SPSTI SUMMER CAAMP EVALUATION 2019

Background: This evaluation was conducted to measure the benefits accruing out of the annual summer camp help by SPSTI, quantitatively. It was based on theoretical tests designed on basis of NCERT recommended syllabus (mathematics and science) and were administered to all students attending the camp.

Aim: The evaluation specifically tests any notable academic achievement of students of class 9 and 10,on basis of 3 parameters:

- Improvement in problem solving ability
- Improvement in conceptual clarity
- Improvement in comprehension ability

Methodology:

- The students attended a 25 day long summer camp in which they were taught several concepts of mathematics and science.
- To do a comparative analysis of the performance of students in a standardized test , 2 tests each were designed for class 9 and 10.
- The test-1 , we shall call it pre-test, was administered to the students 3 days after they started attending the camp. The pre-test was made on basis of the course recommended by CBSE to be covered in schools by the end of May,2019.
- The test-2 , we shall call it post test , was administered to the students at the last day of the camp. The post-test was also made on the same syllabus on which the pre-test had been designed.
- Each test consists of 3 types of questions which are designed to check students familiarity level with the topic in different ways:
  - MCQ(Multiple choice questions)   : to check problem solving ability
  - SAT (Short answer type questions)   : to check general conceptual clarity
  - CT (Comprehension type questions) : to check comprehension ability
- Hypothesis : Do students have an actual performance difference before and after a summer camp?
  $H_0 : \mu_0 = 0$
  $H_a : \mu_0 \neq 0$
- To do a statistical analysis of the two data sets, a pair-wise t-test was chosen to measure any actual improvement (if any) in the students' performance.
- The tables and graphs shown below detail our findings of the study.

General contextual data:

Number of centers used in the data collection : 6

Standard chosen for our study : Class IX & Class X

Number of students participating in the camp for the 6 centers of our study:

      For class IX : 34(Am)+26(Jd)+ 89(Kt)+ 47(Kr) + 62(Ku)+ 81(Yn) = total 339

      For class X : 28(Am)+36(Jd)+ 50(Kt)+ 104(Kr)+ 23(Ku)+ 57(Yn) = total 298

Number of students who participated in both the tests :

      For class IX : 34(Am)+9(Jd)+23(Kt)+35(Kr)+14(Ku)+33(Yn) = total 148

      For class X : 28(Am)+36(Jd)+35(Kt)+55(Kr)+14(Ku)+22(Yn)= total 190

Maximum marks of both tests : 40 (each test had different number of questions which were weighted to reach a total of 40 in each case)

Center codes:

Am : Ambala

Jd   : Jind

Kt   : Kaithal

Kr   : Karnal

Ku   : Kurukshetra

Yn   : Yamunanagar

Note: The data for Panchkula camp was to be included too in the study .However on enquiring with the co-ordinator it was found that the google data sheet uploaded for Panchkula camp was either partly corrupt or unusable. So the data could not be furnished, to be included for the study.

Data collected

Scores of students of class 10 before and after attending the summer camp

Center code	Student Sr no	pre test score	post test score	difference
Am	1	11	26	15
Am	2	13	32	19
Am	3	12	31	19
Am	4	13	20	7
Am	5	12	21	9
Am	6	8	27	19
Am	7	13	27	14
Am	8	10	23	13
Am	9	10	21	11
Am	10	12	20	8
Am	11	10	0	-10
Am	12	10	23	13
Am	13	7	20	13
Am	14	10	20	10
Am	15	7	16	9
Am	16	8	18	10
Am	17	10	28	18
Am	18	10	18	8
Am	19	6	23	17
Am	20	8	27	19
Am	21	7	24	17
Am	22	12	23	11
Am	23	9	24	15
Am	24	9	20	11
Am	25	12	22	10
Am	26	13	22	9
Am	27	5	17	12
Am	28	10	9	-1
Jd	29	6	3	-3

Jd	30	3	0	-3
Jd	31	2	4	2
Jd	32	2	4	2
Jd	33	2	4	2
Jd	34	2	3	1
Jd	35	5	4	-1
Jd	36	5	6	1
Jd	37	4	10	6
Jd	38	7	7	0
Jd	39	5	3	-2
Jd	40	2	3	1
Jd	41	3	9	6
Jd	42	4	4	0
Jd	43	8	4	-4
Jd	44	2	0	-2
Jd	45	3	4	1
Jd	46	4	0	-4
Jd	47	4	3	-1
Jd	48	3	5	2
Jd	49	1	2	1
Jd	50	2	0	-2
Jd	51	6	0	-6
Jd	52	8	6	-2
Jd	53	5	7	2
Jd	54	6	0	-6
Jd	55	6	0	-6
Jd	56	8	7	-1
Jd	57	10	9	-1
Jd	58	5	5	0
Jd	59	4	2	-2
Jd	60	6	2	-4
Jd	61	7	0	-7
Jd	62	5	6	1
Jd	63	9	9	0
Jd	64	6	0	-6
Kt	65	6	16	10
Kt	66	9.5	18	8.5
Kt	67	8.5	15	6.5
Kt	68	4.5	3	-1.5
Kt	69	9	21	12
Kt	70	8	17.5	9.5

