures.
Instruction:

Four sentences below have been analysed into shorter sentences keeping the sense intact. You are to consider whether the sense of the original sentence has been kept up in the analysed shorter sentences.

Read each sentence carefully. In the answer script three small squares have been given against each analysed shorter sentences marked a, b and c.

Put (✓) tick mark, in the square if the sense of the shorter sentences tally with that of the original, in square marked 'a'; if the senses differ then in square marked 'b'; if there be no relation between them, then in square marked 'c'.

Example:

Original - Though sand and salt form a general mixture, their divisibility is not hard.

Analysis:
(a) Sand and salt form a compound mixture
(b) The congruents of a general mixture are divisible.
(c) Salt is dissolved in water, but sand is not so.

Mark how the original sentence has been analysed into three shorter sentences and how the answers have been given in the answer script. Try to answer in the same way the shorter analysed sentences in relation with the original.
1. Sound-wave reflects from the bodies of the audience in a lecture-hall.
(a) Sound-wave has the characteristic of reflection.
(b) Reflection is impossible if there be no audience in the hall.

2. The water of the wet clothes draws for evaporation the latent heat of the body, they wrap.
(a) Heat is necessary for evaporation.
(b) Illness is possible because the heat of the body is absorbed by the wet clothes on the body.

3. In some fountains sulphuric salt-exists. So the water becomes undrinkable but it is fit for bathing for persons with skin disease.
(a) The water which is mixed with sulphur is hard.
(b) By drinking sulphuric water, skin-disease is cured.

4. Stimulated with electric spark, hydrogen and oxygen mix together to form water-vapour.
(a) Electric spark may cause chemical mixture.
(b) Water-vapour intensify into showers.

Division VI

Instruction:
With each paragraph below, four short sentences are given. You are to consider, if those short sentences can be obtained from the paragraph on analysis.

Three kinds of square are given against each sentence in the answer-script. Put (√) tick mark in the square against the
sentence marked 'a' if the sense tallies with that of the paragraph. Put (√) tick mark in the square against the sentence marked 'b' if the sense differ. Put (√) tick mark in the square against the sentence marked 'c' if the sense has no relation.

Example: In Protoplasm, there are small molecules besides nucleus. Coming in touch with sun light, they form green colour. Because of these molecules, leaves of trees look green. The molecules of the petals of a flower assume various colour. In the cells of animals, there is no such molecule or cell-wall.

(a) Molecules & cell-walls exist in plants only.
(b) In the protoplasm of plant-cells nucleus only exists.
(c) Insects and worms are attracted by the colour and smell of the flower.

Mark how the answers of the three sentences have been given in the answer script. Answer, likewise, the questions of the four sentences of every paragraph below:

1. Red rust clusters around iron articles exposed to air and water. Red iron-oxide is formed slowly as a result of chemical combustion of oxygen in the air with iron. This is rust on iron. Rust clings to the iron, and so the glow of iron goes away. Iron-oxide is a compound substance. Its characteristic is quite different from that of iron; because magnet can attract iron but not the rust. The formation of rust as a result of chemical combustion of iron with oxygen of air may be well compared to the combustion and breathing processes. Like combustion, light or
heat does not come out all at once. So it is called slow burning like breathing.

(a) The process of resting cannot be rightly called a chemical process.
(b) Oxide of iron cannot attract magnet.
(c) Though light and heat come out of electricity still it cannot be called a chemical action.
(d) Electricity passed through iron magnetize it.

2. All matters are made of innumerable atoms. These atoms always vibrate. In hard matters attraction works greatly among the atoms. In liquids attraction and repulsion works are equal while in airy things repulsion predominates. Hence, it is that the shape or size of hard things cannot be easily changed - The atoms attract one another fast, but in liquids they slide one upon another easily. So the shape of the liquids can be easily changed. They take the shape of the vessels, they are put in; as for example, when these are put into glass or any pot, they take the shape of the glass or the pot, but their volume are not changed. In aerial substances repulsion among the atoms is so great that they shape or the size of these can be easily changed. Any gaseous substance, be it put in an iron tube or in a big room, it will take the shape or the volume of the same tube or room.

(a) In hard matters atoms attract one another.
(b) Under heat, a liquid gets hot first in the lower part and then in the upper.
(c) Aerial substances have weight.
(d) Various kinds of things have various shapes.

3. A hot substance lying at a distance, warms a cool body its heat. The reason is that a hot body radiates heat. Rays of heat radiate from a hot body in all directions in a straight line. They do not warm the medium through which they pass, they warm the body that obstruct them. The sun lies at a distance of ten millions of miles from the earth, still the earth warms up by the heat of the sun. Only a part of the sun's rays falls upon the earth. These rays are to some extent obstructed by the air and as such the air also gets a little heated. The air in the upper level obstructs the sun less than the air in the lower level, hence the air in the upper level is cooler than the air of the lower level. The rays get great obstruction by the earth and hence the earth becomes hot.

(a) Heat moves in a straight line
(b) Dense air becomes more heated.
(c) Wet air becomes very little hot by the heat
(d) Rays of heat flow to all directions with equal speed.

Division VII

Instruction:

Several questions along with three answers to each of them are given below. Read the questions and the answers carefully. Put a (√) tick mark in the square against the correct answer, that bears the same lettered number in the answer-script.
Example: 1. Why does the star twinkle in the sky?
   
