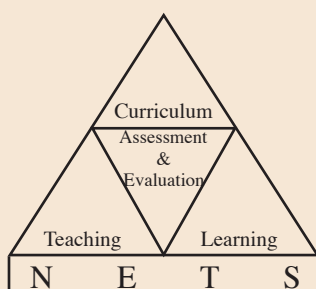




G.C.E.(O.L.) Examination - 2011

Evaluation Report

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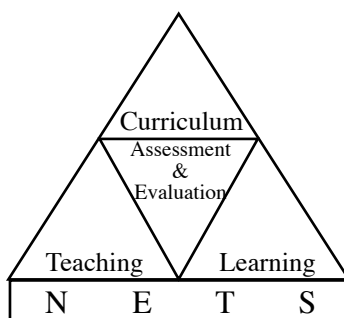


**Research & Development Branch
National Evaluation & Testing Service
Department of Examinations**

G.C.E.(O.L.) Examination - 2011

Evaluation Report

34 - Science



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Department of Examinations**

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Evaluation Report - G.C.E.(O.L.) Examination - 2011

Financial Aid

Transforming the School Education System as the Foundation
of a knowledge Hub Project (TSEP-WB)

INTRODUCTION

Out of all the public examinations in Sri Lanka, the largest number of candidates sit the G.C.E.(O.L.) Examination. The certificate awarded on the results of this examination conducted at the national level, is used not only to select those who are eligible for higher education but also to secure medium level jobs. It is also a basic requirement to follow certain courses of study in International Universities. It has secured such an acceptance due to its validity and reliability as well as its high quality.

Students strive hard to acquire a high achievement level at this examination while their teachers as well as their parents work hard to fulfil the students' expectations. By preparing this evaluation report, the Department of Examinations intends to help students in achieving their goals. It is certain that the information included in this evaluation report will be equally useful to candidates, teachers, principals, subject directors, in-service advisors, parents and researchers in Education. Thus it is more suitable to keep this report in a library for the benefit of the majority.

This evaluation report consists of three parts. Part I contains the objectives of the subject and information on subject achievement. It also elaborates the achievements of the statistical candidates in relation to the different parts of the questions in the question paper. Since this analysis has been done by the Research and Development Division of this Department on the basis of the Classical Test Theory and the Item Response Theory used in the field of evaluation and testing, the information presented here has a high validity and reliability.

Part II contains expected answers for Paper I and Paper II, the marking scheme and the observations regarding answering questions and suggestions for feedback.

Part III of this report embodies the facts that should be taken into considered by the candidates when answering each question and opinions and suggestions with regard to the learning teaching process. I think that this report is of immense value in the organisation of the learning teaching process to achieve respective competencies and competency levels.

I would like to invite suggestions to improve the quality of this report and wish to extend my sincere thanks to the controlling examiners, the chief examiners and the officers of the Department of Examinations for working hard to prepare this evaluation report.

W.M.N.J. Pushpakumara
Commissioner General of Examinations

20th October 2012
Research and Development Branch
National Evaluation and Testing Service
Department of Examinations
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Part I

1. Subject objectives and information on subject achievements

1.1 Subject objectives

After following this course the student will,

- * construct scientific concepts and principles systematically through a joyful learning environment;
- * develop competencies required to solve problems adopting the processes of science and the scientific method appropriately;
- * develop competencies required to manage environmental resources wisely realizing their potentials;
- * develop competencies relevant to the application of scientific knowledge for a healthy life style physically and mentally;
- * develop competencies essential to live communally as a successful citizen who can contribute to country's development and for further education and future employment;
- * develop competencies essential to understand natural phenomena and the scientific foundation of the universe;
- * be keen in using the fitting technology to develop productivity and efficiency to an optimal level when using force and energy; and
- * identify the dynamic nature and limits of science and develop skills for evaluating on scientific criteria the day to day experiences and information communicated by various media.

1.2 Statistical Information on subject achievement

1.2.1 Number of candidates sat for the subject

Medium	School	Private	Total
Sinhala	223826	6216	230042
Tamil	65188	12282	77470
English	9927	2641	12568
Total	298941	21139	320080

Table 1

1.2.2 Grades obtained by the candidates

Grade	School Candidates		Private Candidates		Total	Percentage
	Number	Percentage	Number	Percentage		
A	21750	7.28	303	1.43	22053	6.89
B	20721	6.93	621	2.94	21342	6.67
C	47881	16.02	1900	8.99	49781	15.55
S	88382	29.56	6057	28.65	94438	29.50
W	120207	40.21	12258	57.99	132465	41.39
Total	298941	100.00	21139	100.00	320080	100.00

Table 2

1.2.3 Grades obtained by school candidates who sat the examination for the first time - District wise

District	No. Sat	Distinction (A)		Very Good Pass (B)		Credit Pass (C)		Ordinary pass (S)		Pass (A+B+C+S)		Weak Pass (W)	
		Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
1. Colombo	29869	4572	15.31	3314	11.10	6042	20.23	8070	27.02	21998	73.65	7871	26.35
2. Gampaha	25400	2256	8.88	2078	8.18	4955	19.51	7602	29.93	16891	66.50	8509	33.50
3. Kalutara	14244	1339	9.40	1277	8.97	2849	20.00	4055	28.47	9520	66.84	4724	33.16
4. Kandy	19311	1592	8.24	1599	8.28	3369	17.45	5725	29.65	12285	63.62	7026	36.38
5. Matale	6338	391	6.17	399	6.30	1023	16.14	1857	29.30	3670	57.90	2668	42.10
6. Nuwara Eliya	9592	357	3.72	476	4.96	1203	12.54	2816	29.36	4852	50.58	4740	49.42
7. Galle	15034	1706	11.35	1333	8.87	2784	18.52	4192	27.88	10015	66.62	5019	33.38
8. Matara	11133	1115	10.02	982	8.82	2170	19.49	3285	29.51	7552	67.83	3581	32.17
9. Hambantota	8708	751	8.62	692	7.95	1673	19.21	2587	29.71	5703	65.49	3005	34.51
10. Jaffna	10100	603	5.97	634	6.28	1361	13.48	2775	27.48	5373	53.20	4727	46.80
11. Kilinochchi	1974	38	1.93	61	3.09	134	6.79	474	24.01	707	35.82	1267	64.18
12. Mannar	1568	42	2.68	61	3.89	224	14.29	570	36.35	897	57.21	671	42.79
13. Vavuniya	2843	123	4.33	138	4.85	393	13.82	861	30.28	1515	53.29	1328	46.71
14. Mullativu	1534	25	1.63	40	2.61	112	7.30	385	25.10	562	36.64	972	63.36
15. Batticaloa	6813	364	5.34	408	5.99	975	14.31	1851	27.17	3598	52.81	3215	47.19
16. Ampara	8968	535	5.97	653	7.28	1681	18.74	3014	33.61	5883	65.60	3085	34.40
17. Trincomalee	5239	201	3.84	285	5.44	689	13.15	1630	31.11	2805	53.54	2434	46.46
18. Kurunegala	21446	1633	7.61	1674	7.81	3952	18.43	6742	31.44	14001	65.28	7445	34.72
19. Puttalam	9228	520	5.64	535	5.80	1362	14.76	2790	30.23	5207	56.43	4021	43.57
20. Anuradhapura	11517	597	5.18	720	6.25	1835	15.93	3456	30.01	6608	57.38	4909	42.62
21. Polonnaruwa	5265	286	5.43	303	5.75	827	15.71	1541	29.27	2957	56.16	2308	43.84
22. Badulla	12028	679	5.65	792	6.58	1950	16.21	3480	28.93	6901	57.37	5127	42.63
23. Monaragala	6578	254	3.86	326	4.96	941	14.31	1815	27.59	3336	50.71	3242	49.29
24. Ratnapura	14518	962	6.63	1027	7.07	2493	17.17	4076	28.08	8558	58.95	5960	41.05
25. Kegalle	10716	782	7.30	790	7.37	2000	18.66	3373	31.48	6945	64.81	3771	35.19
All Island	269797	21723	8.05	20597	7.63	46998	17.42	79025	29.29	168343	62.40	101454	37.60

Table 3

1.2.4 Grades obtained by school candidates who sat the examination for the first time - Zonal wise

Educational Zone	No. Sat	Distinction (A)		Very Good Pass (B)		Credit Pass (C)		Ordinary pass (S)		Pass (A+B+C+S)		Weak Pass (W)	
		Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
1. Colombo	14052	3161	22.50	1809	12.87	2717	19.34	3005	21.38	10692	76.09	3360	23.91
2. Homagama	3455	227	6.57	234	6.77	670	19.39	1076	31.14	2207	63.88	1248	36.12
3. Jayawardanapura	6817	678	9.95	691	10.14	1522	22.33	2234	32.77	5125	75.18	1692	24.82
4. Piliyandala	5545	506	9.13	580	10.46	1133	20.43	1755	31.65	3974	71.67	1571	28.33
5. Gampaha	7404	1038	14.02	751	10.14	1542	20.83	2001	27.03	5332	72.02	2072	27.98
6. Minuwangoda	4714	261	5.54	330	7.00	864	18.33	1494	31.69	2949	62.56	1765	37.44
7. Negombo	6783	473	6.97	477	7.03	1219	17.97	2083	30.71	4252	62.69	2531	37.31
8. Kelaniya	6499	484	7.45	520	8.00	1330	20.46	2024	31.14	4358	67.06	2141	32.94
9. Kalutara	6963	641	9.21	682	9.79	1432	20.57	2055	29.51	4810	69.08	2153	30.92
10. Matugama	2817	275	9.76	258	9.16	549	19.49	737	26.16	1819	64.57	998	35.43
11. Horana	4464	423	9.48	337	7.55	868	19.44	1263	28.29	2891	64.76	1573	35.24
12. Kandy	6902	1217	17.63	921	13.34	1508	21.85	1725	24.99	5371	77.82	1531	22.18
13. Denuwara	2138	73	3.41	112	5.24	303	14.17	697	32.60	1185	55.43	953	44.57
14. Gampola	3195	95	2.97	176	5.51	416	13.02	999	31.27	1686	52.77	1509	47.23
15. Teldeniya	1627	38	2.34	75	4.61	234	14.38	477	29.32	824	50.65	803	49.35
16. Wattagama	2438	73	2.99	139	5.70	395	16.20	799	32.77	1406	57.67	1032	42.33
17. Katugastota	3011	96	3.19	176	5.85	513	17.04	1028	34.14	1813	60.21	1198	39.79
18. Matale	3372	317	9.40	253	7.50	588	17.44	981	29.09	2139	63.43	1233	36.57
19. Galewela	1975	50	2.53	104	5.27	301	15.24	602	30.48	1057	53.52	918	46.48
20. Naula	500	15	3.00	21	4.20	68	13.60	153	30.60	257	51.40	243	48.60
21. Wilgamuwa	491	9	1.83	21	4.28	66	13.44	121	24.64	217	44.20	274	55.80
22. Nuwara Eliya	2597	50	1.93	85	3.27	286	11.01	878	33.81	1299	50.02	1298	49.98
23. Kotmale	1292	47	3.64	68	5.26	159	12.31	397	30.73	671	51.93	621	48.07
24. Hatton	2823	119	4.22	161	5.70	357	12.65	735	26.04	1372	48.60	1451	51.40
25. Walapane	1305	33	2.53	54	4.14	150	11.49	400	30.65	637	48.81	668	51.19
26. Hanguranketha	1575	108	6.86	108	6.86	251	15.94	406	25.78	873	55.43	702	44.57
27. Galle	6738	999	14.83	771	11.44	1323	19.63	1767	26.22	4860	72.13	1878	27.87
28. Elpitiya	3041	186	6.12	194	6.38	511	16.80	915	30.09	1806	59.39	1235	40.61
29. Ambalangoda	3410	427	12.52	237	6.95	621	18.21	931	27.30	2216	64.99	1194	35.01
30. Udugama	1845	94	5.09	131	7.10	329	17.83	579	31.38	1133	61.41	712	38.59
31. Matara	4850	733	15.11	539	11.11	1015	20.93	1339	27.61	3626	74.76	1224	25.24
32. Akuressa	1945	148	7.61	146	7.51	392	20.15	601	30.90	1287	66.17	658	33.83
33. Mulatiyana	2087	125	5.99	172	8.24	366	17.54	636	30.47	1299	62.24	788	37.76
34. Morawaka	2251	109	4.84	125	5.55	397	17.64	709	31.50	1340	59.53	911	40.47

Educational Zone	No. Sat	Distinction (A)		Very Good Pass (B)		Credit Pass (C)		Ordinary pass (S)		Pass (A+B+C+S)		Weak Pass (W)	
		Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
35. Tangalle	2467	172	6.97	202	8.19	512	20.75	762	30.89	1648	66.80	819	33.20
36. Hambantota	3760	191	5.08	254	6.76	685	18.22	1173	31.20	2303	61.25	1457	38.75
37. Walasmulla	2481	388	15.64	236	9.51	476	19.19	652	26.28	1752	70.62	729	29.38
38. Jaffna	3668	337	9.19	312	8.51	589	16.06	1032	28.14	2270	61.89	1398	38.11
39. Islands	705	9	1.28	6	0.85	54	7.66	188	26.67	257	36.45	448	63.55
40. Thenmarachchi	1087	47	4.32	58	5.34	147	13.52	280	25.76	532	48.94	555	51.06
41. Valikamam	2802	92	3.28	136	4.85	338	12.06	780	27.84	1346	48.04	1456	51.96
42. Vadamarachchi	1838	118	6.42	122	6.64	233	12.68	495	26.93	968	52.67	870	47.33
43. Kilinochchi	1974	38	1.93	61	3.09	134	6.79	474	24.01	707	35.82	1267	64.18
44. Mannar	1265	40	3.16	57	4.51	185	14.62	463	36.60	745	58.89	520	41.11
45. Madu	303	2	0.66	4	1.32	39	12.87	107	35.31	152	50.17	151	49.83
46. Vavuniya	2235	117	5.23	123	5.50	331	14.81	700	31.32	1271	56.87	964	43.13
47. Vavuniya North	608	6	0.99	15	2.47	62	10.20	161	26.48	244	40.13	364	59.87
48. Mullaitivu	1012	17	1.68	31	3.06	89	8.79	256	25.30	393	38.83	619	61.17
49. Thunukkai	522	8	1.53	9	1.72	23	4.41	129	24.71	169	32.38	353	67.62
50. Batticaloa	2793	174	6.23	152	5.44	367	13.14	680	24.35	1373	49.16	1420	50.84
51. Kalkudah	1182	8	0.68	29	2.45	101	8.54	252	21.32	390	32.99	792	67.01
52. Paddirippu	1618	49	3.03	73	4.51	214	13.23	486	30.04	822	50.80	796	49.20
53. Batticaloa Central	1220	133	10.90	154	12.62	293	24.02	433	35.49	1013	83.03	207	16.97
54. Ampara	2275	153	6.73	175	7.69	409	17.98	726	31.91	1463	64.31	812	35.69
55. Kalmunai	2189	197	9.00	216	9.87	479	21.88	785	35.86	1677	76.61	512	23.39
56. Sammanthurai	1129	45	3.99	47	4.16	170	15.06	389	34.46	651	57.66	478	42.34
57. Mahaoya	594	12	2.02	16	2.69	76	12.79	177	29.80	281	47.31	313	52.69
58. Dehiattakandiya	1060	24	2.26	57	5.38	165	15.57	267	25.19	513	48.40	547	51.60
59. Akkaraipattu	1721	104	6.04	142	8.25	382	22.20	670	38.93	1298	75.42	423	24.58
60. Trincomalee	1944	118	6.07	150	7.72	324	16.67	631	32.46	1223	62.91	721	37.09
61. Mutur	988	25	2.53	36	3.64	82	8.30	264	26.72	407	41.19	581	58.81
62. Kantale	1053	25	2.37	46	4.37	134	12.73	312	29.63	517	49.10	536	50.90
63. Kinnya	1254	33	2.63	53	4.23	149	11.88	423	33.73	658	52.47	596	47.53
64. Kurunegala	5147	764	14.84	542	10.53	1065	20.69	1411	27.41	3782	73.48	1365	26.52
65. Kuliyaipitiya	3725	256	6.87	267	7.17	716	19.22	1176	31.57	2415	64.83	1310	35.17
66. Nikaweratiya	2769	128	4.62	207	7.48	503	18.17	930	33.59	1768	63.85	1001	36.15
67. Maho	3356	104	3.10	178	5.30	542	16.15	1164	34.68	1988	59.24	1368	40.76
68. Giriulla	3731	179	4.80	288	7.72	712	19.08	1172	31.41	2351	63.01	1380	36.99
69. Ibbagamuwa	2718	202	7.43	192	7.06	414	15.23	889	32.71	1697	62.44	1021	37.56
70. Puttalam	4242	149	3.51	175	4.13	526	12.40	1308	30.83	2158	50.87	2084	49.13
71. Chilaw	4986	371	7.44	360	7.22	836	16.77	1482	29.72	3049	61.15	1937	38.85