Kt	71	5.5	14.5	9
Kt	72	7.5	13	5.5
Kt	73	12.5	23.5	11
Kt	74	10	11.5	1.5
Kt	75	8.5	16	7.5
Kt	76	13	23	10
Kt	77	7	19	12
Kt	78	7.5	18	10.5
Kt	79	6.5	15.5	9
Kt	80	3	20	17
Kt	81	14.5	21.5	7
Kt	82	14	26.5	12.5
Kt	83	8	15.5	7.5
Kt	84	8.5	29	20.5
Kt	85	5.5	21	15.5
Kt	86	6.5	27	20.5
Kt	87	18.5	26.5	8
Kt	88	8	12	4
Kt	89	5.5	15.5	10
Kt	90	5.5	11.5	6
Kt	91	4	19	15
Kt	92	5	16	11
Kt	93	3	8	5
Kt	94	6	16	10
Kt	95	3.5	18.5	15
Kt	96	9	15.5	6.5
Kt	97	9	19	10
Kt	98	5	13	8
Kt	99	6	14	8
Kr	100	5	18	13
Kr	101	6	14	8
Kr	102	10	22	12
Kr	103	6	11	5
Kr	104	8	17	9
Kr	105	4	10	6
Kr	106	3	6	3
Kr	107	5	10	5
Kr	108	6	12	6
Kr	109	7	8	1
Kr	110	7	9	2
Kr	111	6	10	4

Kr	112	7	11	4
Kr	113	4	11	7
Kr	114	7	12	5
Kr	115	5	15	10
Kr	116	7	18	11
Kr	117	5	15	10
Kr	118	8	17	9
Kr	119	10	20	10
Kr	120	8	17	9
Kr	121	5	9	4
Kr	122	6	12	6
Kr	123	6	13	7
Kr	124	9	19	10
Kr	125	8	18	10
Kr	126	8	11	3
Kr	127	9	10	1
Kr	128	7	10	3
Kr	129	4	10	6
Kr	130	9	13	4
Kr	131	9	15	6
Kr	132	4	14	10
Kr	133	8	6	-2
Kr	134	8	11	3
Kr	135	9	10	1
Kr	136	6	14	8
Kr	137	6	10	4
Kr	138	6	14	8
Kr	139	3	13	10
Kr	140	8	20	12
Kr	141	7	14	7
Kr	142	10	11	1
Kr	143	7	12	5
Kr	144	5	18	13
Kr	145	6	3	-3
Kr	146	7	9	2
Kr	147	10	18	8
Kr	148	11	15	4
Kr	149	3	14	11
Kr	150	8	7	-1
Kr	151	4	8	4
Kr	152	4	7	3

Kr	153	5	11	6
Kr	154	4	7	3
Ku	155	12	4	-8
Ku	156	6	7	1
Ku	157	8	10	2
Ku	158	9	13	4
Ku	159	1	14	13
Ku	160	1	13	12
Ku	161	3	14	11
Ku	162	3	6	3
Ku	163	3	6	3
Ku	164	0	9	9
Ku	165	4	9	5
Ku	166	4	8	4
Ku	167	4	13	9
Ku	168	0	8	8
Yn	169	14.5	13	-1.5
Yn	170	13.5	11	-2.5
Yn	171	20.5	15	-5.5
Yn	172	13.5	10	-3.5
Yn	173	17	11	-6
Yn	174	13	15	2
Yn	175	14	16.5	2.5
Yn	176	12	11.5	-0.5
Yn	177	15.5	17.5	2
Yn	178	13	18	5
Yn	179	16.5	16.5	0
Yn	180	13	13.5	0.5
Yn	181	12.5	12.5	0
Yn	182	15.5	11.5	-4
Yn	183	19.5	19	-0.5
Yn	184	16.5	21	4.5
Yn	185	19	11	-8
Yn	186	16	12	-4
Yn	187	18	10.5	-7.5
Yn	188	13.5	16.5	3
Yn	189	11	13.5	2.5
Yn	190	12	9.5	-2.5
Mean		7.731578947	13.02631579	5.2947368
Standard dev		4.056682074	7.141750123	6.3907153

Scores of students of class 9 before and after attending the summer camp

Center code	Student Sr No	Pre test score	post test score	difference
Am	1	12	12	0
Am	2	9	10	1
Am	3	16	13	-3
Am	4	13	14	1
Am	5	9	11	2
Am	6	10	4	-6
Am	7	10	12	2
Am	8	13	6	-7
Am	9	13	4	-9
Am	10	12	12	0
Am	11	9	6	-3
Am	12	16	13	-3
Am	13	13	13	0
Am	14	14	12	-2
Am	15	15	10	-5
Am	16	16	12	-4
Am	17	13	8	-5
Am	18	13	6	-7
Am	19	16	10	-6
Am	20	10	11	1
Am	21	8	5	-3
Am	22	9	5	-4
Am	23	14	6	-8
Am	24	11	4	-7
Am	25	8	7	-1
Am	26	10	9	-1
Am	27	8	4	-4
Am	28	12	9	-3
Am	29	12	3	-9
Am	30	7	4	-3
Am	31	6	4	-2
Am	32	9	5	-4