   (a) A star has no light of its own. It gets light from the sun, and glitters because it is at a great distance from the earth.
   
   (b) A star is like a ball of fire; remains at a very long distance and so it seems to glitter when looked at from a distance.
   
   (c) The light of the star, in coming down to earth, has to pass through various layers of its own and of the earth's air, so the current of light gets obstructed, and as a result it looks twinkling sometimes with great glow and sometimes with less.

   The correct answer is the answer marked 'c' so (√) tick mark has been put inside the square against the letter 'c' of the Answer Script.

   Answer the following questions according to example:

   1. Why does a thing shine when polished?
      
      (a) A thing shines because the dirt over it goes off when polished.
      
      (b) A thing shines because its roughness over it goes off and the sun's rays fall upon it more than before.
      
      (c) A thing shines because of the friction with another thing.

   2. On hot days why does a body cool down when fanned?
      
      (a) There is water vapour in the wind. So body cools down.
      
      (b) Sweat on the body evaporates under warm air.
As a result of evaporation some part of the heat of the body goes off. As soon as the heat of the body goes off, cool air around occupies the place. Consequently the body feels cool.

(c) When fanned, the air enters into the body through the pores of hair on the body. It cools the heat inside the body. So we feel cool.

3. Why does methylated spirit evaporate?
(a) Methylated spirit is very light.
(b) There is alcohol, a chemical substance in it.
(c) The boiling point of methyl alcohol, a chemical substance, is very little in methylated spirit; the methyl alcohol evaporates under normal temperature.

4. Milk is spoilt of not warmed, why?
(a) If not warmed, the germs in milk get destroyed slowly.
(b) Carbon keeps milk in good condition, oxygen destroys it; oxygen works under coolness but carbon works in warmth.
(c) In warm countries, a kind of germs, floats in air; those germs enter into milk and transform the sugar in milk into acid, consequently milk is spoilt.

5. Why does blotting paper soak ink?
(a) Blotting paper is soft and vapourless, there is no water and hence draws off water in ink.
(b) The particles in blotting paper are very loose and dry, hence blotting paper sucks ink.
(c) Blotting paper is porous; ink enters into those pores.
6. Man stumbles when he gets down a tram or bus directly. Why?
   (a) The motion of tram or bus is towards the front, and there is very little attraction backwards. So a man stumbles when gets down directly.
   (b) When a tram or a bus moves, it pierces through the air in the front and wind blows against it. When a man gets down directly, the opposite air thrusts him backwards. So he stumbles.
   (c) When a man gets down from a running tram or bus, the motion of his body remains in tact; so when he lands, the movement of his lower part is arrested, but the upper part remains in motion, so he suffers from physical unbalance and stumbles.

7. A glass pot breaks when heated suddenly, why?
   (a) Heat expands that part of the glass that it touches; glass is non-conductor; so other parts of the glass do not expand; hence, there occurs an unbalance of the whole glass-pot. So it breaks.
   (b) A glass-pot extends in volume when heated; but by the touch of the cool air outside, it shrinks, and because of this extension and shrinkage at the sametime, the glass-pot breaks.
   (c) Characteristically to all substances, the volume of glass-pot increases under heat. Under excessive heat it wants to increase rapidly. Hence it breaks.

8. A sound is caused when water is poured out of a bottle full of water. Why?
(a) Sound is caused because of the clash between the upper and the lower pressures.

(b) The neck of the bottle is narrow and the water of the bottle want to come out all at once. Under pressure from above all the water cannot come out all at once through the narrow neck. So sound is caused.

(c) When a part of the water in the bottle is out, the pressure inside the bottle is lower than that outside. Then the air outside finds way to get in and the flow to get out becomes less. When the two kinds of pressure equalise, water falls. Thus intermittent water fall causes sound.

9. How does the pencil write?
(a) There is a kind of substance called 'lead' on the pencil that makes mark on the paper and writing is done.
(b) A kind of carbon called graphite is mixed with clay. It is the carbon that writes on the paper.
(c) Pencil writes with the lead.

10. The sun looks red at sun-set.
(a) At sun-set the other six colours of the rays cannot be seen because of long distance; the wavelength of the red light is the longest; so we see the red light only and hence sun looks red at sun-set.
(b) At sun-set the rays of the sun fall on the earth slanting; so its radiance is not so forceful and because the sun is a burning ball of fire the red-colour predominates.
(c) The rays of the sun pierce through various layers; the dust, the smoke etc that float in those layers, suck other colours but reject only the red. So the sun looks red at sunset.

Division VIII
Instruction: (A)
A few scientists have been named below; each of them is connected with some scientific invention. Read the names carefully and put their famous inventions inside the squares against respective letter marks of the answer-script.
(a) Watt; (b) Torricelli; (c) Bayard; (d) Einstein;
(e) Bell; (f) Thomson.

(B) Instructions:
A few inventions have been given below. Put the names of their inventors inside the squares against respective letter marks of the answer-script.
(a) Radium; (b) Railway; (c) Electric-lamp; (d) Revolver;
(e) Tram; (f) Thermometre.

Division IX
Three answers have been given to each of the questions set below. Read the answers carefully and put a (√) tick mark in the square against respective letter marks of the answer script.
In the answers there is no attempt to test your intelligence. So put the (√) tick mark against the answer that you like.
1. Suppose you are told that iron floats on water mixed with oil; to know it for certain what would you do?
   (a) You will ask the teacher of science of your school.
   (b) You will laugh it away as incredible.
   (c) You will verify it by casting a piece of iron in the water mixed with oil.