Educational Zone	No. Sat	Distinction (A)		Very Good Pass (B)		Credit Pass (C)		Ordinary pass (S)		Pass (A+B+C+S)		Weak Pass (W)	
		Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
72. Anuradhapura	3959	383	9.67	320	8.08	729	18.41	1063	26.85	2495	63.02	1464	36.98
73. Tambuttegama	2088	47	2.25	94	4.50	305	14.61	638	30.56	1084	51.92	1004	48.08
74. Kekirawa	2151	88	4.09	135	6.28	312	14.50	669	31.10	1204	55.97	947	44.03
75. Galenbidunuwewa	1523	41	2.69	90	5.91	238	15.63	537	35.26	906	59.49	617	40.51
76. Kebithigollewa	1796	38	2.12	81	4.51	251	13.98	549	30.57	919	51.17	877	48.83
77. Polonnaruwa	1652	138	8.35	139	8.41	329	19.92	464	28.09	1070	64.77	582	35.23
78. Hingurakgoda	2097	124	5.91	120	5.72	304	14.50	593	28.28	1141	54.41	956	45.59
79. Dimbulagala	1516	24	1.58	44	2.90	194	12.80	484	31.93	746	49.21	770	50.79
80. Badulla	3381	208	6.15	240	7.10	638	18.87	999	29.55	2085	61.67	1296	38.33
81. Bandarawela	3139	314	10.00	281	8.95	564	17.97	848	27.01	2007	63.94	1132	36.06
82. Mahiyanganaya	1920	69	3.59	103	5.36	232	12.08	512	26.67	916	47.71	1004	52.29
83. Welimada	2631	74	2.81	141	5.36	421	16.00	833	31.66	1469	55.83	1162	44.17
84. Passara	957	14	1.46	27	2.82	95	9.93	288	30.09	424	44.31	533	55.69
85. Monaragala	2117	88	4.16	96	4.53	272	12.85	612	28.91	1068	50.45	1049	49.55
86. Wellawaya	2871	131	4.56	168	5.85	438	15.26	748	26.05	1485	51.72	1386	48.28
87. Bibile	1590	35	2.20	62	3.90	231	14.53	455	28.62	783	49.25	807	50.75
88. Ratnapura	5800	553	9.53	511	8.81	1049	18.09	1529	26.36	3642	62.79	2158	37.21
89. Balangoda	2631	164	6.23	177	6.73	479	18.21	770	29.27	1590	60.43	1041	39.57
90. Nivitigala	2551	82	3.21	119	4.66	359	14.07	760	29.79	1320	51.74	1231	48.26
91. Embilipitiya	3536	163	4.61	220	6.22	606	17.14	1017	28.76	2006	56.73	1530	43.27
92. Kegalle	4057	449	11.07	367	9.05	889	21.91	1198	29.53	2903	71.56	1154	28.44
93. Mawanella	3462	223	6.44	237	6.85	632	18.26	1134	32.76	2226	64.30	1236	35.70
94. Dehiowita	3197	110	3.44	186	5.82	479	14.98	1041	32.56	1816	56.80	1381	43.20
All Island	269797	21723	8.05	20597	7.63	46998	17.42	79025	29.29	168343	62.40	101454	37.60

Table 4

1.2.5 Marks obtained according to class intervals

Class Interval	Frequency	Frequency Percentage	Cumulative Frequency	Cumulative Frequency Percentage
91 - 100	533	0.17	320080	100.00
81 - 90	5933	1.85	319547	99.83
71 - 80	13954	4.36	313614	97.98
61 - 70	20250	6.33	299660	93.62
51 - 60	31954	9.98	279410	87.29
41 - 50	39259	12.27	247456	77.31
31 - 40	66216	20.69	208197	65.05
21 - 30	90505	28.28	141981	44.36
11 - 20	49158	15.36	51476	16.08
01 - 10	2307	0.72	2318	0.72
00 - 00	11	0.00	11	0.00

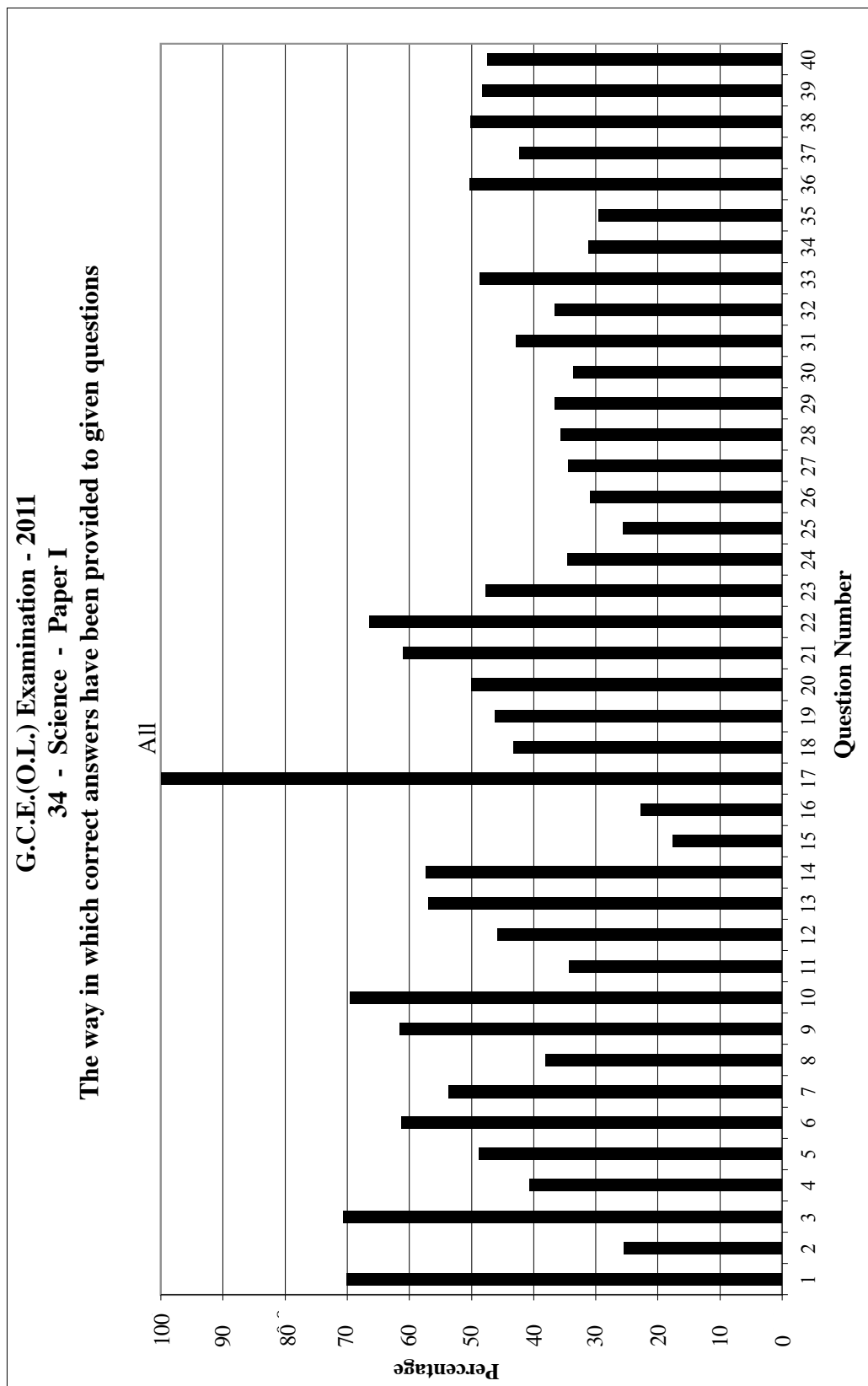
Table 5

The following example illustrates how information can be retrieved from the above table.
Ex : (Taking the class interval 31 - 40 for instance)

The number of candidates scoring from 31 to 40 is 66,216. As a percentage it is 20.69. The number scoring below 40 marks is 208,197 and as a percentage it is 65.05.

1.3 Analysis of Subject Achievement

1.3.1 Achievement in Paper I

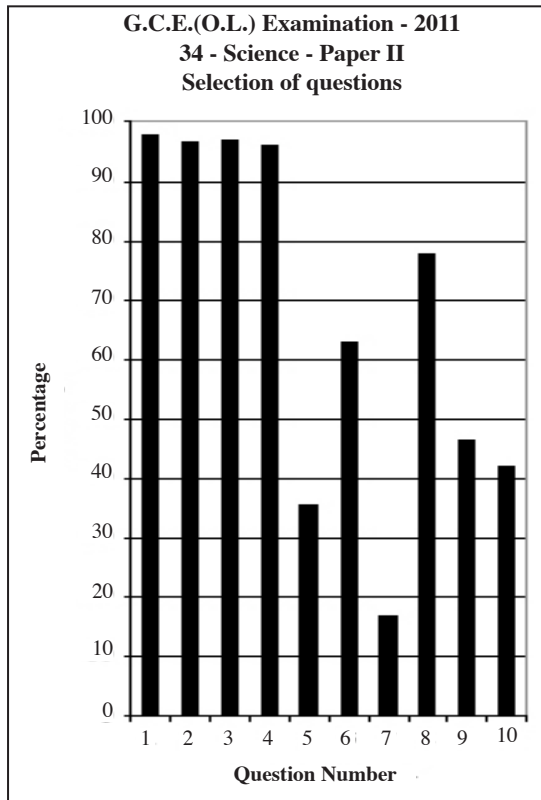


Graph 1 (Prepared using the information collected from form RD/16/05/OL)

Retrieval of information from the above graph can be illustrated by the following example.

Ex : Highest number of candidates have correctly responded to question 3. Its percentage is 71%. Least number of candidates have correctly responded to question 15. Its percentage is 18%.

1.3.2 Selection of questions in paper II

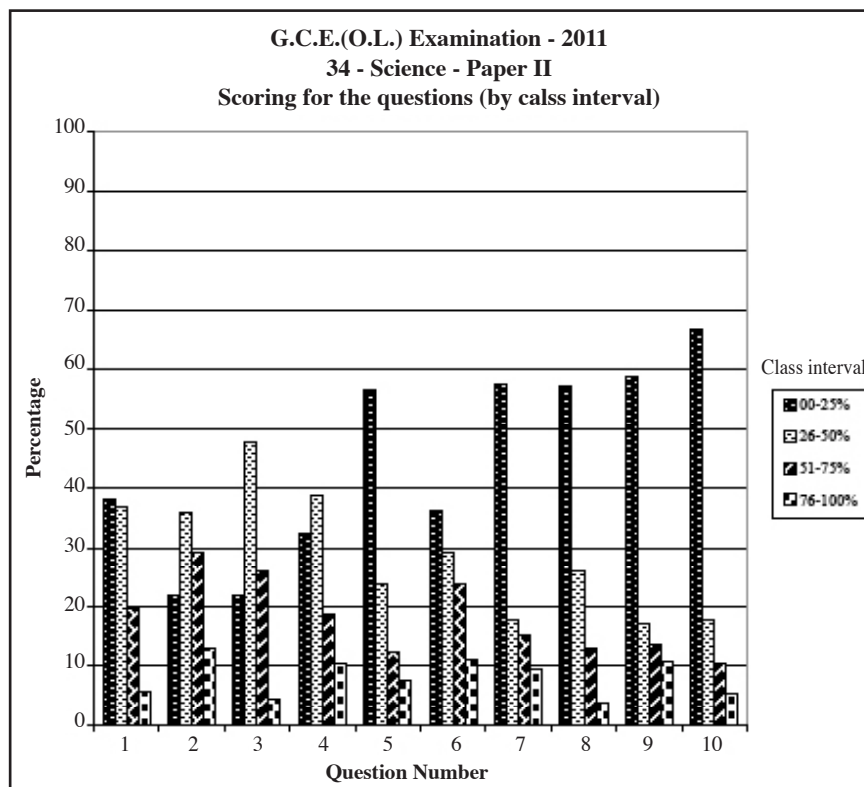


How information can be elicited from this graph is illustrated by the following example.

Ex : Though questions 1 - 4 of this were compulsory a small number has not answered even the compulsory questions. Nearly 98% have answered question 1. The percentage selecting question 7 is about 17%.

Graph 2 (Prepared using the information collected from the form RD/16/02/OL)

1.3.3 Scoring for the questions in paper II

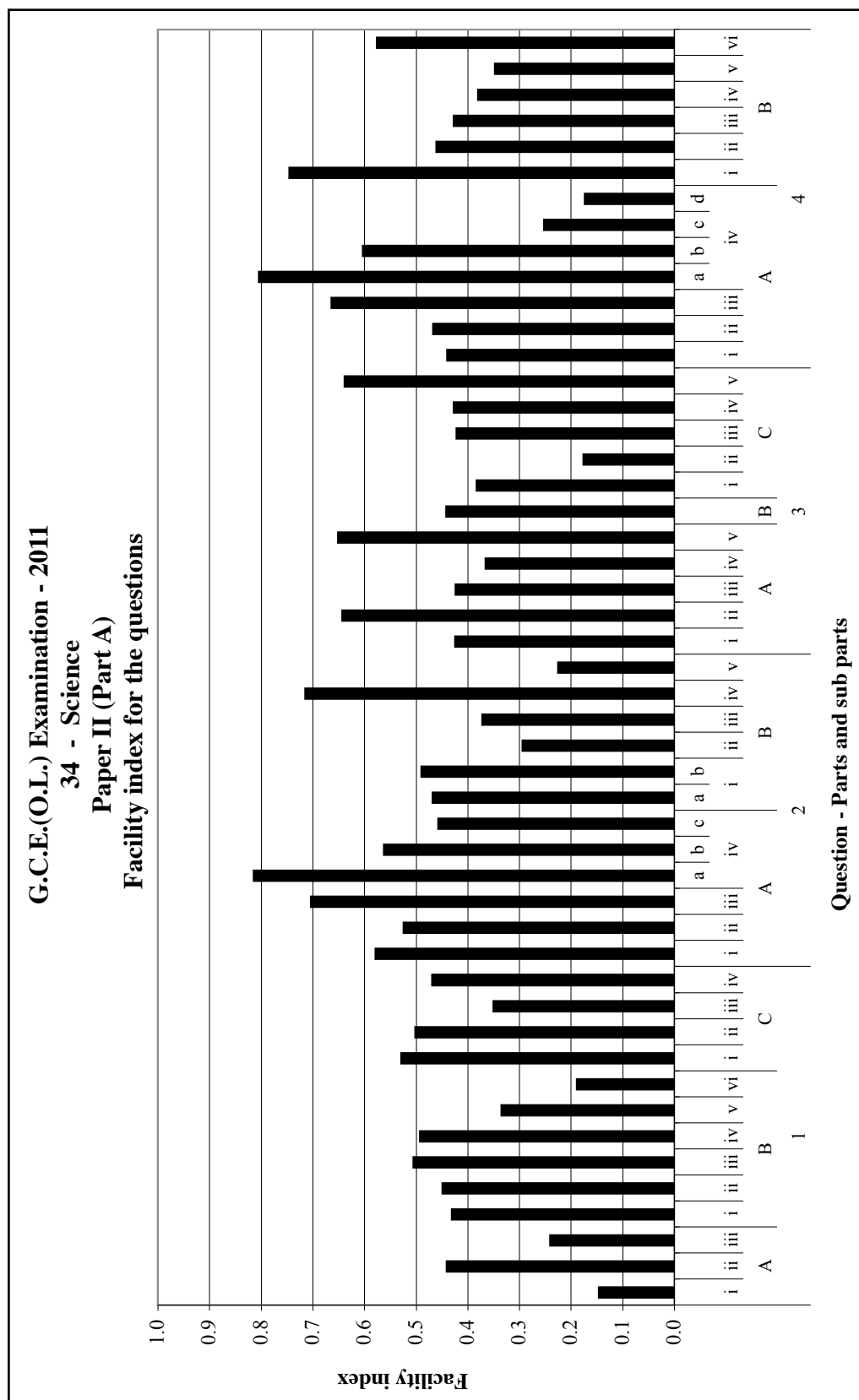


How information can be elicited from this graph is illustrated by the following example.

Ex: Marks allocated for question 1 is 15. The percentage scoring within the range of 76 - 100% of the marks allocated, that is between 12 - 15 is 5%. The percentage obtaining between 0 - 25% of the 15 marks allocated, that is from 0 to 3 is 39%.