Am	33	7	6	-1
Am	34	13	13	0
Jd	35	7	9	2
Jd	36	2	7	5
Jd	37	3	7	4
Jd	38	5	11	6
Jd	39	10	6	-4
Jd	40	5	9	4
Jd	41	9	19	10
Jd	42	4	10	6
Jd	43	3	6	3
Kt	44	5	10.5	5.5
Kt	45	4	14	10
Kt	46	7	11	4
Kt	47	0	13	13
Kt	48	3	9	6
Kt	49	6	9.5	3.5
Kt	50	5	10	5
Kt	51	5	6	1
Kt	52	4	6	2
Kt	53	5	10	5
Kt	54	4	7	3
Kt	55	6	6.5	0.5
Kt	56	0	6	6
Kt	57	6	12	6
Kt	58	7	13	6
Kt	59	6	10	4
Kt	60	6	8.5	2.5
Kt	61	2	7.5	5.5
Kt	62	0	7.5	7.5
Kt	63	6	6	0
Kt	64	4	11	7
Kt	65	4	8	4
Kt	66	5	10	5
Kr	67	8	17	9
Kr	68	8	12	4
Kr	69	10	17	7
Kr	70	8	6	-2
Kr	71	8	19	11
Kr	72	3	9	6
Kr	73	4	15	11

Kr	74	9	17	8
Kr	75	11	15	4
Kr	76	5	11	6
Kr	77	4	10	6
Kr	78	7	11	4
Kr	79	7	11	4
Kr	80	6	15	9
Kr	81	11	10	-1
Kr	82	10	14	4
Kr	83	5	8	3
Kr	84	4	11	7
Kr	85	4	5	1
Kr	86	10	16	6
Kr	87	4	9	5
Kr	88	12	9	-3
Kr	89	5	6	1
Kr	90	3	6	3
Kr	91	8	8	0
Kr	92	3	8	5
Kr	93	5	11	6
Kr	94	7	11	4
Kr	95	6	8	2
Kr	96	3	6	3
Kr	97	2	10	8
Kr	98	8	10	2
Kr	99	10	19	9
Kr	100	6	7	1
Kr	101	7	10	3
Ku	102	4	9	5
Ku	103	9	0	-9
Ku	104	2.5	5	2.5
Ku	105	9	12	3
Ku	106	12.5	13	0.5
Ku	107	7	9	2
Ku	108	6	10	4
Ku	109	10	12	2
Ku	110	7	8	1
Ku	111	7	8	1
Ku	112	6.5	9	2.5
Ku	113	5.5	1	-4.5
Ku	114	5.5	14	8.5

Ku	115	6	10	4
Yn	116	10.5	17	6.5
Yn	117	10	14	4
Yn	118	7.5	10	2.5
Yn	119	8.5	22	13.5
Yn	120	6.5	12	5.5
Yn	121	5.5	13	7.5
Yn	122	7	14	7
Yn	123	8.5	13	4.5
Yn	124	10	5.5	-4.5
Yn	125	6	5	-1
Yn	126	2	4	2
Yn	127	7	6	-1
Yn	128	8	3	-5
Yn	129	11.5	13	1.5
Yn	130	11	10	-1
Yn	131	8.5	18	9.5
Yn	132	5	9	4
Yn	133	7.5	17.5	10
Yn	134	6.5	7	0.5
Yn	135	10	14	4
Yn	136	8.5	8.5	0
Yn	137	5.5	9	3.5
Yn	138	8	6	-2
Yn	139	7.5	7	-0.5
Yn	140	10	5	-5
Yn	141	7.5	6	-1.5
Yn	142	7.5	7	-0.5
Yn	143	8.5	5	-3.5
Yn	144	6	5	-1
Yn	145	6.5	6	-0.5
Yn	146	7	0	-7
Yn	147	8	5	-3
Yn	148	6.5	5	-1.5
Mean		7.543918919	9.375	1.8310811
Std Dev		3.392633604	4.029177175	4.7299718

Question wise mean test scores

Class 9

Centre	MCQ	SAT	CT	MCQ	SAT	CT
Am	7.27	2.62				
			1.50	4.03	2.12	2.20
Jd	3.78	0.78				
			0.78	3.56	1.44	4.33
Kt	2.83	1.52	0			
				2.13	2.52	4.60
Kr	3.63	1.43				
			1.54	4.06	3.26	3.74
Ku	4.79	0.96				
			1.21	0.93	1.29	6.36
Yn	6.12	0.85				
			0.73	3.09	2.50	3.55
Overall means	4.73	1.36	0.96			
				2.97	2.19	4.13