2. You want to know which of 'iron' and 'lead' is comparatively heavy, what would you do to know the truth?
   (a) You will consult a good book of chemistry.
   (b) You will ask the teacher of science of your school.
   (c) You will weigh on scale 'iron' and 'lead' pieces of the same volume.

3. Suppose, you want to know what happens if you put a piece of iron in acid. What will you do?
   (a) You will get some acid and caste a piece of iron in it and watch what happens.
   (b) You will ask the teacher of science of your school.
   (c) You will consult a good book of chemistry.

4. You like very much to listen to Radio and want to have a Radio-set in your house, what will you do?
   (a) You will collect pictures of the different parts and other tit-bits of radio and instal a mini radio set yourself at home.
   (b) Without wasting time or useful articles, you will call for an expert on radio.
   (c) You will purchase a ready-made radio-set at once.
5. Suppose you know that soap is made of coconut oil mixed with costic soda but you do not know the exact proportion of each and different books give you different proportions. What will you do in the case?

(a) You will take the average of different proportions supplied by different books.

(b) You will yourself examine the different proportions as mentioned in different books and prepare soap accordingly.

(c) You will ask the help of a soap-factory and know the process.

6. Suppose, the clock at your house, has suddenly stopped owing to some mechanical disorder. In that case, what will you do?

(a) You will first consider the gravity of the disorder and then take it to some clock-repairer's shop.

(b) You will not unnecessarily handle the parts and worsen the disorder but take it first to the clock maker's shop.

(c) You will first know the exact cause of disorder and try to repair it yourself.

Division X

Instruction:

A few paragraphs are given below. Read the paragraphs carefully. There are bad reasonings or incongruities in some places of some paragraphs. Put (x) cross mark in the square against the paragraph in which you find bad reasonings or incongruities.
in the sentences or parts of sentences of the paragraph.

If the whole of the paragraph be of sound reasoning or correct, put a (✓) tick mark inside the square against the paragraph.

Example:

The constituents of a compound substance lose their own characteristics and form a new substance with completely new characteristics. The characteristic of water composed of hydrogen and oxygen is completely different from those of its constituents. So water may be called a common mixture of Hydrogen and Oxygen.

In the above example the last sentence is wholly incongruent and so a (x) cross mark has been put inside the square and the sentence has been cited.

Observe, how the question has been answered and answer the following accordingly:

1. Glass is a transparent substance. Red glass separating all other colours of white colour sucks off all others excepting the red waves, which catch our sight while flowing through it. So glass looks red. If glass had no power to such off these colours then red glass also would have looked white.

2. A fall of pressure in the Barometer indicates storm and heavy shower. The far you go off the sea-coast the pressure of air decreases. So places which are far off the sea-coast, have less possibility of storm and rain.
3. On the way of the rays of light, if any nontransparent body appear, light cannot be cast behind the body; shadow falls. The moon and the earth are nontransparent bodies. The earth, in the course of revolving comes between the sun and the moon, so the light of the sun does not fall on the moon, only the shadow of the earth falls on the moon. It is called the lunar eclipse. On every full-moon occasion, the earth appears between the sun and the moon but on all such occasions, the lunar eclipse does not take place. If the moon and the earth were not nontransparent bodies, then on every such full moon occasion, lunar eclipse would have taken place.

4. Oxygen helps combustion; as there is oxygen in the atmosphere, air also helps combustion; but the air that is in the storm contains fire-extinguisher carbon dioxide to a great measure. So strong wind puts out the candle or the lamp or the lantern.

5. No being could have lived on earth, without adapting itself to the environment. One of the chief characteristics of a living being is to change its body or nature according to climate, diet, selfdefence and other environmental conditions. This ability for adaptation disappears when a living being falls sick of disease. By using medicines physicians bring back this ability for adaptation.

6. Floating on water or going down under depends upon the buoyance of water. The strength of this buoyancy of water is equal to the weight of water removed by anything. So the more
a thing has the capacity to remove water, the more it will have possibility to keep floating.

A dead body floats on water whereas a man who does not know how to swim sinks, because a dead body removes more water than a living man.

Division XI

Instruction:

A few paragraphs are given below. Read the paragraphs carefully. Inferences that can be drawn from those paragraphs are given in sentences below. Put a (√) tick mark inside the square (from 'a' to 'e') in the answer script against the same letter of the answer that you deem fittest.

Example:

Hydrogen and oxygen mixed and form water; but the characteristics of water are quite different from theirs. The iron-sulphide, a compound substance that can be had from the chemical mixture of iron and sulphur, is not attracted by magnet.

Oxygen is an instigator for combustion, but carbon-dioxide that is formed by its chemical mixture with carbon, is a fire-extinguisher.

Nitrogen and hydrogen both are odourless; the compound mixture, named amonia, that is formed by their chemical mixture, has acute smell.

(a) The characteristics of substance are changed in a mixture with other substances.
(b) One substance is easily mixed with another.
(c) The quality and the characteristics of a compound are different from those of its constituents.
(d) It is not possible to say what elements a compound is composed of.
(e) A compound may be of either solid, liquid or gaseous state.