Graph 3 (Prepared using the information collected from the form RD/16/02/OL)

1.3.4 Achievement in Paper II

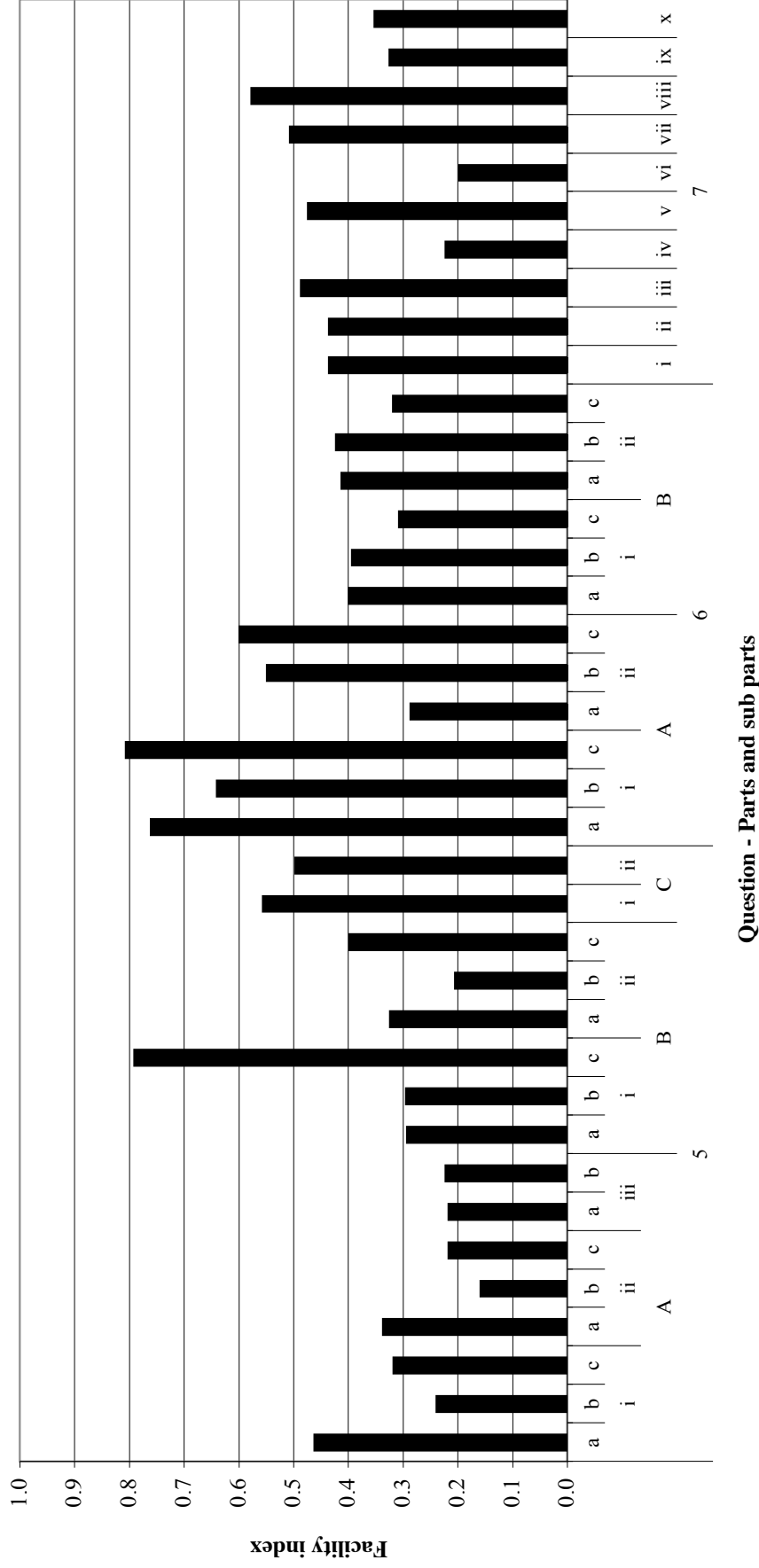


Graph 4.1 (Prepared using the information collected from the form RD/16/04/OL)

How information can be elicited from the above graph is illustrated by the following example.

Ex : The facility of part B (iii) of question 1 is 51% and the facility of part A (i) is 15%.

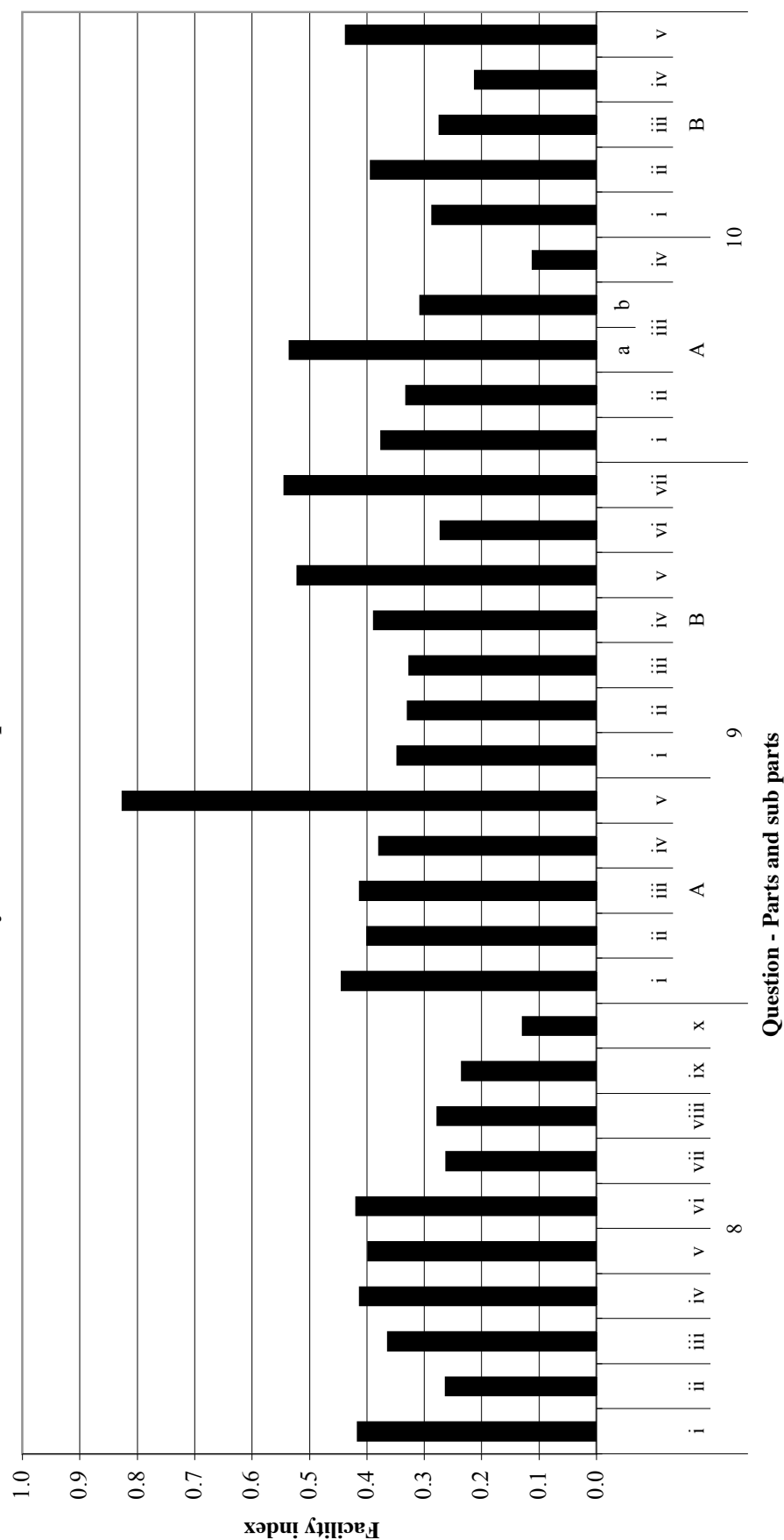
G.C.E.(O.L.) Examination - 2011
34 - Science
Paper II (Part B)
Facility index for the questions



Question - Parts and sub parts

Graph 4.2

G.C.E.(O.L.) Examination - 2011
34 - Science
Paper II (Part B)
Facility index for the questions



Question - Parts and sub parts

Graph 4.3

Part II

2. Information on questions and answers

2.1 Question paper I and information on answers to paper I

2.1.1 Structure of the paper I

Time is 01 hour. Total mark is 40.

- This question paper consists of 40 multiple choice questions each with four options. For questions from 1 - 40, the candidates were expected to select the correct or the most suitable option from the options (1), (2), (3) and (4).
- Questions have been set as follows. 1 - 12 from Biology; 13 - 24 from Chemistry; 25- 36 from Physics; and 37 - 40 from current phenomena.
- Responding to all the questions is expected.

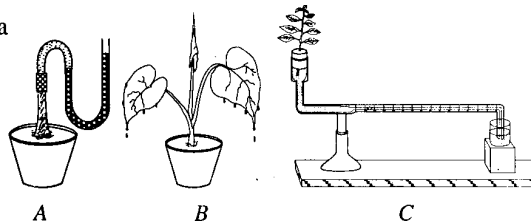
2.1.2 Paper I

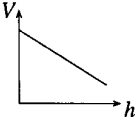
- Select which of the following feature/features conforms/conform to the statements given in question 1 and question 2.

A - presence of a nucleus
C - presence of a cell wall

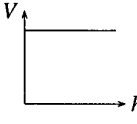
B - presence of chloroplasts
D - presence of mitochondria

- Seen **only** in plant cells is/are
(1) A. (2) A and B. (3) B and C. (4) C and D.
- A feature common to a living cell is
(1) A. (2) B. (3) C. (4) D.
- Which of the following gives the botanical name of coconut according to binomial nomenclature correctly?
(1) *Cocos nucifera* (2) *cocos nucifera*
(3) Cocos Nucifera (4) COCOS NUCIFERA
- Which of the following is the correct statement about the three main types of muscles in the human body, the skeletal muscles, smooth muscles and cardiac muscles?
(1) Cardiac muscles and skeletal muscles are striated.
(2) Cardiac muscles and smooth muscles are striated.
(3) Skeletal muscles and smooth muscles are striated.
(4) Only skeletal muscles are striated.
- What is the correct path along which an impulse travels in a reflex arc?
(1) motor neuron → sensory neuron → effector
(2) motor neuron → spinal cord → sense organ
(3) sensory neuron → spinal cord → motor neuron
(4) receptor organ → motor neuron → sensory neuron
- A person suffering from colour blindness
(1) can see only distant objects clearly. (2) can see only near objects clearly.
(3) cannot distinguish colours in dim light. (4) cannot distinguish red and green colours.
- A man sighting a barking and lunging dog, starts to run fast. Which of the following hormone secreted in the human body is related to this incident?
(1) growth hormone (2) thyroxine (3) oestrogen (4) adrenaline
- Cell division involves division of the nucleus and cytoplasm and production of daughter cells. In mitosis, daughter cell acquires
(1) a number of chromosomes equal to that in the mother cell.
(2) one of each pair of homologous chromosomes in the mother cell.
(3) twice the number of chromosomes in the mother cell.
(4) half the number of chromosomes in the mother cell.
- The 'population' is correctly defined as
(1) all the communities living in a certain area and the non-living environment interacting with them.
(2) the zone in which the living beings are spread on earth.
(3) the other organisms which prey on an organism.
(4) the organisms of the same species living within a given period of time in a specified area.
- Which of the following correctly indicates the phenomena illustrated by the diagrams A, B and C?
(1) A - transpiration, B - guttation, C - root pressure
(2) A - root pressure, B - guttation, C - transpiration
(3) A - guttation, B - transpiration, C - root pressure
(4) A - root pressure, B - transpiration, C - guttation
- Which of the following principles is justified by the fact that some organisms match their body colours with that of the environment, resemble plant leaves or twigs and have mottled (with stripes and patches) skins?
(1) changing of living organisms to suit the conditions of their environments in which they have long existed
(2) subjecting living beings' adaptations to natural selection
(3) perpetuation (persistence) of living beings just as they were from the time of their creation in the world
(4) making changes by living beings for protection from enemies

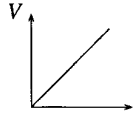


12. A function controlled by the medulla oblongata is
 (1) vision. (2) muscle-movement coordination.
 (3) heartbeat. (4) maintaining body balance.
13. In the isotope $^{37}_{17}\text{Cl}$ of chlorine, the number of protons, neutrons and electrons respectively are
 (1) 17, 17 and 20. (2) 17, 20 and 17. (3) 20, 17 and 17. (4) 17, 17 and 17.
14. An atom of a certain element contains four energy levels filled with electrons. Its outermost energy level contains two electrons. The period and group to which that element belongs respectively are
 (1) 2 and II. (2) 2 and IV. (3) 4 and II. (4) 4 and IV.
15. A balloon filled with hydrogen gas moves vertically up from the ground. Which graph correctly shows the variation of the volume of the balloon (V) against the vertical height (h) to the balloon from the ground? (Assume that the temperature remains constant.)
- 

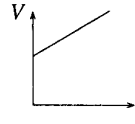
(1)



(2)



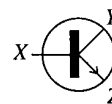
(3)



(4)
16. To two equal volumes of water at the same temperature, common salt in the form of ordinary crystals and powder was added separately and dissolved. When the two solutions are saturated, which of the following is correct about the masses of salt dissolved?
- (1) The masses dissolved are equal.
 (2) The mass of salt powder dissolved is greater than that of salt crystals.
 (3) The mass of salt crystals dissolved is greater than that of salt powder.
 (4) The mass of salt dissolved differs according to the method of dissolving.
17. Which of the following fire extinguishers can be used to extinguish a fire without leaving any substance released from it at the place of the fire?
- (1) soda-acid fire extinguisher (2) foam fire extinguisher
 (3) halon fire extinguisher (4) powder fire extinguisher
18. At an archaeological site, an old iron sword with a silver hilt was found. Though the silver hilt was well protected with fine carvings, the rest of the sword had heavily corroded. Which of the following best explains this observation?
- (1) Low quality iron has been used to make the sword.
 (2) The silver hilt had been fixed later to the sword.
 (3) Iron has acted as the cathode.
 (4) Iron has acted as the sacrificial metal.
19. The label of a bottle of concentrated hydrochloric acid (HCl) in the laboratory indicates that it is 36.5% (w/w). This means that
- (1) 100 parts of the solution contain 36.5 parts of HCl by mass.
 (2) the solution contains 36.5 parts of HCl and 63.5 parts of water by mass.
 (3) 100 parts of the solution contain 36.5 parts of HCl by volume.
 (4) the solution contains 36.5 part of HCl and 63.5 parts of water by volume.
20. Which of the following chemical found in home can be used to speed up the clotting of rubber latex?
- (1) soap solution (2) vinegar (3) sugar (4) salt solution
21. What is the formula of the compound formed by the combination of a trivalent metal M with a divalent non-metal X ?
- (1) M_3X_2 (2) M_2X_3 (3) MX_3 (4) M_2X
22. During the production of salt in salterns, precipitation of salts occurs in the order calcium carbonate, calcium sulphate and sodium chloride. Which of the following correctly gives the relationship among the solubilities of those salts?
- (1) $\text{CaCO}_3 < \text{CaSO}_4 < \text{NaCl}$ (2) $\text{NaCl} < \text{CaCO}_3 < \text{CaSO}_4$
 (3) $\text{CaSO}_4 < \text{NaCl} < \text{CaCO}_3$ (4) $\text{CaCO}_3 < \text{NaCl} < \text{CaSO}_4$
23. Of carbon, graphite and diamond are
- (1) isotopes. (2) allotropes. (3) compounds. (4) different physical states.
24. Which of the following has the maximum effect on the depletion of the ozone layer?
- (1) ammonia (NH_3) (2) carbon dioxide (CO_2)
 (3) chloroform (CHCl_3) (4) methane (CH_4)

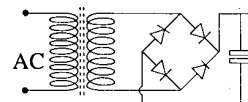
25. Which of the following is true about the transistor shown in the figure?

- (1) It belongs to PNP type.
- (2) A positive (+) potential should be applied to the terminal Y.
- (3) In the internal circuit, base is connected to an N-type semiconductor.
- (4) Y is the emitter.

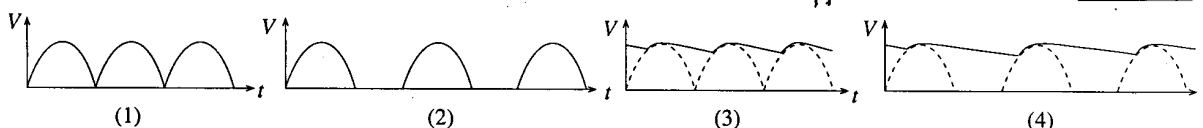


26. Equal quantities of heat are provided to two objects of equal masses made of substances of different specific heat capacities. Which of the following statements is correct with regard to the final temperature of those objects?

- (1) The temperature of the object made of the substance with higher specific heat capacity is higher.
- (2) The temperature of the object made of the substance with lower specific heat capacity is higher.
- (3) The temperatures of both the objects are the same.
- (4) Nothing can be stated without knowing the volumes of the objects.

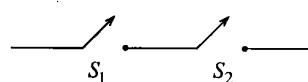


27. Which of the following graphs correctly displays the output given by the rectifier circuit shown in the diagram?

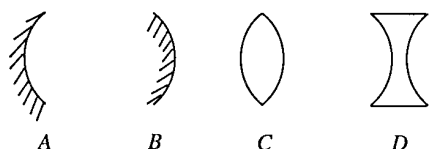


28. The part of the electrical circuit shown in the diagram with two switches connected in series demonstrates the action of a/an

- (1) AND gate.
- (2) OR gate.
- (3) NOT gate.
- (4) analog amplifier.