Class 10

Centre	MCQ	SAT	CT	MCQ	SAT	CT
Am	6.14		0			
		3.75		6.00	8.79	6.71
Jd	3.69		0			
		1.03		2.58	0.31	0.86
Kt	4.26					
		3.10	0.40	6.97	4.39	6.06
Kr	4.69					
		1.82	0.09	5.51	2.80	4.22
Ku	3.43		0			
		0.71		4.43	3.00	2.14

Yn	6.59					
		6.23	2.16	5.34	3.82	4.73
Overall means	4.80			5.14		4.12
		2.77	0.44		3.85	

Qualitative Interpretations

- We see a general improvement in student's ability to solve comprehension type questions.
- The students tended to use more scientific terms in answering their SAT questions in test-2 , as compared to test-1, which shows an improvement in their science communication skills.

Quantitative interpretations/Statistical analysis

t-Test: Paired Two Sample for Means : for class 9

	post test score	pre test score
Mean	9.375	7.543918919
Variance	16.23426871	11.50996277
Observations	148	148
Pearson Correlation	0.196480853	
Hypothesized Mean Difference	0	
df	147	
t Stat	4.709555134	
P(T<=t) one-tail	2.8467E-06	
t Critical one-tail	1.655285437	
P(T<=t) two-tail	5.6934E-06	
t Critical two-tail	1.976233277	

mean differences	1.831081081
standard deviation of differences	4.729971759
standard error of differences	0.390121495
T alpha half 95%	1.976233277
lower confidence interval	1.06011
upper confidence interval	2.602052162

Interpretation :

A paired sample t-test was conducted to compare class 9 students' performance before and after attending the SPSTI summer camp. There was a significant difference in the scores for pre-test (M= 7.54, SD=3.39) and post -test (M=9.37, SD= 4.02) conditions; t(148)= 1.97, p= 5.6934E-06 .

We can thus strongly reject the null hypothesis.

These results suggest that when students attended the summer camp **their performance got actually improved after the camp as compared to their performance prior to the camp**.

The upper and lower confidence intervals suggest that we can say with 95% confidence that the difference in marks obtained by the students in the pre-test and post-test lies between 1.06 to 2.6 marks. Thus there is a general improvement of around 1.83 marks or 4.5% improvement.

t-Test: Paired Two Sample for Means : for class 10

	pre test score	post test score
Mean	7.731578947	13.02631579
Variance	16.45666945	51.00459482
Observations	190	190
Pearson Correlation	0.459412487	
Hypothesized Mean Difference	0	
df	189	
t Stat	-11.42014741	
P(T<=t) one-tail	1.30867E-23	
t Critical one-tail	1.652955802	
P(T<=t) two-tail	2.62E-23	
t Critical two-tail	1.972595036	

mean differences	5.294736842
standard deviation of differences	6.390715296
standard error of differences	0.463631217
T alpha half 95%	1.972595036
lower confidence interval	4.380180205
upper confidence interval	6.209293479

Interpretation :

A paired sample t-test was conducted to compare class 10 students' performance before and after attending the SPSTI summer camp. There was a significant difference in the scores for pre-test (M= 7.73, SD=4.05) and post -test (M=13.02, SD= 7.14) conditions; t(190)= 1.97, p= 2.62E-23 .

We can thus strongly reject the null hypothesis.

These results suggest that when students attended the summer camp **their performance got actually improved after the camp as compared to their performance prior to the camp**.

The upper and lower confidence intervals suggest that we can say with 95% confidence that the difference in marks obtained by the students in the pre-test and post-test lies between 4.38 to 6.2 marks. Thus there is a general improvement of around 5.29 marks or 13.25% improvement.

Graphical Visualization

Class 10 pre-test
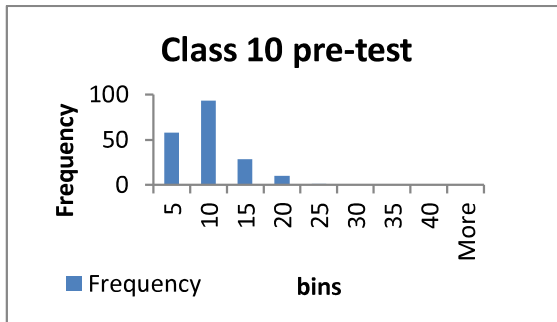
Class 10 post-test

Marks obtained by class 10 in pre-test
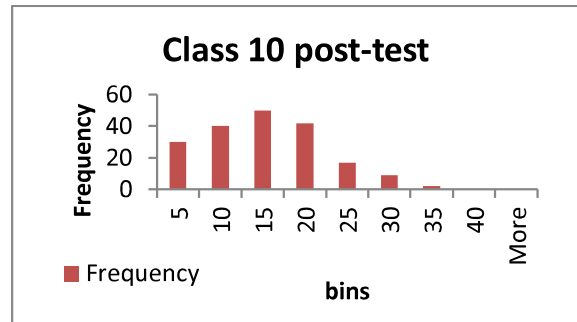
Marks obtained by class 10 in post-test

Interpretation:

- The marks with highest frequency shift from (5- 10) to (10-15) range which shows general improvement
- The pre-test histogram is right skewed which means mean is greater than median or mode. The post test histogram is bell shaped which means mean, median and mode are almost same.