Now, observe the answer-script how the answer has been given; here the inference marked 'c' is correct, hence (√) tick mark has been put in the square against 'c'.

Answer exactly in the same manner.

1. A brick is put upon green grass; after three or four days, it will be seen that grass has turned white and dormant; if the brick is taken off, it will be seen that grass is gradually gaining colour and full life.

   (a) The light and heat of the sun help to maintain the vivacity and green colour of plants.
   (b) The sun's light is necessary for saving the life of all things.
   (c) Plants cannot live without carbon dioxide.
   (d) All things lose vigour without the sun's light.
   (e) Plants take food from the light of the sun.

2. Ram said "last night I had heard the clicks of clock ten minutes before I heard the firing from the gun. I did not count how many strokes the clock clicked, but I am sure that these
were more than one and it seems the strokes were odd in number".

Ram had been out of home for the whole morning since day break and Ram's clock had stopped five minutes before it was five in the afternoon.

When was the sound of the gun's firing first heard?
(a) Ten minutes before 3 P.M.?
(b) At 3 P.M.
(c) Ten minutes after 3 P.M.
(d) Forty-five minutes after 4 P.M.
(e) Ten minutes before 5 P.M.

3. A piece of copper sulphate when is thrown into water it mixes with water after sometime; then the water turns blue.

We prepare syrup mixing sugar with water. Carbon-dioxide lies saturated in soda water; but sand lying in water gather at the bottom.

(a) Water can saturate most of the substances.
(b) All things are not soluble in water.
(c) Water has power to dissolve.
(d) Sand is not soluble in water so gathers at bottom.
(e) All compound substances mix with water but elemental things do not.

4. Hydrochloric acid is formed by a chemical mixture of hydrogen and chlorine.

Sulphuric acid is the compound mixture of the three elements—sulphur, oxygen and hydrogen.
Nitric acid is the compound of three elements - nitrogen, hydrogen and oxygen.

Carbonic acid contains carbon, oxygen and hydrogen.

(a) In any compound mixture, hydrogen must remain.
(b) Acid is formed by a mixture of two or three aerial substance.
(c) In any acid, hydrogen and oxygen remain in a great measure.
(d) In all kinds of chemical mixture, hydrogen exists.
(e) Hydrogen is always present in all acids.

5. One seer of water takes half an hour time to evaporate;
Two seers of water take forty-five minutes;
Three seers of water take one hour;
Eight seers of water take two hours and fifteen minutes.
Nine seers of water take two hours and a half.

From the above examples can you find out a law, by which, the weight of water being known, we can say how much time will be required for the water to evaporate?

(a) One seer of water will take as much time, as twice the quantity will require twice the time plus a half.
(b) Fifteen minutes upto three seers and then one four for each five seers, and for each seer half an hour.
(c) Fifteen minutes will be required for each seer of water to evaporate.
(d) More time will be required for more water.
(e) First seer of water requires half an hour and the next each seer, fifteen minutes.

6. An iron peg does not float on water.

A lump of pure gold weighs ten times the weight of water of the same volume. A silver coin and copper piece go down to the bottom of water.

The weight of one cubic inch water is less than half an ounce but that of one cubic inch of brass is more than two ounces.

(a) All things do not float on water.
(b) All things do not weigh the same.
(c) Heavy things go down under water generally.
(d) Most metals are heavier than water.
(e) If the weight of a hard substance be heavier than that of water of equal volume, then it will sink into water.
APPENDIX D

(d) ACHIEVEMENT TEST IN PHYSICAL SCIENCE

ACHIEVEMENT TEST IN PHYSICS (PAPER I & II)

TAKEN FROM HIGHER SECONDARY EXAMINATION, 1975
1. Explain fully how you would determine the melting point of a solid substance from the time-temperature graphs of heating and cooling.

2. What is Torricelli's vacuum? Is it, strictly speaking a perfect vacuum?

   A glass tube 50 inches long, closed at one end, is completely filled with mercury and is then interled vertically over a trough of mercury. The tube is then slowly inclined to the vertical until the height of the top of the tube over the mercury trough is less than 30 inches. Explain with reasons what you will observe with regard to the mercury in the tube. Barometric height is 30 inches of mercury.

   A glass tube 50 inches long, closed at one end, is half filled with mercury and is then inverted vertically with its open end just dipping into a mercury trough. If the barometer stands at 30 inches of Hg, what will be the height of mercury in the tube?

   If the barometric height be 76 cm of Hg find the atmospheric pressure in absolute unit (density of mercury = 13.6 gms/c.c.; acceleration due to gravity = 980 cms/sec²).

3.(a) Explain the difference between 'thrust' and 'pressure' inside a liquid. What is the pressure at a point inside a liquid?
In a U-tube there is some mercury at the bottom. Kerosene oil and glycerine are respectively poured into the two limbs of the tube. When the heights of kerosene oil and glycerine are respectively equal to 20 cm and 12.7 cm the level of mercury is the same in the two limbs. If the density of kerosene oil be 0.8 gm/c.c. find the density of glycerine.

(b) Distinguish between sp. gr. and density of a substance. How would you determine the sp. gr. of a liquid by Hare's apparatus?

4. Define mechanical equivalent of heat, potential energy and kinetic energy. Show that in the case of a body falling freely under gravity the sum of potential energy and kinetic energy is the same at every point of the path. What happens to this energy when the body reaches the ground?