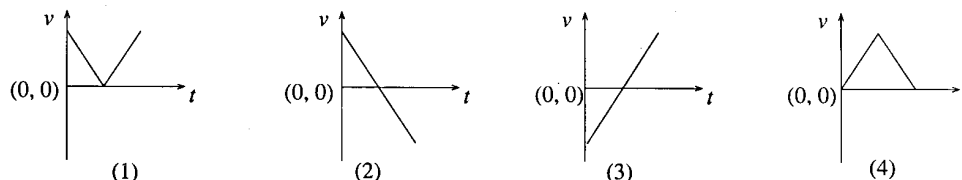


29. In any instance an object is placed in front of the optical items A, B, C and D a virtual image is produced by

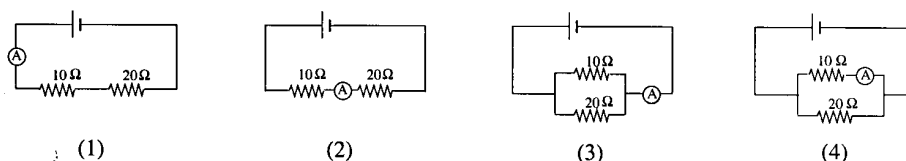


- (1) A and C.
- (2) B and C.
- (3) A and D.
- (4) B and D.

30. A stone thrown vertically upwards falls freely on the ground. Which of the following is the correct velocity-time graph for the complete motion of the stone?



31. The circuits below show four ways of connecting two resistors of resistance 10Ω and 20Ω and a cell with a constant electromotive force of 2 V. Which circuit shows the highest ammeter reading?



32. Consider the following statements regarding the electrostatic charges.

- A - The petrol bowsers are earthed through a metal chain to prevent accumulation of electrostatic charges on them.
- B - In the production of hydroelectricity, the electrostatic charges in water are converted to current electricity by the dynamo.
- C - During lightening, electrostatic charges in a cloud make an electric discharge with another cloud or with the earth.

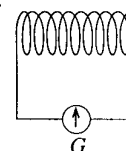
Which of the above statements are true?

- (1) A and B
- (2) A and C
- (3) B and C
- (4) A, B and C

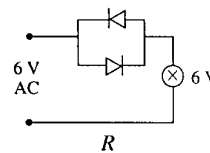
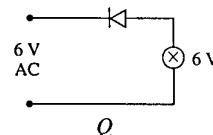
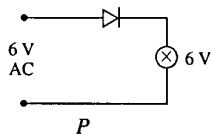
33. A coil and a sensitive centre-zero galvanometer are connected as shown in the diagram.

The galvanometer **does not** show a deflection when

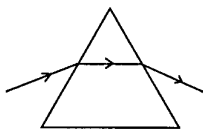
- (1) a strong bar magnet is kept motionless at the centre of the coil.
- (2) the south pole of a bar magnet is taken away from the coil.
- (3) the north pole of a bar magnet is brought closer to the coil.
- (4) a bar magnet is kept motionless and the coil is moved closer to it.



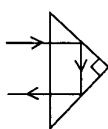
34. A 6 V alternating current (AC) is supplied to the circuits shown. Which statement is true about the 6 V bulbs connected to the circuits?



- (1) Bulb in *R* shines more brightly and bulbs in *P* and *Q* shine less brightly.
 - (2) Bulbs in *P*, *Q* and *R* shine with equal brightness.
 - (3) Bulbs in *P* and *R* shine with equal brightness but the bulb in *Q* does not light.
 - (4) Bulbs in *Q* and *R* shine with equal brightness but the bulb in *P* does not light.
35. Which of the following ray diagrams displays a phenomenon that **cannot** occur when a monochromatic (single colour) ray of light passes through a prism?



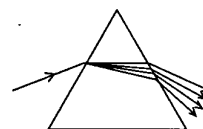
(1)



(2)



(3)



(4)

36. Which of the following can be explained by the equilibrium among three forces?
- (1) Equilibrium of an object suspended in a spring balance
 - (2) Equilibrium of an object floating in water
 - (3) Equilibrium of an ordinary pan balance used with weights
 - (4) Equilibrium of a book kept on a table
37. It was reported recently that a small asteroid passed across the moon's orbit around Earth. Which of the following is least likely to happen in such an occasion?
- (1) Attraction of the asteroid towards earth and catching fire
 - (2) Falling the asteroid on moon subjected to its attraction
 - (3) Deviation of moon from its orbit
 - (4) Changing of the path of the asteroid
38. Deaths and destruction of property due to natural disasters are on the increase at present. The best measure that can be adopted to minimise losses during such a disaster is
- (1) becoming aware about the environmental pollution and taking steps to minimise it.
 - (2) refraining from deforestation of hilly areas and setting fire to forests in such areas.
 - (3) evacuating the disaster-prone areas and resettling in safer areas.
 - (4) paying attention well to warnings on disasters and preparation in advance.
39. Recently it was published that there is a gaseous fuel ore in the Sri Lankan sea bed. What gas would most probably be a major component of that ore?
- | | | | |
|--------------|----------|-------------|---------------------|
| (1) nitrogen | (2) neon | (3) methane | (4) sulphur dioxide |
|--------------|----------|-------------|---------------------|
40. Which of the following has the **highest** risk of being struck with lightening during a thunderstorm?
- | | |
|---------------------------|---|
| (1) use of a mobile phone | (2) use of a land phone with wire connections |
| (3) travelling in a bus | (4) use of a radio without an antenna |

* * *

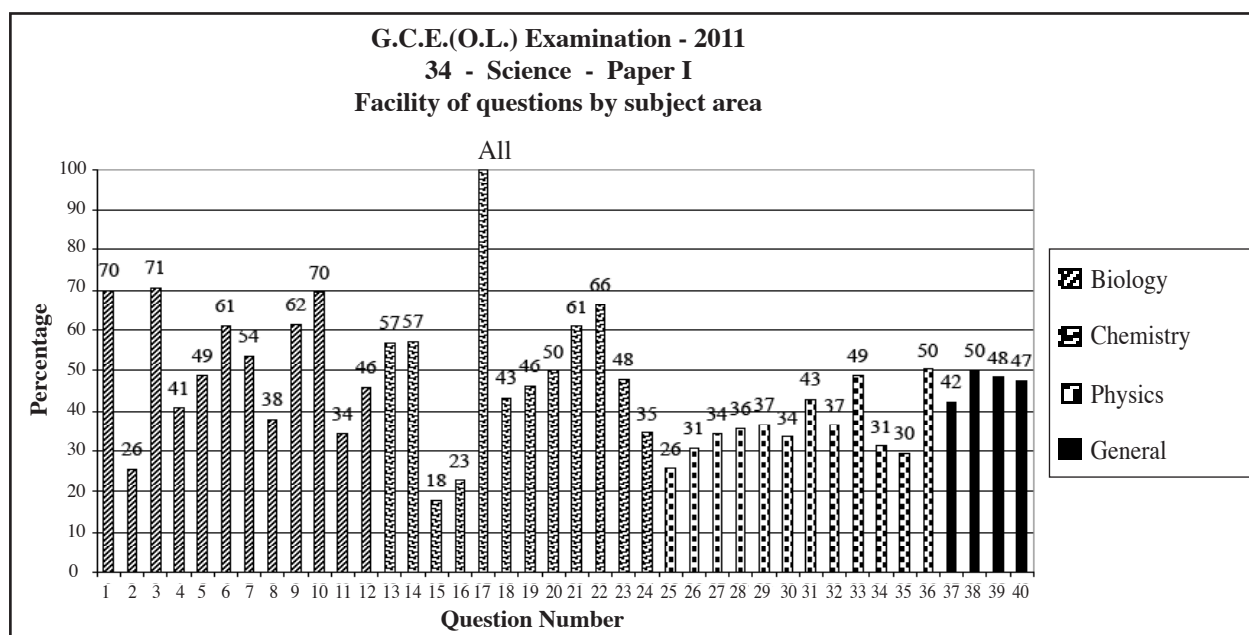
2.1.3 Expected answers and the marking scheme for paper I

Question No.	Answer	Question No.	Answer
01.	3	21.	2
02.	4	22.	1
03.	1	23.	2
04.	1	24.	3
05.	3	25.	2
06.	4	26.	2
07.	4	27.	3
08.	1	28.	1
09.	4	29.	4
10.	2	30.	2
11.	2	31.	3
12.	3	32.	2
13.	2	33.	1
14.	3	34.	1
15.	4	35.	4
16.	1	36.	3
17.	All	37.	3
18.	4	38.	4
19.	1	39.	3
20.	2	40.	2

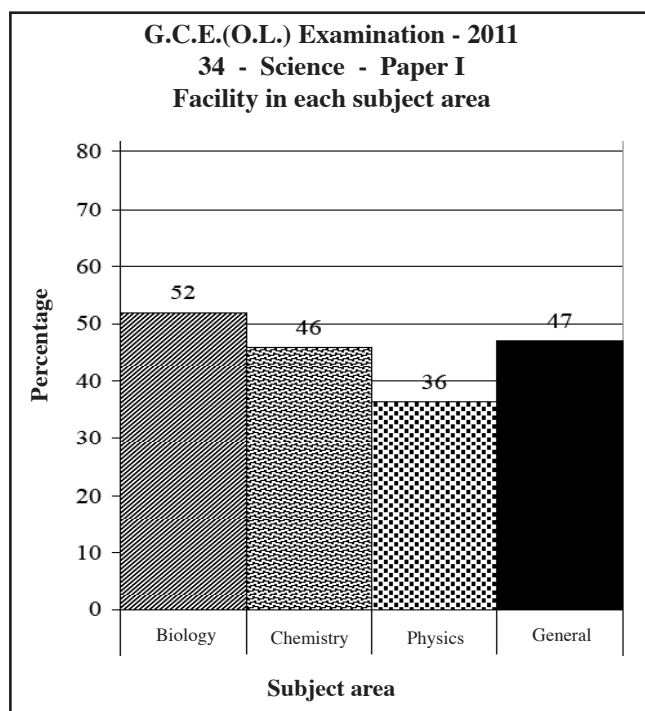
Each correct answer carries 02 marks, amounting the total to 80.

$$\text{Final mark for paper I} = \frac{80}{2} = 40$$

2.1.4 Observations on the responses to paper I (by subject area) :



Question Number	Subject area	The question of highest facility and its facility	The question of lowest facility and its facility
1 - 12	Biology	3 (71%)	2 (26%)
13 - 24	Chemistry	22 (66%)	15 (18%)
25 - 36	Physics	36 (50%)	25 (26%)
37 - 40	General	38 (50%)	37 (42%)



Of the major themes on which paper I was set, Biology had been a facile part for 52% of the students. 47% have responded correctly for general questions based on current phenomena. Physics had been an easy section for 36%. The most difficult subject theme in paper I is Physics.

On the whole, the facility of paper I is 44.9%.

2.1.5 Responses to the options in paper I - as a percentage

Question Number	Correct Answer	Percentage of students selecting each option				
		1	2	3	4	Missing
1	3	6%	18%	70%	6%	–
2	4	55%	7%	12%	25%	1%
3	1	71%	7%	14%	8%	–
4	1	41%	18%	19%	22%	–
5	3	16%	17%	49%	18%	–
6	4	3%	7%	28%	61%	1%
7	4	16%	21%	9%	54%	–
8	1	38%	27%	12%	22%	1%
9	4	19%	10%	10%	61%	–
10	2	13%	69%	9%	9%	–
11	2	15%	34%	5%	45%	1%
12	3	8%	20%	46%	26%	–
13	2	19%	57%	17%	7%	–
14	3	10%	23%	57%	9%	1%
15	4	13%	22%	48%	17%	–
16	1	23%	32%	17%	27%	1%
17	* All	30%	21%	38%	11%	–
18	4	8%	8%	41%	43%	–
19	1	46%	16%	27%	10%	1%
20	2	21%	50%	12%	17%	–
21	2	18%	61%	14%	7%	–
22	1	66%	14%	10%	10%	–
23	2	12%	48%	24%	16%	–
24	3	12%	31%	34%	22%	1%
25	2	32%	26%	25%	17%	–
26	2	25%	31%	18%	26%	–
27	3	30%	22%	34%	14%	–
28	1	36%	21%	21%	22%	–
29	4	18%	21%	24%	37%	–
30	2	12%	34%	9%	45%	–
31	3	24%	18%	43%	15%	–
32	2	8%	36%	30%	26%	–
33	1	49%	18%	15%	19%	–
34	1	31%	17%	37%	15%	–
35	4	24%	20%	27%	29%	–
36	3	21%	13%	50%	15%	1%
37	3	21%	19%	42%	18%	–
38	4	20%	16%	13%	50%	1%
39	3	20%	12%	48%	20%	–
40	2	35%	47%	3%	14%	1%

* Under each question the student percentage selecting the correct option is shaded.

* 'Missing' indicates the percentage of students selecting more than one option.

* For question 17, all responses were considered correct.

2.1.6 Overall observations, conclusions and suggestions regarding the answers to paper I

In answering question paper I, most of the students have become unsuccessful in questions 2, 11, 15, 16, 18, 25, 26, 27, 30, 34 and 35.

As regards question 11 connected to Biology, the percentage selecting option 2, the correct answer is 34% whereas 45% have selected option 4. The reason for this is the misunderstanding of students that the organisms' acquired characteristics for protection from enemies are inherited leading to their natural selection. When teaching the principles of evolution, it should be emphatically stated that modifications are not inherited and what is inherited are the fitting variations or adaptations caused by the changes in hereditary characteristics.

Less than 24% have responded for the questions 15 and 16. For question 15, only 17% have selected the correct response (option 4), but 48% have taken distractor 3 as the correct response. In this, the students have failed to understand that initially there had been a certain volume of the gas in the balloon. But they understood that when the balloon rises, its volume increases due to the decrease in pressure. This may be because the students' recall of the fact that when they were taught the relevant principles through Boyle's law, the graph of $\frac{1}{V}$ against P is a straight line passing through the origin.

For this, the students should be made to understand through practical activities that when a gas bubble rises up from the bottom of a vessel of water, its volume increases with height. They should be imparted with the ability of applying this behaviour in other similar occasions. In this experiment, it should be stressed that there is an initial volume for the gas.

The correct option 1 has been selected by 23% for question 16. Options 2 and 4 were chosen by 32% and 27% respectively. Incomprehension of saturated solutions and not understanding that the factors affecting the rate of reactions do not affect saturation would have been the reasons for it. This situation can be avoided by offering opportunities to involve in practical activities compulsorily when preparing saturated solutions.

Less than 35% have answered the questions 25, 26, 27, 30, 34 and 35 correctly.

Of the above, the percentage selecting the correct option (2) for question 25 is 26%. Selection of all the options almost with a similar spread as 32% for 1, 25% for 3 and 17% for 4 shows that the candidates didn't have a good understanding of the relevant basic principles of electronics. They have not understood the make and circuit symbols of pnp and npn transistors, identification of the terminals of a transistor and how it can be biased for correct functioning. The students should be theoretically explained how the electronic devices (diodes and transistors) have to be biased when putting them into circuits correctly.

For question 30, the correct answer, option 2 has been selected by 34%. Forty five percent have chosen option 4 as the correct response. Not knowing that velocity is a vector quantity and not understanding properly the change in velocity with acceleration due to gravity had made it difficult for students to understand the phenomenon from a graph. Hence it is required to explain that velocity has both a magnitude and direction and the velocity of an object moving upwards under gravity decreases with time and after the maximum point it reaches, increases in the opposite direction. The teaching process needs to be adjusted to develop the skill of presenting practically obtained data graphically as well as interpreting graphical representations verbally.

Percentage selecting the correct response 1 for question 3 is 31%. 37% have selected option 3 as the correct response. The reason for this may be the lack of proper understanding between the action of a diode and direct and alternating currents. Thus it is required to explain during the learning teaching process how the potentials should be biased to make a current flow in the use of diodes and that the magnitude of the current decreases when one half of the alternating current flows through diodes. This should be explained by experiments using AC and DC currents.

Twenty nine percent have selected the correct option 4 for question 35. Though the students know that ordinary white light comprises several colours and they can be deviated through different angles by a prism, the question would have been a difficult one for them because they were not aware that one colour cannot be resolved into other colours. The learning teaching process should be organised so that this is grasped by the students.

2.2 Paper II and information on answers

2.2.1 Structure of the paper II

Time 03 hours. Total mark for paper II is 60.

This paper consists of two parts A and B.

Part A – This contains four structured essay questions and all the questions should be answered in the paper itself. First question is set integrating sections from Physics, Chemistry and Biology. Other three questions are set on Biology, Chemistry and Physics. Each question carries 15 marks and the total mark is 60.

Part B – This comprises six questions, with two questions each from, the sections Chemistry, Physics and Biology. The candidate should select at least one question from each part and answer three questions. Mark allocated for each question is 20, So the total mark is 60.

$$\begin{aligned}\text{Total mark for paper II} &= 60 + 60 \\ &= 120\end{aligned}$$

$$\text{Final mark for paper II} = \frac{120}{2} = 60$$

2.2.2 Expected answers, marking scheme and observations and conclusions related to paper II

- ★ The observation related to the answers for paper II have been presented by graphs 2, 3, 4.1, 4.2 and 4.3. The graphical part related to a question is given along with the observations and conclusions on that question.