  This shows the average performance has improved and we have fewer outliers i.e. a trend of uniformity in performance.

Class 9 pre-test
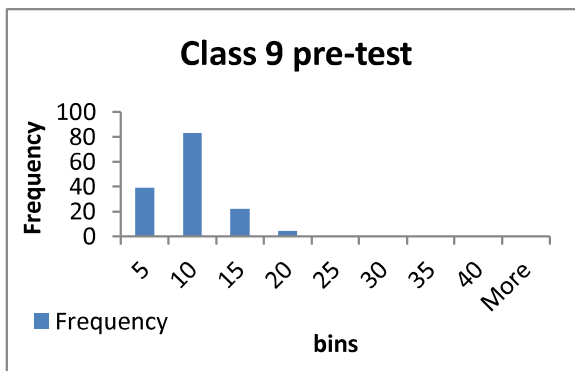
Class 9 post-test

Marks obtained by class 9 in pre-test
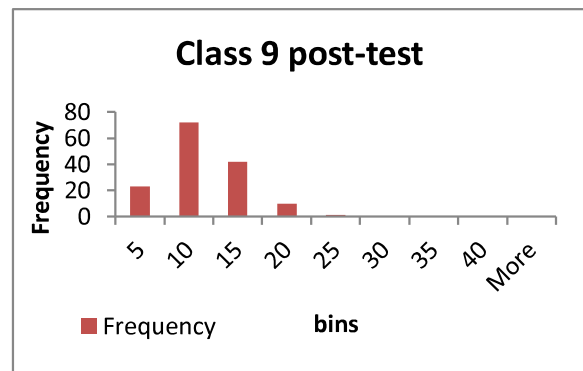
Marks obtained by class 9 in post-test

Interpretation:

- The marks with highest frequency stays at (5-10)range itself however frequency of marks between (15-20) range increases which shows that mean marks obtained have shifted to right thus indicating some improvement.

- The histogram shows more student in the pre-test scored marks towards lower end of the spectrum while the post test histogram shows more students obtained marks on the higher end of the spectrum .

Conclusion

- The statistical test lead us to the result that there was actual improvement in performance of the students of class 9 and 10 before and after attending the SPSTI summer camp.
- The histograms show that the performance level of students has become more uniform than it was before the camp and It shows an attempt on part of the camp organizers to bring the students at a common level which is quite commendable.
- The mean scores obtained by students in the different types of questions lead us to believe that there is a general improvement in their ability to solve comprehension type questions thus showing that students could better sift through a given data and pin-point relevant parts and concepts to reach at required results.

Suggestions and way forward

- Some centers register quite some attrition in the number of students as the camp progresses. There is a need to look into the reasons for it and solve them before the next camp is held.
- The Panchkula centre got left out which actually had quite a number of students. Had those results been included in the study the results could have been different. So the study also suggests to include more centers for the next year evaluation so that bulkier data is obtained which can give a further more accurate view of the summer camp's actual significance.
- Even at centers where significant attrition is not seen we see students turning up for classes though not for the test. This shows a need to make the test more child centric so that the test in a part of the child's learning experience and not a problem for them to reckon with.
- The test employed in this estimation were quite theoretical in nature due to inability of the camp organizers to resort to experimental testing which will require significantly more funds. However, there is a need to include experiential learning in the camp sessions more and more and also test the students for development in their experiential skills.
- The students who attend the camp were tested only before and after the camp was held. There is however, a need to follow up on their performance, even when they get back to their respective schools and for this appropriate channels need to be institutionalized in place.

Appendix 1

Test 1

Class-IX

Questions

M.C.Q.

1. Volume of a cube is given by equation $x3-4x+5x-2$. Which is a possible dimension of the cube?

(a) 1,2,2   (b) 1,2,3   (c) 1,3,3   (d) 2,2,3

2. If $x - 2a + 3$ is a factor of $p(x)$, degree of $p(x) > 1$ then which of the following is always true?

(a) $p(a) = 0$ (b) $p(2a) = 3$ (c) $p(2a + 3) = 0$ (d) $-p(2a-3) = 0$

3. Which option represents an irrational number?

(a) 0/10   (b) 1.59   (c) 2.45   (d) 1.7549596...

4. Which number is the greatest among the following?

(a) $2^{2^{22}}$

(b) 2^{22^2}

(c) 22^{22}

(d) 2^{222}

5. Which of the following statements is true?

(a) One can draw a line segment of length $\sqrt{2}$.