A piece of lead falls freely through 200 metres and strikes the ground. If all the energy is converted into heat and if all the heat remains within the lead piece find the rise of its temperature (sp. heat of lead 0.03; \( J = 4.2 \times 10^7 \text{ ergs/cal} \); \( g = 980 \text{ cms/sec}^2 \)).

5. Describe with a neat diagram a six's maximum and minimum thermometer and explain its action. What are the advantages of using mercury in a thermometer? What is the temperature at which the reading of the fahrenheit scale will be five times that of the centigrade scale?
6. Define coefficient of linear expansion of a solid. Explain with reasons whether this coefficient depends on the unit of temperature and on the unit of length. Prove that the coefficient of superficial expansion of a solid is approximately twice its coefficient of linear expansion.

Two long thin plane sheets of different metals but of the same size, are rivetted together and heated. Explain with reason what will happen.

A clock with a seconds pendulum keeps correct time at 0°C. When the temperature is increased to 30°C the clock loses 20 sec a day. What is the coefficient of linear expansion of the material of the pendulum?

7. (a) Distinguish between saturated and unsaturated vapour. A glass vessel is just saturated with water vapour. Describe and explain what will happen when (i) the temperature is increased, (ii) the temperature is decreased.

(b) Describe a suitable experiment to show that a liquid can be made to boil at a temperature below its normal boiling point.

(c) Why does a person catch cold while standing in the open on a windy day with wet clothes on him?

8. Describe a thermoflask and explain fully how exchange of heat between outside and inside is prevented. Describe an
experiment to demonstrate convection current. Describe an experiment to demonstrate that water is a bad conductor of heat.

9. (a) The sound of thunder is heard 5 sec after the flash is seen; find the distance of the cloud (velocity of sound is 1120 ft/sec).

(b) Describe an experiment to demonstrate that sound requires a medium for propagation.

(c) Explain the different characteristics of a musical sound. On what factors do they depend?

10. What are the laws of transverse vibration of a string? How would you experimentally verify the law of length? The frequency of transverse vibration of string 20 cm. long is 256. What would be the frequency if the length be increased to 25 cm?

What is the function of the hollow wooden body of a violin?
1. (a) Explain, with the help of a diagram, the occurrence of the annual eclipse of the sun.

(b) Explain the formation of elliptical patches of light on ground due to sunlight passing through the interspaces of the leaves of a tree.

(c) A luminous globe 50 cm in diameter is placed at a distance of 80 cm from a stone sphere 10 cm in diameter. Calculate the cross-sectional area of the umbral cone cast on a screen placed at right angles to the line joining the centres of the globe and the sphere, the distance of the screen from the centre of the stone sphere being 15 cm (given \( \pi = 3.14 \)).

2. (a) Give the description of a Hartle\' optical disc and explain how the laws of reflection can be verified with its help.

(b) Arrange two mirrors in such a way that whatever may be the angle of incidence, a ray of light after suffering a single reflection from both the mirrors will return in a direction parallel to that of incidence.

(c) Find out the deviation suffered by a ray due to reflection at a plane mirror.

What will be the deviation suffered by a ray due to reflection when it is incident on a plane mirror at an angle of 60°?

3. (a) State the laws of refraction of light. What is meant by the refraction index of a material?
(b) Show that when a ray of light is incident on one of the faces of a parallel-faced glass block, it emerges out from the other face in a direction parallel to the direction of incidence.

(c) A glass tube of 15 cm side contains a small air bubble. When viewed normally through one of the faces of the cube its apparent depth is 6 cm and when viewed through the opposite face it is only 4 cm. Calculate the actual distance of the bubble from the first face and also the refractive index of glass forming the cube.

4. (a) What do you mean by a real image and a virtual image?
(b) Show, with the help of suitable diagrams, how the size and the nature of images change as an object approaches a convex lens from an infinite distance.
(c) Where must an object be placed in front of a convex lens of 1 ft. focal length such that - (i) a real image of the same size as the object is formed; (ii) a virtual image is formed 2 ft infront of the lens?

5. (a) Explain why magnetism is considered to be of molecular origin.
(b) 'When the N-Pole of a strong bar magnet is suddenly brought very near the N-pole of a magnetic needle, the two N-poles are found to be attracted'. Explain why it is so.
(c) Define a line of force in a magnetic field and state any four properties of a magnetic line of force.
6. (a) Describe an experiment to show that equal and opposite kinds of charges are developed in electrostatic induction.

(b) Give an explanation of the generation of frictional electricity from the sound-point of electron theory.

(c) Define electrostatic unit of charge. Write down the charge on an electron in that unit.

7. (a) Give the construction of a dry cell and explain its action.

(b) Describe an experiment to demonstrate the action of a magnet on an electric current.

(c) Calculate the length of a wire of diameter 0.8 mm and of resistivity $110 \times 10^{-6}$ ohm cm. So that its resistance becomes 100 ohms.

8. (a) Enunciate ohm's law and describe an experiment to verify the law.

(b) Explain, with the help of a diagram, the action of a shunt.

(c) Determine the resistance of a shunt which, when joined to an electrical instrument of resistance 3663 ohms, will allow only $1/34$ of the total current in the circuit to pass through the instrument.

9. (a) State Faradays's laws of electrolysis. Define chemical equivalent and electron-chemical equivalent.
(b) Define watt and B.O.T. unit. Calculate the number of Joules in 1 B.O.T. unit.