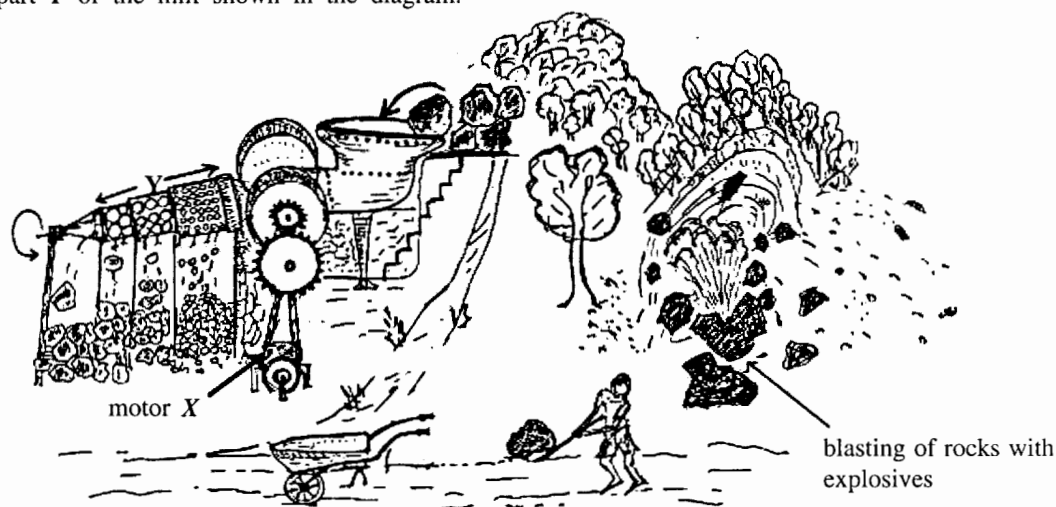
Part A - Structured Essay

Objectives for Question 1

- Inquiring into the understanding about the environmental pollution caused by environment - based activities.
- Inquiring into the knowledge on minerals and rocks.
- Inquiring into the awareness about the human activities leading to environmental problems.
- Examining the awareness about human activities leading to environmental problems.
- Examining about the scientific strategies adopted when using mechanical techniques.
- Making understand the integrated nature of science through phenomena related to various stages of industrial manufacture.

Question 1

1. Given below is a diagram of a quarry and its environs where rocks are blasted and crushed into metal of smaller sizes. Large granite boulders are blasted using explosions. The crusher is driven by the motor X. The large pieces of rocks fed into the crusher are broken into pieces and separated according to their sizes by the rotating part Y of the mill shown in the diagram.



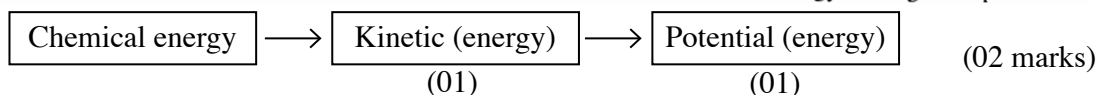
- (A) (i) Granite is a type of rock. State a feature in which rocks differ from minerals.
no definite composition/heterogeneous/a mixture of two or more minerals/no definite crystalline structure/no constant physical properties (such as boiling point/melting point/specific heat capacity/ density/ refractive index)
Also award marks even if a characteristic feature of a mineral is written highlighting that it belongs to minerals. (01 mark)
- (ii) To which type of rocks does granite belong?
igneous (01 mark)
- (iii) To which type of weathering of rocks does the crushing of rocks in metal mills belong?
Physical (01 mark)

- (B) Complete the following table which indicates the problems associated with this work site and the reasons for those problems.

Problem	Reason	
(i) Pollution of air	dust / granite particles / solid particulate wastes / gases emitted during explosions / gases like SO_x, NO_x / combustion of fuel (No marks for poisonous gases. If only C, CO or CO_2 is written without starting fuel combustion, no marks)	(01 mark)
(ii) Cracking of the walls of buildings	shock / (strong) vibrations / seismic waves / collision with (pieces of) rocks	(01 mark)
(iii) Frequent ailing of workers with respiratory complaints	inhaling or presence in the air of dust / solid particulate wastes / toxic gases (such as SO_x, NO_x)	(01 mark)
(iv) earthslips / landslides / soil erosion	Loosening of soil layers in the sloping area	(01 mark)
(v) decline of photosynthesis/death of plants / disturbing plant respiration / suppressing plant growth / drying of leaves / fall of leaves / blocking transpiration/lowering the yield	Coverage of the leaves of nearby plants with dust particles	(01 mark)

- (vi) What is the non-material environmental pollutant produced by the above work site?
Sound (01 mark)

- (C) (i) Blasting of rocks is an instance that utilizes the energy produced during the combustion of explosives. During the explosion, a piece of rock thrown up happened to fall on a higher point of the hill. Complete the following schematic diagram which shows the transformation of energy during this process.



- (ii) An alloy has been used to make part Y of the machine. Write a property which this alloy should have in conformity with the function performed by part Y.

Strength / hardness / low wear-out / non-corrosive or rust resisting / withstands heat / withstands vibrations/less corroded (01 marks)

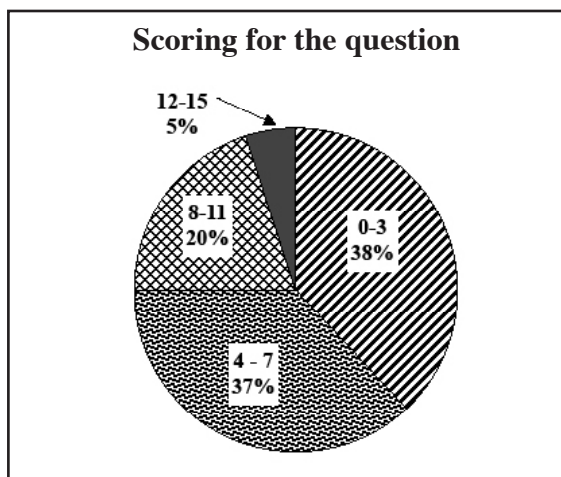
- (iii) State a method used to transfer energy between the parts of the machine.
chains/cog (toothed) wheels/conveyor belts/pulleys/axles (01 marks)

- (iv) Name a simple machine belonging to the classes of levers shown in the above diagram and state the class of levers to which it belongs.

Simple machine	Class of levers
wheelbarrow (01)	2 nd / second (class) (01)
crowbar / iron rod or	
wedge / bar (01)	2 nd / second (class) (01)

(any one of these) (02 marks)

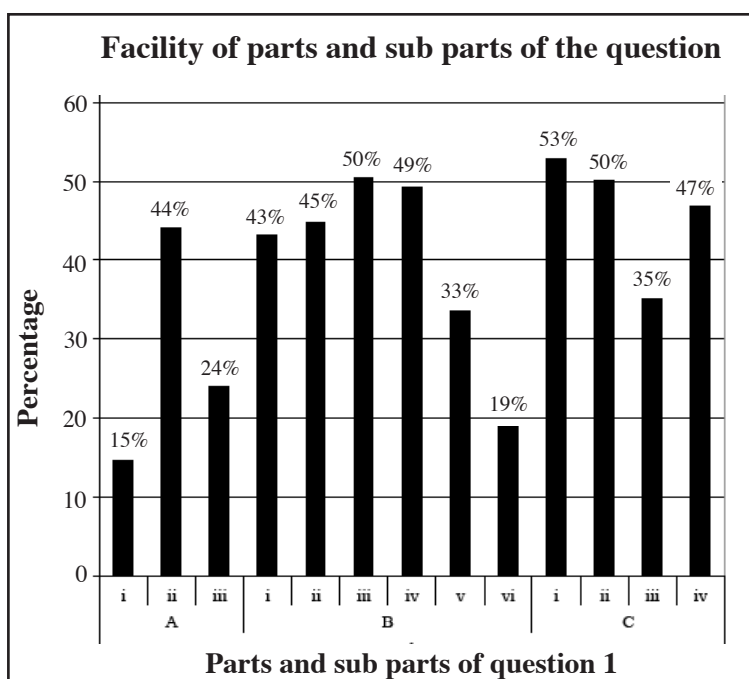
Overall observations and conclusions regarding the answers to Question 1 :



Although question 1 is compulsory, 98% have answered it. The mark allocated for the question is 15. The percentages of candidates scoring within the following four intervals are:

0 - 3	—	38%
4 - 7	—	37%
8 - 11	—	20%
12 - 15	—	5%

The percentage scoring above 12 for this question is 5% while 38% have scored less than 3 marks.



This question comprises 13 sub parts of which the facility of 8 is above 40%. The sub part with minimum facility is A(i) for which the facility is 15%. The Facility of B(vi) is 19%. C(i) had been the easiest sub part for which the facility is 53%.

The facility of sub part 1A(i) is 15%. This may possibly be due to the inability to identify the differences between rocks and minerals clearly. Students should be given opportunities to observe the rocks and minerals readily available in the environment.

The facility of sub part A(iii) is 24%. The students have failed to identify that crushing of rocks in a quarry is a mode of physical weathering brought about by human activity.

The facility of sub part B(v) is 33%. Students have not understood that the biological processes of a plant leaf are hampered when it gets covered by dust particles.

The facility of sub part C(iii) is 35%. The low value may be due to the less number of occasions of observing with understanding the events of energy transmission in real life situations.

The facility of sub part C(iv) is 47%. The possible reason for this may be the lack of students' understanding through experience that a crowbar is used as a class II lever when rolling a stone while the same becomes a class I lever when lifting a stone. The students need to develop the skill of representing by figures the lever action used in day to day life.

Objectives for Question 2

- Inquiring into the knowledge of classification criteria used to distinguish the main groups of living organisms.
- Inquiring into the understanding of the relationships between the adaptations and habitats of living organisms in their classification.
- Examining the understanding of the relationship between the structure and function of different parts of the alimentary canal.
- Examining the understanding of the chemical process taking place during digestion of food.
- Inquiring into the ability to identify the parts of the alimentary canal.

Question 2

2. (A) The diagram shows a rough sketch of the classification of living organisms.

- (i) What feature makes it possible to distinguish micro-organisms from the rest of the living organisms?

invisible to naked eye / microscopic (01 Mark)

- (ii) What is the special feature belonging to the plant group?

photosynthesize/presence of chloroplast/chlorophyll / autotrophic / production of food (01 Mark)

- (iii) What is the main feature that distinguishes vertebrates from invertebrates?

presence of a backbone / vertebral column

(01 mark)

- (iv) Complete the following table on vertebrate animals.

Group of animals	Environment/Environments to which the animals have adapted to live in	A main feature that helps identify the group of animals
(a) Fishes (Pisces)	water / aquatic (01)	fins / gills / scales / streamlined shape / two - chambered heart (01)
(b) Amphibians	water / aquatic and land / terrestrial (01)	wet skin/glandular skin/webbed feet/3 - chambered heart / living one stage of life cycle in water / having 2 or 3 methods of respiration / respire through skin, buccal cavity, lungs (any two) (01)
(c) Reptiles	land / terrestrial (01)	dry skin / scaly skin / non-glandular skin/3-chambered heart / 4-chambered heart with an incompletely divided ventricle (01)

(06 marks)

(B) The figure is a rough sketch of a part of the digestive system.

- (i) Name the **two** parts A and B in the figure.

A - salivary glands/sub-lingual gland (01 mark)

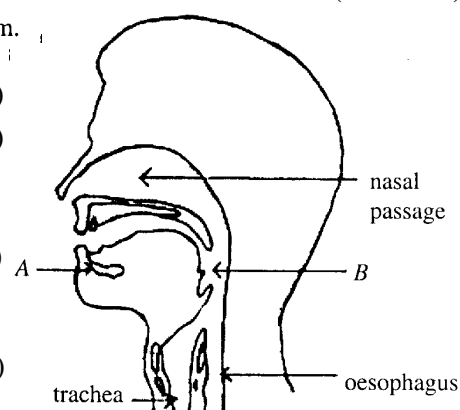
B - pharynx (01 mark)

- (ii) What is the device that prevents entry into trachea, the food that comes to part B?

(presence/closing/moving down/of) epiglottis (01 mark)

- (iii) What action of movement carries the food entering the oesophagus?

peristalsis (01 mark)



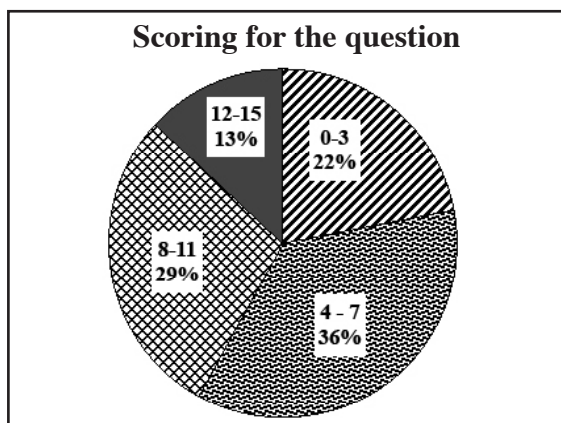
- (iv) Write a function that takes place inside the buccal cavity during the process of digestion of food.
breaking food into small pieces / grinding / mixing with saliva / starting of digesting / digestion of carbohydrates (starch) / forming food into lumps / physical / mechanical digestion (01 mark)

- (v) What function is carried out by the enzymes in the digestion of food?

converting complex substances in food into simple substances / water soluble substances / hydrolysing / chemical digestion (01 mark)

(15 marks)

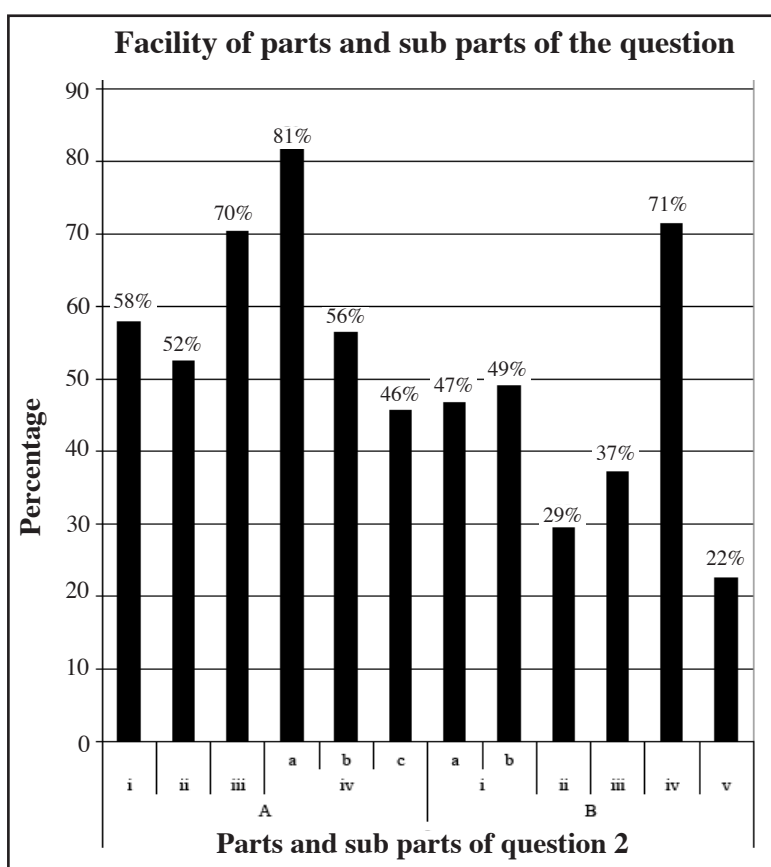
Overall observations and conclusions regarding the answers to Question 2 :



Although question 2 is compulsory, the percentage of respondents for it is 97%. The mark allocated for the question is 15. The percentages of candidates scoring within the following intervals are:

0 - 3	–	22%
4 - 7	–	36%
8 - 11	–	29%
12 - 15	–	13%

The percentage scoring above 12 for this question is 13% while 22% of the candidates have scored below 3.



This question comprises 12 sub parts. Of them the facility for 9 sub parts is greater than 45%. Sub part A(iv)(a) is the easiest for which the facility is 81%. The most difficult sub part is B(v) and its facility is 22%.

The facility for (A) (iv) (a) sub part is 81%. This question is based on the classification of vertebrate animals. Students have identified the characteristics of pisces better.

For the parts A (iv) (b) and (iv) (c) the facility is 56% and 46% respectively. The students haven't understood that the amphibians and reptiles are adapted to live in aquatic and terrestrial environments. Thus, the adaptations of living beings to their environments should be accentuated.

The facility for sub part B(ii) is 29% whereas the facility for B (iii) sub part is 37%. Though the questions are set on very easy sections of the subject, the reason for such a low facility would be the student's inability to use the correct technical terms and lack of proper understanding of the action of the digestive system. When teaching this lesson, the structure - function relationship of the digestive system should be highlighted.