(b) 0 is both a rational and irrational number.

(c) Sum of a rational and irrational number may be rational or irrational.

(d) The product of 2 irrational numbers is always a rational number.

6. Which factor impedes evaporation, upon an increase?

(a) Humidity   (b) Temperature   (c) Wind   (d) Surface area

7. At what temperature,do the Fahrenheit and Celcius scale read the same?

(a) −80o C   (b) 30 K   (c) 40 F   (d) 233 K

Short answer questions:

(a) If $ax^2 + bx + c = 0$; 2 and 3 are the roots of equation, then find the values of a, b and c?

(b) Evaluate using a suitable identity and state the identity: (98^3)

(c) Simplify: $\frac{\sqrt{24}}{8} + \frac{\sqrt{54}}{9}$.

(d) Find the value of a in $\frac{\sqrt{2}+\sqrt{3}}{3\sqrt{2}-2\sqrt{3}} = 2 - a\sqrt{6}$?

(e) If $a = 2 + \sqrt{3}$, find $a - \frac{1}{a}$?

(f) How does water get cooled in an earthen pot?

(g) Which burn is worse and why: water at $100°$ C or steam at $100°$ C ?

Comprehension Type question

Figure 1

The above setup shows a substance being heated in a conical flask. The final temperature is T° C.

i.   What can be this substance and what is the process?
ii.   What happens if we put ice instead of that substance?
iii.   If we decrease the pressure should T increase or decrease to keep the result same?
iv.   In mountainous regions, will water boil faster or slower?
v.   If for another subtance T is greater what does it indicate about its interactive forces?
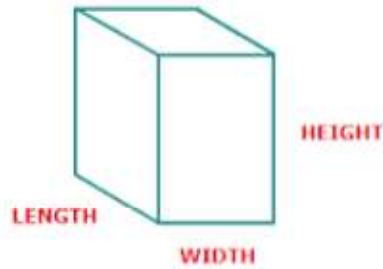
Figure 2

2 Volume of a cuboid is given by $(9-a)(m+n)(m^2-mn+n^2)(105)^2$ where the 3 dimensions are length:$(9-a)$, width:$(m+n)(m^2-mn+n^2)$, height:$(105)^2$. If $m \leq n$ and $a < m$,then find:

   i. If a is such that $\sqrt{a}$ is rational find the length.

   ii. If the width lies between 30 and 50 find it.

   iii. The height is 105^2. Compute without actually multiplying.

   iv. Find the volume through factorization.

   v. If insead of $a < m$, $a > m$ then find the length.

Appendix 2

Test 2

Class IX

M.C.Q

1) If the area of a square is twice the area of a circle, which of the following is not true?
   a) The side of the square will be longer than the radius.

   b) The perimeter of the square and circle will be roughly the same.

   c) The radius of the circle can be an irrational number.

   d) The area of the square will be an irrational number is radius is rational.

2) Which of the following polynomials have x-2 as a factor?

   a) $3x^2 + 6x - 24$ b) $4x^2 + x -2$

   c) $2x^2 + 3x -4$ d) $x^2 - x + 4$

3) Which of the following is not true for an irrational number?

   a) Sum of two irrationals is always an irrational.

   b) Product of two irrational numbers is never irrational.

   c) Irrational numbers don't exist on the real number line.

   d) Irrational numbers cannot be negative.

4) Which of the following is true?

   a) There are infinitely many integers between any 2 integers.

   b) The square of an irrational number is always rational.

   c) Number of rational numbers between 15 and 18 are finite.

   d) $(12)^{0.5} / (3)^{0.5}$ is a rational number.

5) Simplify : $256^{-\{(\sqrt{4})^{-3}\}}$

a) 2

b) 4

c) ½

d) 16

6) Which of the following is not true for a cell?

a) A cell must have a cell membrane.

b) A cell cannot exist independently.

c) A cell can destroy itself.

d) A plant cell wall is composed of cellulose.

Short Answer Questions

1) If $p(x) = x^2 - 4x + 3$, evaluate $p(2) - p(-1) + p(1/2)$
2) Without finding the cubes, factorize: $(x-2y)^3(2y-3z)^3(3z-x)^3$.
3) Show that the expression $4a^2 + 4a -3$ can represent the area of a rectangle when a > 1/2.
4) If both x-3 and x-⅓ are factors of $ax^2 +5x + b$. Can we say a=b? Prove if true.
5) An object traveling along a straight line with uniform acceleration starts from rest and travels 20 m in the first 2s. What will be the velocity after 7 s from the start?
6) Can we store heat? If yes, how? If not, why?
7) A child walks to his school everyday 4 km away from his house. What is the distance covered by the child everyday? What is the displacement of the child everyday?