(c) An electric kettle weighs 1000 gm and contains 1800 gm of water. The temperature of water is 20°C. When a current of 5 amp. is passed through the heating coil of the kettle at 220 volts, what will be the time required for the water to reach its normal boiling point (sp. heat of the kettle material is 0.1).

10. Describe in details how in the laboratory you may prove that, in the case of an image formed by a plane mirror, the distance of the image and that of the object from the surface of the mirror are equal.

11. You have mapped the lines of force on one side of a bar magnet, N-pole pointing north, and determined its neutral point. Give an account of your work.
ACHIEVEMENT TEST IN CHEMISTRY (PAPER I & II)

TAKEN FROM HIGHER SECONDARY EXAMINATION, 1975.
1. Define and describe the following processes:
   (a) Sublimation; (b) Fractional crystallisation;
   (c) Destruction distillation. Mention one application of each of them with a suitable example.

2.(a) Explain, with suitable examples, the differences between physical and chemical changes.
   (b) Explain what kind of change takes place when
   (i) a piece of copper is dissolved in nitric acid, (ii) a piece of lime is mixed with water, (iii) a platinum wire is heated in a Bunsen flame, (iv) white phosphorus is dissolved in carbon-disulphide, (v) kerosene oil is burnt.

3.(a) What is water of crystallisation? How would you determine the percentage of water of crystallisation of a hydrate?
   (b) A hydrate on being rendered anhydrous loses 45.6% of its weight. The anhydrous substance on analysis shows the following percentage composition: Al = 10.5%, K = 15.1%, S = 24.8% and O = 49.6%. What will be the empirical formula of the hydrate and the anhydrous substance? (Al = 27, K = 39, S = 32).

4.(a) Establish a relationship between the temperature, pressure and volume of a given mass of gas.
   (b) A dilute solution of sulphuric acid contains 65% of the acid by weight and its density is 1.55. Calculate the volume of hydrogen liberated at 27°C and 750 mm pressure when 750 gm of zinc is mixed with one litre of this solution (Zn = 65).
5. (a) State and illustrate Gay-Lussac's Law of gaseous volume. Show how the Gay-Lussac's Law of gaseous volume can be explained by Avogadro Hypothesis.

(b) Describe an experiment to prove that air contains roughly four parts by volume of nitrogen and one part by volume of oxygen.

(c) How would you prove that a colourless liquid is water or not?

6. Describe how dry ammonia is prepared in the laboratory? Draw a neat sketch of the apparatus used. Describe one experiment to demonstrate its high solubility in water and basic character.

How does it react with chlorine and oxygen.

7. Describe with equations what happens when:

(a) Hydrogen sulphide gas is led into acidified ferric chloride solution.

(b) Powdered manganese dioxide is added to a solution of hydrogen peroxide.

(c) Sodium nitrate is strongly heated.

(d) A mixture of manganese dioxide, sodium chloride and conc. sulphuric acid is heated.

(e) Sulphur dioxide gas is led into a solution of iodine.

8. Write short notes on: (a) Softening of hard water, (b) Nitrogen-cycle, (c) Allotropy of carbon.
9. (a) Describe the preparation of carbon monoxide in the laboratory.

(b) Explain with equations how it reacts with the following:
   (i) chlorine, (ii) copper oxide, (iii) steam.

(c) Why is it dangerous to burn coal in insufficient air?

10. (a) State with equation the gas evolved when sodium nitrate, conc. sulphuric acid and a little copper turnings are heated together.

(b) An aqueous solution of a salt may contain carbonate or chloride as acid radical. How would you identify the acid radical of the salt by suitable dry and wet tests?
1. (a) What is Avogadro Hypothesis? State giving example how the atomic weight of an element can be determined with its help by the Cannizzaro method.

    (b) The oxide of an element contains 53% of the element. The vapour density of its chloride is 66. Determine the atomic weight of the element.

2. Write short notes on the following:

    (a) Atomic number and Avogadro number.

    (b) Chemical equivalent and electrochemical equivalent.

    (c) Acid salt and basic salt.

3. (a) 10 cc of conc. sulphuric acid (d = 1.83) is diluted with water to form one litre of the solution. 10 cc of this solution requires 17.5 cc of 0.2 N caustic soda solution for neutralisation. What was the percentage of sulphuric acid in the acid?

    (b) A current of 1.5 ampere when passed for 30 minutes through the solution of a salt deposits 0.8898 gm of the metal on the cathode. The valency of the metal is 2. What is its atomic weight? (1 Faraday = 96,500 coulomb).

4. Name a chief area of zinc and describe with equations how the metal is extracted from the ore. Explain with equations how zinc reacts with caustic soda solution and copper sulphate solution. State a few important uses of zinc.
5. Describe the preparation and uses of the following:
   (a) steel, (b) glass, (c) caustic soda.

6. State giving equations what happens when:
   (a) Red lead is heated with conc. hydrochloric acid.
   (b) A zinc rod is dipped into a solution of lead acetate.
   (c) A piece of sodium is dropped into water.
   (d) A solution of caustic soda is slowly added to a solution of aluminium sulphate.
   (e) Chlorine gas is led into dry slaked lime.

7. Explain the difference between ordinary distillation and destructive distillation. Describe the manufacture of coal gas. What are its important constituents? Name the important by-products obtained in the manufacture of coal gas and describe their uses.