The facility of sub part B (v) is 22%. Though the action of individual enzymes in the process of digestion are specifically taught, students have faced a difficulty when explaining the common action of enzymes. During teaching learning process emphasis must be laid on what is an enzyme and what is its action.

When teaching about the systems of the human body, attention of students should be drawn for the use of models, preparation of models and naming with correct technical terms. It is also important that the relevant concepts and principles are explained to suit the respective levels.

Objectives for Question 3

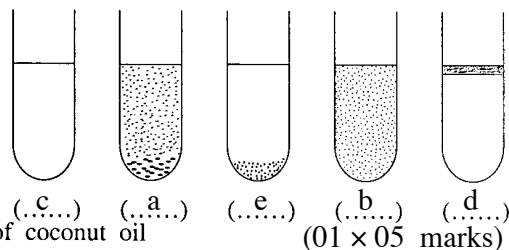
- Examining the knowledge on Physical and Chemical properties and uses of various elements and their compounds.
- Examining the knowledge and understanding of the nature of mixtures.
- Examining the knowledge and understanding of the activity series and electrochemical changes.
- Examining the ability to predict the results of an experiment.

Question 3

3. (A) Of the elements hydrogen (H), nitrogen (N), neon (Ne), sodium (Na) and silicon (Si), select the element that fits the description given below and write it on the dotted line opposite each description.

- (i) The element of highest density Si / silicon (01 mark)
- (ii) The element that is used as a basic raw material in the production of chemical fertilizers N / nitrogen (01 mark)
- (iii) The element which combines in 1 : 1 proportion with chlorine to form an acidic compound H / hydrogen (01 mark)
- (iv) The element that occurs naturally as highly water soluble ionic compounds Na/sodium (01 mark)
- (v) The element which has completed the maximum number of electrons in the outermost energy level Ne/neon (01 mark)

(B) The given quantities of the following substances were separately added to boiling tubes containing the same volume of water and **shaken thoroughly**. On the dotted line under each of the figure which most correctly indicates how the mixture appears after a short period of time, **write the letter** that corresponds to the substance added.



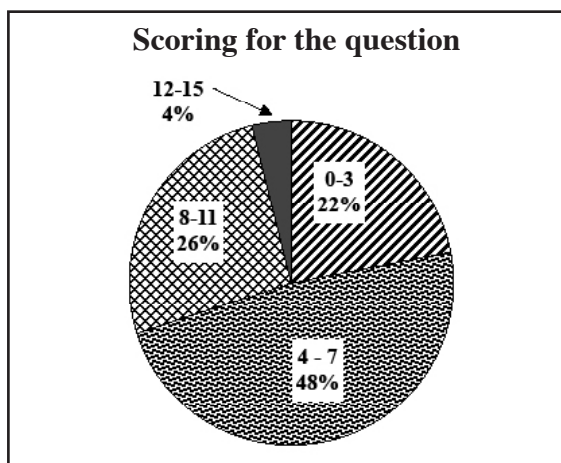
- (a) a few of soil (b) 2-3 drops of coconut oil
- (c) about 1 cm³ of ethanol (d) about 1 cm³ of kerosene
- (e) a few of glass powder

(C) Each of the experimental set ups given in the left hand side column of the following table is made by dipping a metal plate in a dilute solution of a salt of a metal. The table also gives some observations on the metal plate and the salt solution in each set up at the beginning and at the end of the experiment. Write on the dotted lines, the observations relevant to the blanks (i) to (v) in the table.

Experiment	At the beginning		At the end	
	Metal	Solution	Metal	Solution
	silvery	blue colour	a brown coloured solid substance has deposited	colourless
	(i) reddish brown/ copper colour (01)	colourless	(ii) no change/ copper colour/ reddish brown colour (01)	(iii) no change/ colourless (01)
	grey colour	blue colour	(iv) zinc / Zn plate dissolves / corrodes / a brown reddish brown solid material is deposited (01)	(v) becomes colourless / blue colour decreases (01)

(15 marks)

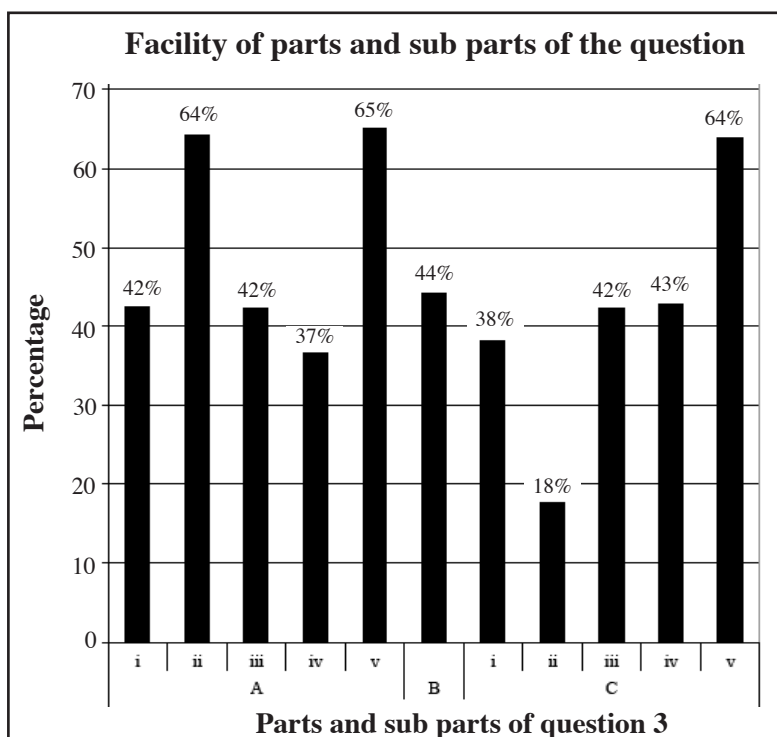
Overall observations and conclusions regarding the answers to Question 3 :



Although question 3 is compulsory, the percentage answering it is 97%. The mark allocated for the question is 15. The percentages of candidates scoring within the following intervals are:

0 - 3	–	22%
4 - 7	–	48%
8 - 11	–	26%
12 - 15	–	4%

The percentage of candidates scoring above 12 for this question is 4% while 22% have scored below 3.



This question comprises 11 sub parts. Of them, facility for 8 sub parts is greater than 40%. The easiest sub part is A(v) with the facility of 65% while the sub part of lowest facility is C(ii) with the facility of 18%.

The facility of the sub part (A)(i) is 42%. The reason for this situation is the lack of adequate understanding about the physical states of matter and ignorance of the fact that silicon is denser than sodium.

The facility of the sub part A (iii) is 42%. Students' insufficient knowledge about the valencies of elements and acidic, basic and neutral properties of compounds would have caused this situation.

The facility of the sub part A (iv) is 37%. Lack of understanding about the solubility of substances and the dissociation of compounds into ions in aqueous solutions has created this situation.

The facility for sub part B is 44%. The students have not experienced that when a few drops of coconut oil are shaken thoroughly with water, a heterogeneous mixture with a long lasting turbidity is formed. This is due to the fact that even the simple activities such as this are not done in the classroom.

The facility for sub part C (i) is 38%. Lack of adequate knowledge about the physical and chemical properties of various elements and compounds has caused this situation.

The facility for sub part C (ii) is 18%. The possible reason would be the little knowledge in the activity series and chemical changes.

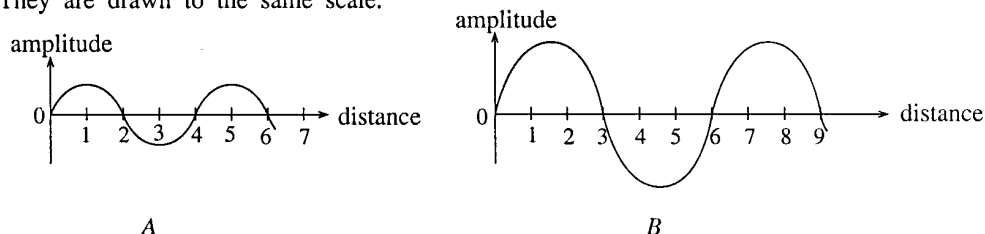
During the classroom teaching process, students need to be exposed to practical activities at every possible occasion. When teaching the periodic table, attention should be paid for the patterns across a period and down a group with regard to the variation of properties of elements. Students need to be directed to use the standard adjectives as far as possible when stating the colour of substances. (Eg. Cu - reddish brown)

Objectives for Question 4

- Examining the ability to identify a transverse wave.
- Examining the ability to identify the factors that determine the pitch of a sound wave.
- Examining the ability to identify the factors that determine the loudness of a sound wave.
- Examining whether the frequency range of an audible sound wave by human ear has been understood.
- Examining the ability of calculation using the relationship among the frequency, wavelength and velocity of a wave.
- Examining the ability to select the lens used in a simple microscope.
- Examining the ability of drawing ray diagrams and constructing the image using ray diagrams.
- Examining the ability of predicting the properties of the image formed by a lens.

Question 4

4. (A) Given below are two waves *A* and *B* produced by vibrating a string in an acoustic instrument in two occasions. They are drawn to the same scale.



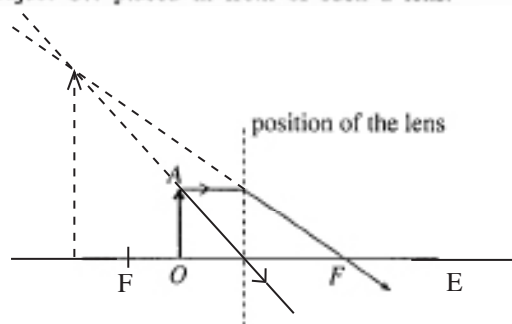
- (i) To which wave type do these mechanical waves produced in the string belong? transverse (waves) (01 mark)
- (ii) Of the waves *A* and *B*, which produces a sound of higher pitch? *A* (01 mark)
- (iii) Of the waves *A* and *B*, which produces a sound of greater loudness? *B* (01 mark)
- (iv) Reflection of sound waves is used to find the depth of the sea. The frequency of the sound wave used for this by a ship exploring the ocean is 40 000 Hz.
- (a) Can this sound wave be heard by a human ear? No (01 mark)
- (b) Give reasons for your answer. The audible range of human ear is in between 20 - 20000 Hz / Not in the audible range of the human ear / ultrasonic waves frequency is more than 20000 Hz or above the audible level (01 mark)
- (c) What is the wave length of the wave used for the exploration if the velocity of sound in sea water is 1 500 m s⁻¹?

$$V = f \lambda \quad / \quad 1500 = 40000 \times \lambda$$

$$\lambda = \frac{1500}{40000} \quad / \quad \frac{3}{80} \text{ (m)} \quad / \quad 0.037 \text{ (m)} \quad / \quad 0.0375 \text{ (m)} \quad (01)$$
 (02 marks)
- (d) What is the depth of that place in the sea if the sound wave sent by the ship took 10 s for return after being reflected by the sea floor?

$$1500 \times \frac{10}{2} \quad / \quad 1500 \times 5 \quad / \quad 7500 \text{ (m)}$$
 (01 mark)

(B) A lens is used as a simple microscope to see small objects magnified. The figure shows the path of a ray emitted by an object OA placed in front of such a lens.



(i) What type of a lens is used here? convex/converging (01 mark)

(ii) Mark as F the position of the focus of the lens **on the side of the object**.
Marking F approximately at an equal distance from the optical centre. (01 mark)

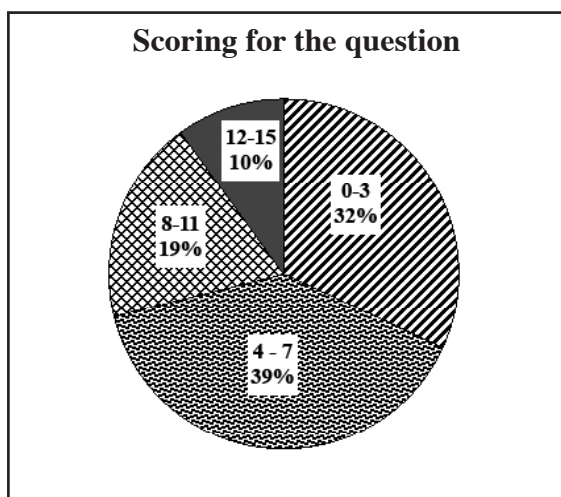
(iii) Draw on the diagram, the other ray required to construct the image of the object.
Drawing the ray (01 mark)

(iv) Draw the image of the object on the diagram.
Drawing the image with correct high and position (even without producing the lines) (01 mark)

(v) Mark on the diagram as E , the position at which the eye should be kept to see the image.
Marking E on the axis/near the axis on the right side of the lens
(award marks even if an eye is drawn instead of E in the correct position.) (01 mark)

(vi) Write **two** characteristics of the image formed here.
 • Virtual or cannot be taken on a screen • enlarged / magnified or larger than the object
 • upright / erect • object and image on the same side
 • image distance . object distance (give one mark each for any one) (02 marks)
(15 marks)

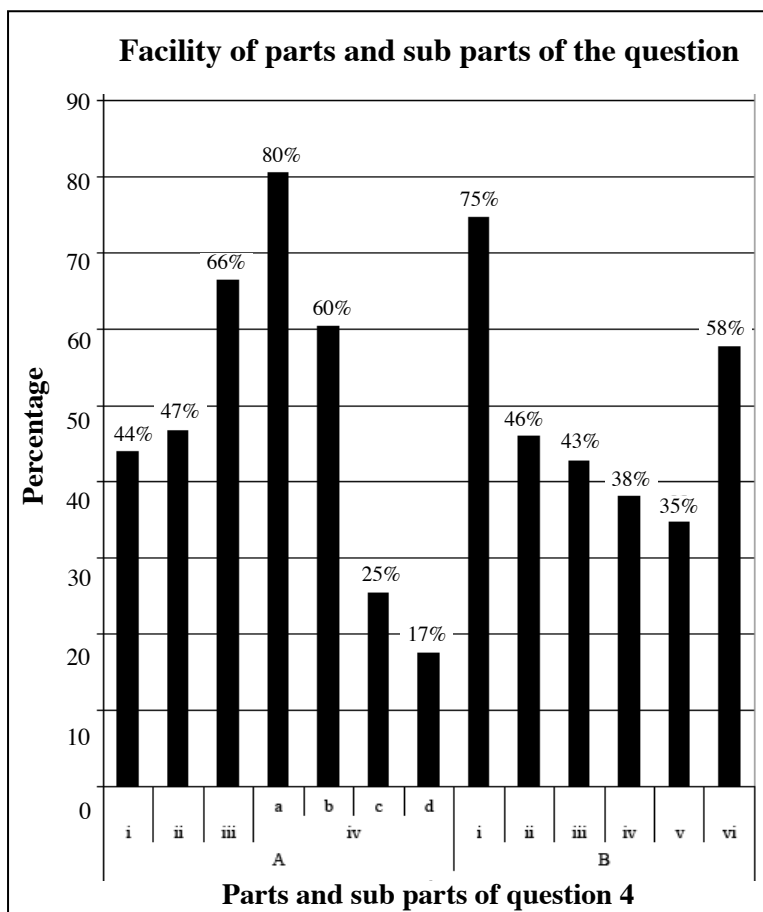
Overall observations and conclusions regarding the answers to Question 4 :



Although question 4 is compulsory, the percentage answering it is 96%. The mark allocated for the question is 15. The percentages of candidates scoring within the following intervals are:

0 - 3	–	32%
4 - 7	–	39%
8 - 11	–	19%
12 - 15	–	10%

The percentage of candidates scoring above 12 for this question is 10% of candidates while the percentage scoring less than 3 is 32%.



This question comprises 13 sub parts. Of them facility for 9 sub parts is above 40%. Sub part A(iv) (a) with the facility of 80% had been the easiest whereas the sub part of least facility is A(iv)(d). Its facility is 17%.

The facility of (A)(iv)(a) sub part is 80%. Nearly 80% know that humans cannot hear a sound wave of frequency 40,000 Hz. But only 60% were successful in explaining why humans cannot hear a wave exceeding 40,000 Hz.

The facility of sub part (A)(iv)(c) is 25%. Writing the relationship among the frequency, wave length and velocity of a wave correctly had been difficult for the students. The students should be taught to derive equations showing the relationship among the above factors and solve problems in a stepwise manner using data.

The facility of sub part (A) (iv) (d) is 17%. The students have not understood that when the sound wave sent out by the ship is reflected, the distance between the ship and the sea floor is half the distance traveled by the wave. Majority have also failed to understand and use the meaning of the statement that velocity of sound in sea water is 1500 ms^{-1} appropriately to solve the problem. This can be remedied by getting the students to read the question carefully, use schematic diagrams, practice the use of units correctly and solve many problems related to this phenomenon.

The facility of sub part (B) (i) is 75%. So, 75% were able to identify the lens type used in the simple microscope. But only 46% have succeeded in answering B (ii). Difficulty has arose in marking the focus on the side of the object. 43% were able to draw the other ray essential to construct the image. Facility shown by B (iv) is 38%. Many have had a difficulty in drawing the image of the object. Facility of sub part B (v) is 35%. Many have failed to mark correctly the position of the eye to see the image.