Comprehension type questions
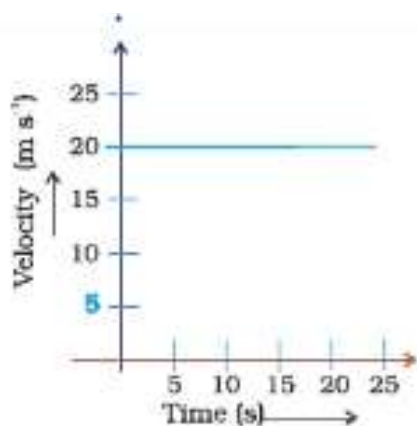
1) The given velocity-time graph shows the motion of a cyclist .Find the following using suitable reasoning.

     1) Acceleration

     2) Velocity

     3) Distance travelled in 15 s

     4) Does a real world cyclist usually move like this?

     5) If the cyclist stops moving at t=30 sec and starts to return back at the

     same velocity, what will be the displacement 40 sec after the cyclist

     Initially starts?

2) You are provided with a mixture of two substances A and B. In each of the following cases suggest a method to differentiate/separate A and B.Give a brief reason for your choice of the methodology.

     1) Naphthalene and Ammonium Chloride.
     2) Water and sugar.
     3) Water and oil.
     4) Sand and water
     5) Salt and sugar

Appendix 3

Test 1

Class X

M.C.Q.

1) $aFe(s) + bH_2O(g) \rightarrow cFe_3O_4(s) + dH_2(g)$ is an equation given to you. Which option correctly represents the values of a,b,c,d respectively.

a) 1,2,1,4   b) 2,3,1,4

c) 3,4,1,4   d) 4,2,1,3

2) Which of the following cannot be used as air fillers in snack packets e.g. chips?

a) Argon   b) Nitrogen

c) Oxygen   d) Carbon-dioxide

3) Which of the following organs is not a part of human excretory system?

a) Intestines   b) Kidney

c) Skin   d) Heart

4) Which of the following cannot produce their own food?

a) Cactus   b) Human

c) Algae   d) All of the above

5) Which of the following lenses would you use to burn a piece of paper?

a) A convex lens of focal length 50 cm.

b) A concave lens of focal length 50 cm.

c) A convex lens of focal length 5 cm.

d) A concave lens of focal length 5 cm.

6) Speeds of light in vacuum, water, glass are a,b,c m/s respectively. Which of the following

   relations hold?

   a) a=b=c   b) a>b>c

   c) a>b=c   d) a>c>b

7) How many zeroes does a polynomial of degree n have on the real line?

   a) at least n   b) exactly n

   c) at most n   d) insufficient information

8) Which of the following statements is not true?

   a) (a+b) divides (a^2-ab+b^2)

   b) deg r(x) may be 0

   c) 2+$\sqrt{3}$ is a root of $x^4 - 6x^3 - 26x^2 + 138x - 35$

   d) all polynomials have at least one root on the real line

9) Which of the following conditions must a pair of linear equations satisfy if they have
infinitely many solutions?

   a) $a_1/a_2 = b_1/b_2 \neq c_1/c_2$ b) $a_1/a_2, b_1/b_2, c_1/c_2$ are all unique

   c) $a_1/a_2 = c_1/c_2 \neq b_1/b_2$ d) $a_1/a_2 = b_1/b_2 = c_1/c_2$

10) In a triangle ABC $\angle A = x$, $\angle B = 3x-2$, $\angle C - \angle B = 9$. The three angles are respectively:

   a) 25,73,82   b) 23,74,83

   c) 25,82,73   d) 30,88,97

11) Find the value(s) of p if the quadratic equation p^{2}x^2 - 12x + p + 19 has the root 2..

   a) 1   b) 1,-1.25

   c) 4,-5   d) -1,1.25

Short Answer Questions

1) If we dip a zinc nail in copper sulphate solution, what happens to the nail? Explain through a chemical equation.
2) What is the difference between rusting and corrosion?
3) What is the role of saliva in digestion of food?
4) What if humans had three or less chambers in their heart? Explain with reference to double circulation.
5) We cover half of a lens with a black coating and place an object in front of it. Comment on the nature of the image.
6) A candle is placed in front of the pinhole camera and a screen is kept on the other side. Comment on the nature of the image.
7) Let $p(x)= 3x^2 – x^3 – 3x + 5$ and $g(x)= x – 1 – x^2$. Find $q(x)$ and $r(x)$, where,
   $p(x) = g(x) × q(x) + r(x)$.

8) Find a cubic polynomial with the sum of its zeroes, sum of the product of its zeroes taken two at a time and the product of its zeroes as 2, –7, –14 respectively.

10) One says, "Give me a hundred, friend! I shall then become twice as rich as you". The other replies, "If you give me ten, I shall be six times as rich as you". Tell me what is the amount of their (respective) capital? ['Bijaganita' of Bhaskara II]

11) The sum of a number and its reciprocal is 10/3. Find the number.