8. What is an ester? How would you prepare ethyl acetate? How does it react with dilute caustic soda solution? What are fats and oils?

9. Write short notes on the following:
   (a) Fractional distillation of petroleum; (b) unsaturated hydrocarbons; (c) alcoholic fermentation.
10. (a) Describe how you have performed the charcoal test in the reducing flame for the detection of metallic radicals.

(b) How would you prove the presence of aluminium in a sample of aluminium sulphate by dry as well as by wet tests?

(c) State what are the colours of litmus in acid and in alkaline solution.
ACHIEVEMENT TEST IN MATHEMATICS (PAPER I & II)

TAKEN FROM HIGHER SECONDARY EXAMINATION, 1975.
1. (a) Simplify:

\[
\frac{3}{1-\sqrt{2}+\sqrt{3}} + \frac{1}{1-\sqrt{2}-\sqrt{3}} - \frac{2}{1+\sqrt{2}-\sqrt{3}} + \frac{3}{\sqrt{2}}
\]

(b) If \(2^x = 3^y = 12^z\), prove that \(xy = z(x+2y)\).

(c) Prove that \(\log a \cdot \log b \cdot \log c \cdot \log a = 1\).

2. (a) If \(P, Q\) and \(R\) be the \(p\)th, \(q\)th and \(r\)th terms of an A.P.,

prove that \(P(Q-R) + Q(R-P) + R(P-Q) = 0\).

(b) If \(U_1, U_2, U_3\) ........ form a G.P. with common ratio \(k\), find

in terms of \(k\) and \(u_1\) the sum of \(u_1u_2 + u_2u_3 \ldots + u_n u_{n+1}\).

3. (a) Find the condition that the roots of the equation:

\[
\frac{a}{x-a} + \frac{b}{x-b} = 5
\]

are equal in magnitude but opposite in sign.

(b) If \(\alpha, \beta\) are the roots of \(5x^2+7x+3=0\), find the value of

\[
\frac{\alpha^3+\beta^3}{\alpha-1+\beta-1}
\]

4. (a) Solve: \(x^2 + y^2 + xy = 34; x+y+\sqrt{xy} = 14\)

(b) If \(z\) is equal to the sum of two quantities of which one

varies directly as \(y\) and the other inversely as \(y^2\), and

\(z=49\) when \(y=3\), or \(5\), find the relation between \(z\) and \(y\).

5. (a) Find the number of permutations of \(P\) things taken all

together when the things are not all different.
(b) How many numbers greater than 6000 can be formed with the digits 3, 4, 5, 6, 8 if no digit is repeated? How many of these are odd numbers?

6. Obtain the expansion of \((1+x)^n\) in the form

\[ C_0 + C_1x + C_2x^2 + \ldots + Cnx^n, \]

where \(n\) is a positive integer. Show that

\[ C_0^2 + C_1^2 + C_2^2 + \ldots + C_n^2 = \frac{(2n)!}{(n!)^2} \]

7. (a) Prove that, if \(x\) is so small that its cube and higher powers may be neglected,

\[ \sqrt{\frac{1+x}{1-x}} = 1 + x + \frac{1}{3} x^2, \text{ approximately.} \]

(b) Express the recurring decimal 0.3 as an infinite geometric series and use the sum of this series to find the value of 0.3 in the form of a rational number.

8. (a) Define \(\cos \theta\), when \(\theta\) is an obtuse angle. If \(\tan \theta = -2\), find the values of \(\cos \theta\) when \(\theta\) is in the

(i) second, (ii) fourth quadrant.

(b) Prove that \(\sec \theta - \tan \theta = 1 - 2 \sec \theta \tan \theta + 2 \tan^2 \theta\)

9. (a) Prove that \(\sin (A+B) \sin (A-B) = \sin^2 A - \sin^2 B\).

(b) If an angle \(\alpha\) is divided into two parts, such that the ratio of the tangents of the parts is \(\lambda\), show that the difference \(x\) between the parts is given by \(\sin x = \frac{\lambda - 1}{\lambda + 1}\) \(\sin \alpha\).
10. (a) Without using tables prove that
\[ \cos 32^\circ \sin 20^\circ + \cos 144^\circ \cos 2^\circ + \sin 68^\circ \cos 16^\circ = 0 \]

(b) Prove that \( \cos^{-1} \frac{4}{7} + \cos^{-1} \frac{12}{13} = \cos^{-1} \frac{33}{65} \).

11. (a) If \( \alpha + \beta + \gamma = \pi \), prove that
\[ \sin^2 \alpha + \sin^2 \beta - \sin^2 \gamma = 1 - 2 \cos \alpha \cos \beta \sin \gamma \]

(b) Find the general solution of the equation.
\[ \sqrt{3} \cos \theta + \sin \theta = \sqrt{2} \]

12. (a) In a triangle \( \triangle ABC \), prove that
\[ \sin^2 A = \frac{(a+b+c)(b+c-a)(c+a-b)(a+b-c)}{4b^2c^2} \]

Where the symbols have their usual meanings.