The learning teaching process should be developed in such a way that students understand how to create ray diagrams that help the construction of the image during refraction through lenses and decide the characteristics of the image through them. It is important to offer more opportunities for students to draw ray diagrams.

Part B - Essay Type Questions

- Answer **three** questions, selecting **one** question from each of the sections Biology, Chemistry and Physics.

Objectives for Question 5

- Inquiring into the advantages and disadvantages of the sexual reproduction of plants.
- Examining the understanding of various adaptations in plants to effect fertilisation.
- Examining the understanding about practical problems that should be focussed in vegetative propagation of plants.
- Investigating the ability to identify correctly the factors affecting homeostasis of the human body.
- Inquiring into the mechanism of filtration of urine.
- Examining the knowledge about the diseases in the urinary system.

Question 5

Biology

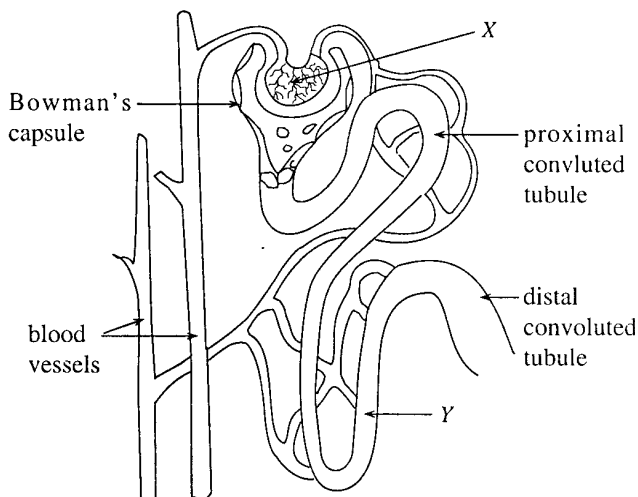
5. (A) In addition to sexual reproduction, natural vegetative **reproduction** also helps plants to perpetuate. Plants are also multiplied by artificial vegetative **propagation**.

- (a) State **two** advantages of vegetative reproduction.
- (b) What is the main disadvantage of vegetative reproduction?
- (c) State **two** methods used to propagate plants by artificial vegetative **propagation**.
- (a) In sexual reproduction, what is meant by pollination?
- (b) How does pollination occur in a sexually reproducing plant bearing hydrophilous flowers?
- (c) Why is the presence of unisexual flowers important for a plant?
- (a) When planting shoots, instructions are given to remove their leaves as much as possible and plant the stem part. Explain the reason for this.
- (b) Lack of leaves is a special feature of plants such as cacti which grow in arid environments. What is the adaptation shown by those plants to effect the function of leaves?

- (B) Homeostasis is the process by which the condition of the internal environment of the body is kept constant.

- (a) State **two** internal conditions of the body that should be kept constant by homeostasis.
- (b) What is the homeostatic function carried out by the skin?
- (c) Excess proteins entering the body by way of food is subject to metabolism and removed from the body as urea. In which organ is this urea produced?

- (a) The diagram represents a nephron/uriniferous tubule that filters urine. Name X and Y shown in the diagram.



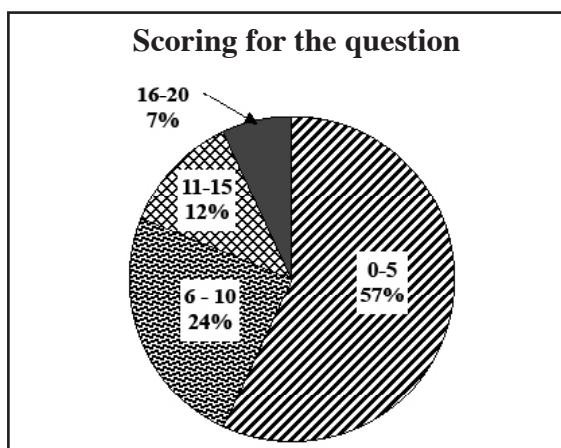
- (b) Name a component which cannot be filtered into the Bowman's capsule from X.
- (c) Many substances that are filtered into the nephron from the blood are reabsorbed into the blood vessels. What is the component that is **not** reabsorbed into the blood?

- (C) Renal stones are a form of crystallised salts.

- (i) Name a place where renal stones can be formed.
- (ii) State a practice that can be followed to prevent the formation of renal stones.

5. (A) (i) (a) • Plants which do not produce seeds or produce less seeds can be propagated.
 • Propagation of superior plants with high yields/high quality
 • To obtain fruits in a short period of time
 • To obtain a large number of plants in a short period of time
 • To obtain daughter plants identical with the mother plants
 • Propagation of plants which are resistant to unfavourable conditions such as diseases/pests/drought
(one mark each for any two) (02 marks)
- (b) • Unable to obtain new varieties
 • Not contributing to evolution
 • Extinction due to unfavourable conditions at once
(one mark each one such idea) (01 mark)
- (c) • Grafting
 • Tissue culture/Cell culture
 • Layering
 • Planting stem cuttings/root cuttings/leaves
(one mark for any two) (02 marks)
- (ii) (a) Deposition of (mature) pollen (grains) on stigma **(01 mark)**
 (b) Pollen (grains) / (staminate) flowers having fallen onto water, float and pollen (grains) get deposited on stigma. **(01 mark)**
 (c) To effect cross pollination/to avoid self – pollination **(01 mark)**
- (iii) (a) To reduce transpiration/drying (by removing leaves) **(01 mark)**
 (b) • Presence of chloroplast/chlorophyll in the stem
 • Modification of stems for photosynthesis
 • Stems become greenish
(one mark for any one) (01 mark)
- (B) (i) (a) • Temperature
 • Glucose level/concentration (in blood)
 • Water balance
 • Osmotic pressure in the body fluid
 • Salt concentration
(one mark each for any two) (02 marks)
- (b) Regulation of body temperature/water balance control **(01 mark)**
 (c) Liver (award one free mark if attempted) **(01 mark)**
- (ii) (a) X – Glomerulus/glomerular capillaries **(01)**
 Y – Loop of Henle/ascending limb **(01)** **(02 marks)**
 (b) Blood cells/Plasma proteins **(01 mark)**
(Give marks for naming a blood cell or a plasma protein)
 (c) Urea/Uric acid/Creatinine/Nitrogenous wastes **(01 mark)**
- (C) (i) (a) Pelvis/Kidney/Urinary bladder **(01 mark)**
- (ii) • Drinking more water/adequate amount of water
 • Avoiding acid food and salt - rich food
 (Award marks for naming an acid food and a calcium-rich food)
 • Passing urine when the need arises
 • Not drinking water containing harmful salts
 • Drinking water from which harmful salts have been removed
(one mark for any one) (01 mark)
(20 marks)

Overall observations and conclusions regarding the answers to Question 5 :

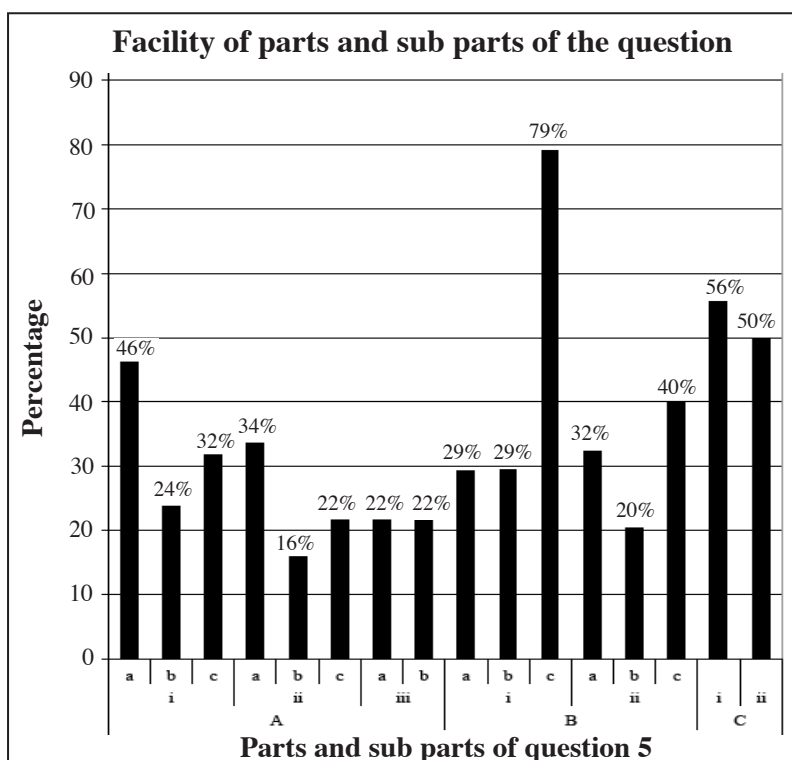


The percentage selecting this question is 35%.
Total mark allocated to this question is 20.

The percentage of candidates scoring within the following intervals are:

0 - 5	–	57%
6 - 10	–	24%
11 - 15	–	12%
16 - 20	–	7%

The percentage scoring above 16 for this question is 7% and 56% have scored less than 5 marks.



The question comprises 16 sub parts. Of them the facility of 5 sub parts is above 40% while for the remaining 11 sub parts it is below 40%. The sub part of least facility is A(ii)(b) for which it is 16%. The sub part of highest facility is B(ii)(c). Its facility is 79%.

From the questions 5 and 6 under Biology in the essay section, less candidates have selected question 5. The facility of sub part (A)(i)(a) that examines the advantages of vegetative reproduction is 46%. The facility of sub part (A)(i)(b) is 24%. Students have failed to write the disadvantages of vegetative reproduction correctly. During teaching it should be explained that vegetatively reproduced organisms are less subject to natural selection but it is practiced for economic gains.

Facility of sub part A(ii)(b) is 16%. Seemingly the understanding in students about the pollination of a hydrophilous plant is not adequate. When teaching this should be illustrated using suitable examples.

The facility for sub parts A(ii)(c) is 22%. From this it is apparent that the candidates have little knowledge about the advantages and disadvantages of sexual and asexual reproduction. The facility for sub parts A(iii)(a) and (iii)(b) is 22%. Majority of the students do not have an adequate understanding about the practices to be followed to prevent transpiration of plants during their vegetative reproduction and adaptations of plants to check transpiration. It is required to emphasize how plants get over the difficulties they face when cutting off transpiration.

Sub parts B(i)(a) and B(i)(b) have a facility of 29% each. Correct identification of the factors affecting the homeostasis of the human body has been difficult for the students.

The facility of B(ii)(a), B(ii)(b) and B(ii)(c) sub parts are 32%, 20% and 40% respectively. The students have scant knowledge about the parts of a human nephron and the mechanism of urine filtration which need more emphasis during teaching.

During the classroom teaching process, the basic concepts should be related to students' experiences and natural events as far as possible.

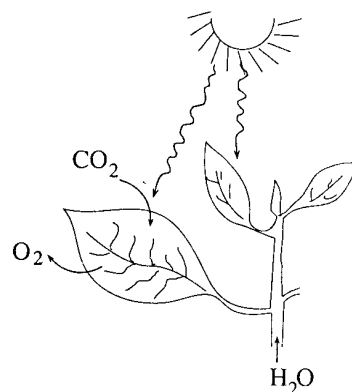
Objectives for Question 6

- Inquiring into the understanding of factors and principal process related to photosynthesis.
- Examining the ability to explain how photosynthetic process is important for the existence of other living organisms.
- Inquiring into the knowledge of the structure and action of heart.
- Inquiring into the factors affecting the complaints related to blood circulation.
- Inquiring into the understanding of the functions and protective mechanisms of blood.

Question 6

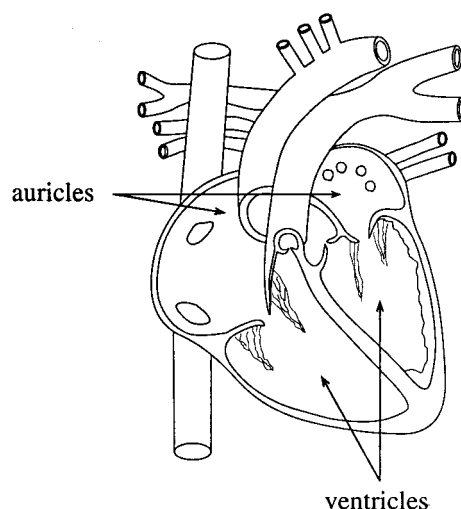
6. (A) Indicated in the diagram are some substances and factors connected with the process of photosynthesis in plants.

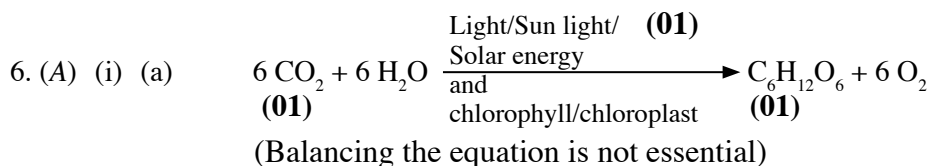
- (a) Indicating all the essential factors, write in the form of an equation, the photosynthetic process taking place in plant leaves.
 - (b) Through which tissue is the food produced in leaves transported to other parts of the plant?
 - (c) What is the substance which the plants absorb from soil to produce food?
- (a) State **two** functions effected by food produced in the plant.
 - (b) The consumers of which level die first if the earth is cut off from sunlight for a long period of time?
 - (c) Explain how plants help reduce air pollution.



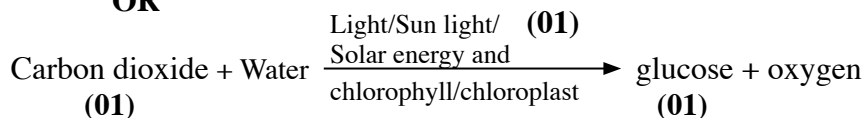
(B) The diagram shows the structure of the human heart.

- (a) Contraction of auricles makes the blood flow into the ventricles. State the valves through which the blood flows from each auricle as such.
 - (b) What is the main difference in the composition of blood contained in the systemic aorta and the pulmonary aorta?
 - (c) The characteristic sounds generated during the working of the heart are known as 'lub' and 'dub'. State separately, by the action of which parts of the heart these 'lub' and 'dub' sounds are produced.
- (a) What structural difference in arteries causes high blood pressure (hypertension)?
 - (b) State **two** functions carried out by blood in the body.
 - (c) Clotting of blood is a very important protective measure in case of an injury. Name the vitamin and the metal ion that contribute to the clotting of blood.





OR



(award marks even through the symbols and words are mixed) **(03 marks)**

- (b) Phloem (tissue) **(01 mark)**
 (c) Water / H_2O **(01 mark)**

- (ii) (a) growth/respiration/storage (one mark each for any two) **(01 mark)**
 (b) First level consumers/herbivores/Organisms of the second tropic level **(01 mark)**
 (c) Production/liberation of O_2 (during photosynthesis) **(01)**
 Absorption of CO_2 **(01)**

OR

Maintaining the balance of **(01)**
 atmospheric oxygen / O_2 and carbon dioxide / CO_2 **(02 marks)**

- (B) (i) (a) • Through tricuspid valve from right auricle / atrium **(01)**
 • Through bicuspid valve/mitral valve from left auricle/atrium **(01)** **(02 marks)**

- (b) In systemic aorta $\longrightarrow$ oxygen / O_2 concentration is high
 carbon dioxide / CO_2 concentration is low

OR

In pulmonary aorta $\longrightarrow$ oxygen / O_2 concentration is low
 carbon dioxide / CO_2 concentration is high
(01 mark)

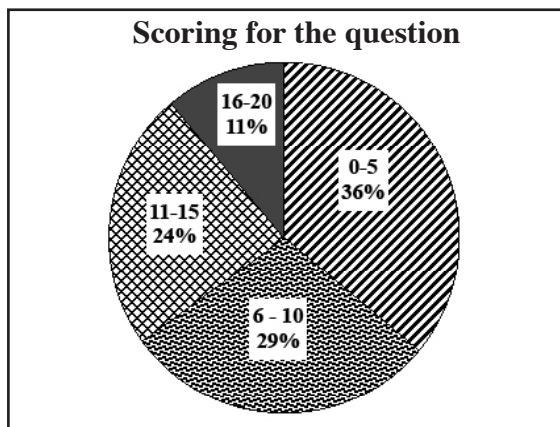
- (c) Lub - Closing of bicuspid / mitral and tricuspid valves **(01)**
 Dub - Closing of semi lunar valve **(01)**
(02 marks)

- (ii) (a) • Increase in the thickness of artery walls/thickening of walls of arteries/
 decrease in elasticity of arteries
 • Narrowing of the lumen of arteries
 • Deposition of fat or cholesterol on the inner walls of arteries
(for any one) (01 mark)

- (b) • Regulation of temperature
 • Transport of food or nutrients/oxygen - O_2 / carbon dioxide - CO_2 /
 excretory products/hormones/enzymes/Transport of substances
 • Protection or stating a protective action
(Give one mark each for any two) (02 marks)

- (c) • Ca^{++} / Ca^{2+} / Calcium ions **(01)**
 • vitamin K **(01)**
(02 marks)
(20 marks)

Overall observations and conclusions regarding the answers to Question 6 :

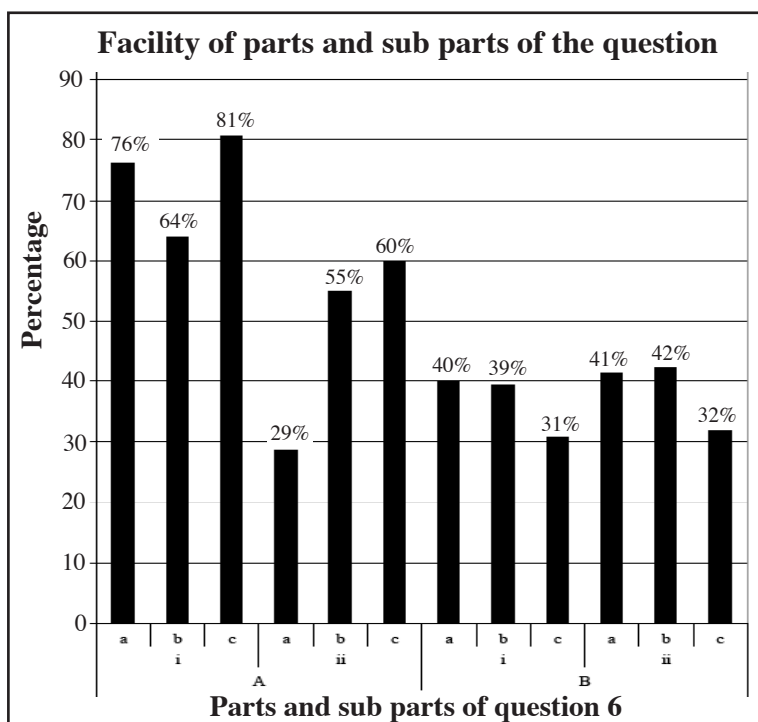


The percentage of candidates selecting question 6 is about 63%. From the two questions in the Biology section of part B, this is the more popular question. The total mark allocated for this question is 20.