Comprehension type Question

1) A student focussed the image of a candle flame on a white screen using a convex lens. He noted down the position of the candle, screen and lens as under:

   Position of candle = 12 cm

   Position of convex lens = 50 cm

   Position of the screen = 88 cm

   a) What is the focal length of the convex lens?
   b) Where will the image be formed if he shifts the candle towards the lens at a position of 31 cm?
   c) What will be nature of the image formed if he further shifts the candle towards the lens?
   d) Draw a diagram to show the formation of the image in case (c) as stated above.
   e) Find the power of the lens.

2) A ball is thrown upwards from a rooftop, 80m above the ground. It will reach a maximum vertical height and then fall back to the ground. The height of the ball from the ground at time t is h, which is given by, h = -16t² + 64t + 80.

   a) Draw a rough graph of height attained by ball vs time taken .

   b) What is the height reached by the ball after 1 second?

   c) What is the maximum height reached by the ball ?

   d) How long will it take before hitting the ground?

Appendix 4

Test 2

Class X

M.C.Q.

1) After balancing the following equation : $aKClO_3 + b\ P_4 \rightarrow c\ P_4O_{10} + d\ KCl$
Which option correctly represents the values of a,b,c and d respectively?

a) 3,10,3,10   b) 10, 10, 3, 10

c) 10,3,3,10   d) 3,10,10,3

2) Which of the following gases are used a part of rocket fuel?
a)Helium   b) Nitrogen

c) Oxygen   d) Carbon-dioxide

3) Which of the following statements is necessarily false?

a) Oxygen is required for respiration.

b) Plants absorb oxygen and release CO_2.

c) Humans cannot respire anaerobically.

d) Respiration is to humans what photosynthesis is to plants.

4) In which of the following cases does the rate of photosynthesis drop?

a) Excessive rainfall

b) Good manuring

c) Cloudy days

d) All of the above

5) Which of the following are responsible for conduction of electricity in metals?

a) Electrons   b) Protons

c) Neutrons.   d) All of the above

6) A line Lnever cuts the x axis and cuts y axis at y = 2. Which statement is correct?

a) It has positive slope   b) It has negative slope

c) The line is parallel to the x-axis.

d) The line has a negative intercept on the x axis.

7) Which of the following statements is not true?

a) 6 is a divisor of $(96-42)^2$

b) deg r(x) may be 0

c) A line can cut a curve at more than 2 points

d) We can draw an infinite number of lines through 2 gives points.

8) Find the value(s) of a if one of the roots of the quadratic equation $a^2/x - x + a - 2$ is 2.

a) 2   b) 2,-1.5

c) 4,-5   d) 2,-2

Short Answer Questions

1. An archaeologist found some gold while searching for treasure. He went to a friend who was a scientist to help him hide the treasure. His friend came up with the idea of coating the gold with copper so it could be hidden easily. Was the idea a good one? How can it be done? Explain briefly.
2. A trick often used by street artists to produce fire out of nowhere is quite commonplace. The secret to the trick is a very common metal we encounter in our lives. What is the metal? Where do we most commonly encounter it? Can some other metal be used in place of this metal?
3. What is the role of oesophagus in digestion of food?
4. Should the resistance of ammeter be high or low? What about voltmeter?
5. A passenger train takes 2 hours less for a journey of 300 km, if its speed is increased by 5km/hr from its usual speed. Find the usual speed.
6. Find the sum and product of the zeroes of the polynomial $4x^2 - 7x$.

Comprehension type Questions

1. A man makes a garden, rectangular in shape, such that its length is 4 times the breadth.The breadth is 10m. Find the following.

1) The area the garden.

2) Perimeter of the garden.

3) The man wants to put a fence around the garden. If the cost of fencing is Rs 10/m ,how much the man had to pay.

4) Suppose he wanted to make asquare garden of the same perimeter, will its area be bigger?

5) The man also wants to install a circular fountain at the centre, one fourth of the garden's area. Find the radius of the fountain.

2.
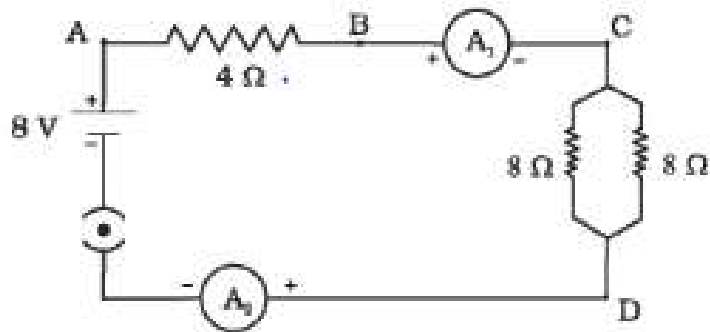
Answer the following questions based on the above figure.

1) Current flowing through the 8 ohm resistors?
2) Power dissipated in the 4 ohm resistor?
3) Is there a difference in the readings of the ammeters?
4) Drop in potential across the 8 ohm resistors?
5) Suppose the ammeter A_1 was connected in parallel to the 8 ohm resistors what will be the current flowing through the 8 ohm resistors?