(b) From a balloon the angles of depression of the top and the bottom of tower whose height is \( h \) are observed to be \( \alpha \) and \( \beta \). Show that the height of the balloon above the ground and its horizontal distance from the tower are respectively,
\[ h \cos \alpha \sin \beta \cosec (\beta - \alpha) , h \cos \alpha \sin \beta (\cosec (\beta - \alpha) \].
1. With the help of your scale draw a straight line 2 cm long. With its help construct two other straight lines, one 
$(2 + \sqrt{5})$ cm. long and another $2\sqrt{3}$ cm. long. Construct a square whose area is equal to sum of the squares described on these two 
latter straight lines. Find by measurement the approximate 
length of a diagonal of this square (very brief statement with 
full traces of construction to be given, but no proof).

2. (a) In a triangle the square on a side opposite to an acute angle is equal to the sum of the squares on the other two
sides diminished by twice the rectangle contained by one of the 
latter two sides and the projection of the other on it. Prove this.

(b) $\triangle PQR$ is an acute-angled triangle. $QS, RT$ are perpendi-
culars to $PR, PQ$ respectively meeting them in $S, T$. show that
$QR^2 = PQ \cdot QT + PR \cdot RS$.

3. (a) The tangent at any point of a circle makes with a chord drawn from that point angles equal respectively to the angles in the alternate segments of the circle. Prove this theorem.

(b) $PQ$, a diameter of a circle, produced to an external
point $R$. $RT$ is drawn tangent to the circle, touching it at $T$.
$QN$ is perpendicular to $RT$ at $N$. Prove that $TQ$ bisects the $\angle PQN$ and $PQ \cdot NQ = QT^2$. 
4.(a) XYZ is a right angled triangle, angle at X being
right angle. XP is perpendicular to YZ, meeting it at P. Prove
that the \(\triangle XYP, ZPX\) are similar and each of them is similar to
the whole triangle ZXY.

(b) AB is a diameter of a circle. Tangent at a point P on
the circle meets the tangents to the circle at A and B in Q and
R respectively. Prove that \(PQ \cdot PR = r^2\), where \(r\) is the radius
of the circle.

5.(a) Find the angle between the lines \(ax + by + c = 0\) and
\(a'x + b'y + c' = 0\)
Find also the conditions that the lines may be
(i) Parallel, (ii) Perpendicular.

5.(b) \(C\) is a moving point moving in such a manner that the
area of the \(\triangle CAB\), where \(A, B\) are the points (1,2) and (5,-2), is
numerically equal to 12 sq. units. Find the equation to a locus
of \(C\).

6.(a) Find the equation of the straight line which divides
perpendicularly the straight line joining the points (7,9) and
(-1, -7), internally in the ratio 3:5. What is the distance of
this line from the origin?

(b) Find the co-ordinates of the point P, lying on the
straight line \(3x + 2y + 11 = 0\), which is equidistant from the
points (-7,3) and (1,5).
7. (a) Show that the length of the chord of the circle
\[ x^2 + y^2 + 5x - 2y - 24 = 0 \]
cut off on the x-axis is greater than that cut off on the y-axis by unity.

(b) Find the locus of a moving point P if \( PA^2 + PB^2 = AB^2 \)
where A, B are points (0,0) and (3,4), find also the equation of tangents to this locus at the points where this locus crosses the y-axis.

8. (a) Find the equation of the parabola where vertex is (2,3)
whose latus rectus has the equation \( x = 4 \). Find also the co-ordinates of the points of intersection of the latus reaction with the parabola.

(b) If \( (at^2, 2at) \) be one extremity of a focal chord of the parabola \( y^2 = 4ax \), show that \( \left( \frac{3a}{t^2} - \frac{2a}{t} \right) \) are the co-ordinates of the other extremity of the chord. Hence show that tangents to the parabola at the extremities of the focal chord intersect at right angles on the directrix of the parabola.

9. (a) If c and d be the perpendicular distances of the two foci of an ellipse from any tangent to it. Show that cd is constant.

(b) Find the equations of the normals to the hyperbola
\[ 3x^2 - 2y^2 = 10 \]
at the points where the hyperbola is intersected by the straight line \( x+y+3 = 0 \).

10. (a) Either, of two parallel straight lines, if one is perpendicular to the same plane.
AB, CD are two parallel straight lines. Plane XY passes through AB but not through CD and plane XZ passes through CD but not through AB. These two planes intersect along the straight line into XM. Show that XM is parallel to AB and CD. Or, OA and OB are two straight lines lying in the plane XY, OP another straight line not lying in the plane XY, is perpendicular to OA. Is OP perpendicular to (i) the plane XY; (ii) OB?

If OC be another straight line lying in the plane XY and if OP be perpendicular to OC also, will then OP be perpendicular to (iii) the plane XY, (iv) OB?

Straight line AB is perpendicular to the plane XY; BC is a straight line lying in the plane XY and CD, another straight line lying in the same plane, is perpendicular to BC. E is any point on AB. Prove that CD is perpendicular to CE.

(b) Either, If a be the length of an edge of an equilateral triangular pyramid, show that $h = a\sqrt{2} \frac{2}{3}$, where $h$ is the height of the pyramid. Hence find in Kg. The weight of a solid equilateral triangular pyramid of iron, each edge of which is $20\sqrt{2}$ cm. (weight of 1 cu cm. of iron = 7.8 gms).

or, find the cost of excavating a canal, 2 km. long, vertical cross-section of which is a trapezium 20 metres across at the top, 10 metres across at the bottom and 5 metres deep, at the rate of Rs. 6.25 per cubic metre of each excavated.