The percentage of candidates scoring within the following intervals are:

0 - 5	—	36%
6 - 10	—	29%
11 - 15	—	24%
16 - 20	—	11%

Of the candidates 11% have obtained marks above 16 for this question. Yet, the percentage scoring below 5 is 36%.



The question comprises 12 sub parts of which 11 sub parts have a facility greater than 40%. The most difficult part had been A(ii)(a) for which the facility is 29%. Sub part A(i)(c) has turned out to be the easiest with the facility of 81%.

This is the question selected by a majority of students from the two question 5 and 6 related to Biology. Despite the question tests a very easy section in photosynthesis, the relatively low facility would be due to the poor ability of students to explain the main functions carried out by the products of photosynthesis.

Facility of sub part (A)(ii)(a) is 29%. It has become difficult for students to name functions carried out by food within the plant.

Facility of sub part (B)(i)(a) is 40%. Writing the left and right auriculo - ventricular values separately had been a difficult task for the students.

Facility of sub part (B)(i)(b) is 39%. This means that writing the differences in the composition of blood in the systematic aorta and pulmonary aorta has been an easy task only for 39%. Many candidates have written that the systemic aorta contains pure blood and the pulmonary aorta contains impure blood. This reveals that the students write answers without understanding questions and have not learnt proper scientific facts.

Facility of sub part (B)(i)(c) is 31%. Seemingly the ability to explain correctly the cause of 'lub' and 'dub' sounds during the working of the heart is not adequate.

Facility of sub part (ii)(c) is 32%. In spite of an easy question, students have not responded correctly. It is apparent that the students do not have an adequate knowledge about the factors essential for blood clotting. Many had a difficulty in naming the vitamin contributing to blood clotting. During teaching it is required to show how the facts learnt under different topics are interconnected. Eg. The effects of the vitamin deficiencies on body functions.

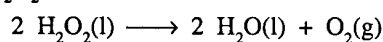
In some instances, the lack of scientific literacy has faltered the expression of ideas. Use of words like 'pure blood' and 'impure blood' is an example. It is through the learning teaching process that this kind of faults could be avoided.

Objectives for Question 7

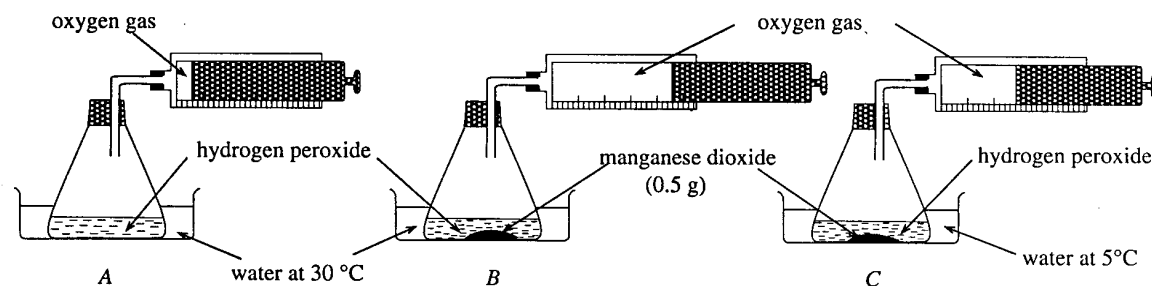
- Examining the knowledge and understanding in rate of reactions and factors affecting it.
- Examining the understanding about the control of factors that may affect the results when designing an experiment.
- Examining the knowledge in the classification of chemical reactions.
- Examining the knowledge about simple tests for identifying gases.
- Examining the ability of coming to logical conclusions based on observations.
- Examining the ability of designing a simple experiment.
- Examining the knowledge in the practical use of common chemical substances.

Question 7

7. Hydrogen peroxide (H_2O_2) undergoes the chemical change represented by the equation below.



Manganese dioxide (MnO_2) acts as a catalyst for the reaction above. The oxygen gas produced in the reaction is collected in identical syringes as shown in the following experimental set ups.

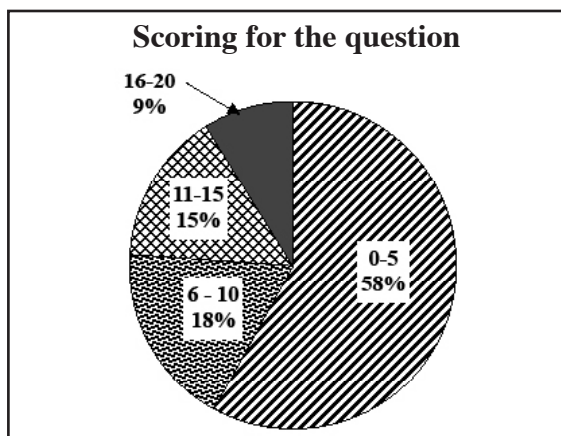


The diagrams above show how the set ups appeared after a **constant period of time** of their arrangement.

- Which pair of set ups would you select to show that MnO_2 acted as a catalyst for the above reaction?
- By the action of MnO_2 as a catalyst for the above reaction, the rate of the reaction is increased. In relation to the pair of set ups you mentioned under (i) above, state an observation which confirms this.
- According to the observations on the set ups B and C, what conclusion can be drawn about the rate of reactions?
- Speeding up a reaction without being consumed during the reaction is a property of a catalyst. Describe how you can show that MnO_2 is **not** spent during the above reaction.
- Name **two** other factors that affect the rate of a reaction but **not** tested in the above experiments.
- Immersing the flasks with H_2O_2 in troughs of water at the relevant temperature as shown in the diagrams, increases the accuracy of the experiment. Explain the reason for this.
- What type of a reaction is the above which H_2O_2 undergoes?
- Describe a simple test to show that the gas collected in the syringes in the above set ups is oxygen.
- Calculate the mass of oxygen that can be produced from 1 mole of H_2O_2 according to the above chemical change. (H = 1; O = 16)
- State **two** instances where H_2O_2 is used.

7. (i) A and B (02/00 marks)
- (ii) Faster effervescence/faster liberation of gas bubbles in B/In B, a greater volume of gas is collected (in a constant time interval) (than in A)
 Time taken to collect a constant volume of gas is less in B (than A)/
 The piston in B is pushed out faster (than in A)
N.B. B may be indicated as the flask/set up with MnO_2 (02/00 marks)
- (iii) Depends on temperature/increases with increase in temperature
 Decreases with decrease in temperature (01 marks)
- (iv) • After the reaction, MnO_2 is separated by filtering (01) and dried (01)
 • The mass of MnO_2 used at the beginning is the same as that at the end/
 Mass of dry MnO_2 remained at the end is equal to 0.5 g (01) (03 marks)
- (v) • Concentration
 • Surface area of reactants/Physical nature of reactants.
 • Pressure
 • Light/Radiation
(Give one mark each for any two) (02 marks)
- (vi) Rising of temperature of the reactant mixture is prevented during the reaction/ Temperature of the reactant mixture is kept constant (02/00 marks)
- (vii) Decomposition (reaction) (01 mark)
- (viii) Insert a glowing splinter (01) into the gas - filled syringe (01)
OR
 Spurting the gas in the syringe (01) onto the glowing splinter (01)
 Observing whether it rekindles / glowing splinter rekindles (01) (03 marks)
- (ix) Mass of $\text{O}_2 = 32 \text{ g} \times \frac{1}{2} / 16 \text{ g}$ (02 marks)
- (x) • As a bleaching agent decolouriser in beauty culture
 • To prepare O_2 gas (in the laboratory)
 • To disinfect water / To purify water / For tertiary purification of water
 • To disinfect (clean) wounds / As an antiseptic
(Give one mark each for any two) (02 marks)
(20 marks)

Overall observations and conclusions regarding the answers to Question 7 :

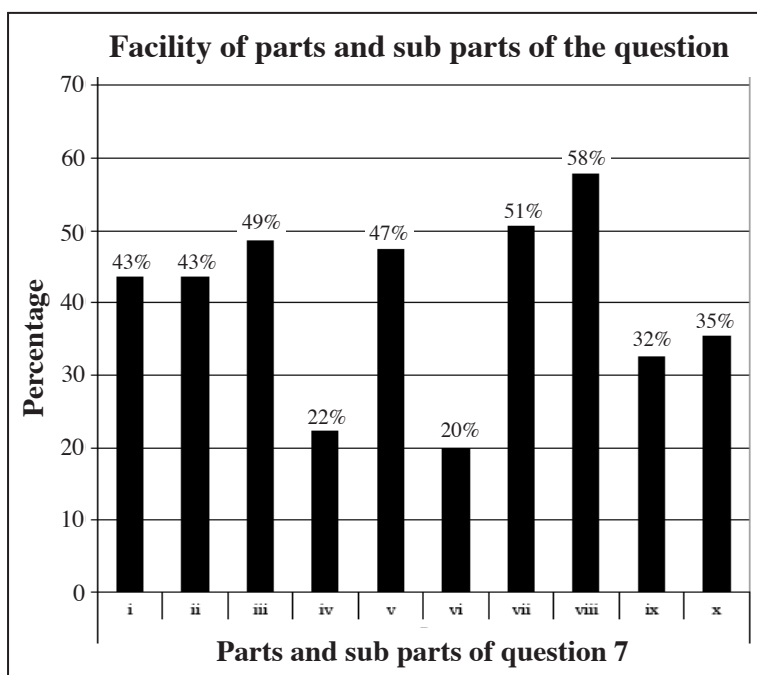


The percentage of candidates selecting question 7 is 17%. Of the two questions in Chemistry in part B, this is the one of lower choice. The mark allocated for the question is 20.

The percentage obtaining marks in the respective intervals are:

0 - 5	–	58%
6 - 10	–	18%
11 - 15	–	15%
16 - 20	–	9%

The percentage scoring above 16 for this question is 9% while the score of 58% is below 5.



This question consists of 10 sub parts of which the facility of 6 sub parts is above 40%. The easiest sub part (viii) has a facility of 58% and the most difficult part (vi) records a facility of 20%.

The facility of sub part (iv) of question 7 is 22%. In this, the students have failed to design an experiment with correct steps to show that a catalyst used to increase the rate of a reaction remains after the reaction without being consumed.

The facility of sub part (vi) is 20%. The answers witness that the students have no adequate understanding of the fact that when investigating the factors except the one that is controlled should be kept constant in both the experimental and control settings.

The facility of sub part (ix) is 32%. Students are weaker in solving problem involving chemical calculations.

The facility of sub part (x) is 35%. Notwithstanding the question is a simple one, the facility is low. This may be due to the lack of adequate knowledge in practical usage of common chemicals.

Less popularity of this question witnesses the low inclination of students to answer the questions based on pure science and experiments, the fundamental methodology of acquiring knowledge in science. This is further justified by the fact that, more than 75% of the respondents for this question couldn't secure even half of the marks allocated. It should be noted that both the product and the process are important in learning science and it is inculcated in students by experiments conducted with necessary controls. Hence, in the learning teaching process of science more opportunities should be offered to conduct experiments.

One way of remedying the students' weaknesses in chemical calculation, a more abstract exercise is the presentation of them through concrete examples. For example the concept of the mole, the fundamental unit of measuring the amount in chemistry can be presented through simple examples.

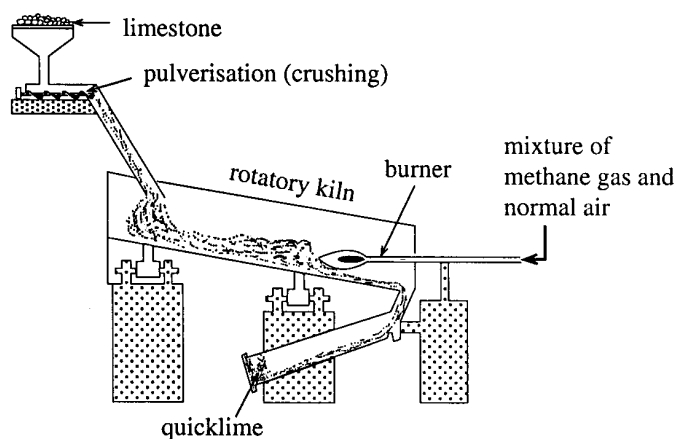
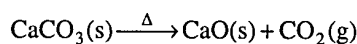
Objectives for Question 8

- Examining the understanding of the exothermic/endothermic nature of a reaction.
- Examining the ability to use basic concepts to increase the efficiency and productivity of a chemical reaction.
- Comparing the efficiency and productivity of a modern technical device with those of traditional practices.
- Examining the knowledge of facts that should be considered when starting an industry.
- Examining the ability of simple chemical calculations.
- Inquiring into the knowledge about the substitutes that can be used for a fuel.
- Inquiring into the knowledge about industries that can be launched using calcium oxide as a raw material.
- Examining the ways of using industrial by-products.
- Examining the awareness about environmental problem created by chemical industries.

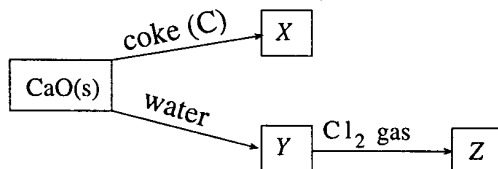
Question 8

8. In lime kilns, quicklime (CaO) is produced using limestone (CaCO_3). Given below is a diagram of a rotatory kiln which produces quicklime more efficiently than the traditional local lime kilns.

The cylindrical kiln installed with a little inclination to the horizontal, rotates around its axis. The heat required to decompose limestone is continuously provided by burning methane gas inside the kiln. The chemical equation for the decomposition of limestone is as follows.



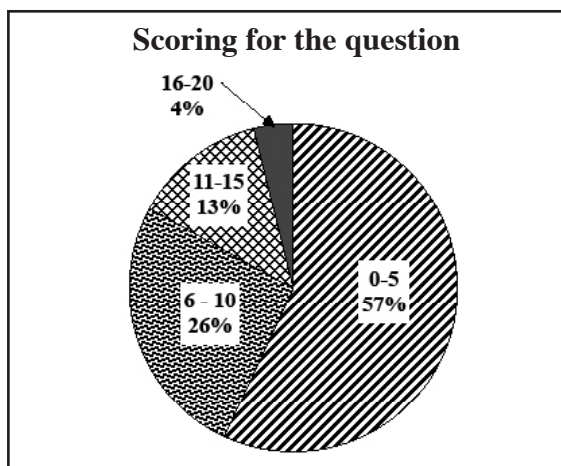
- Is the above decomposition reaction an exothermic reaction or an endothermic reaction?
- Describe the advantage of introducing limestone into the kiln after pulverisation.
- State **two** weaknesses of the traditional lime kiln that can be overcome by using the rotatory kiln.
- An industrialist opines to start a quicklime manufacturing industry using the rotatory kiln. State three facts that should be taken into consideration in this venture.
- What is the molar mass of CaCO_3 ? ($\text{C} = 12$; $\text{O} = 16$; $\text{Ca} = 40$)
- What is the mass of CaO that can be obtained from one mole of CaCO_3 ?
- In place of methane, what is the methane-containing gaseous fuel which can be produced locally and used in the above industry?
- What are the products X, Y and Z in the following schematic diagram which indicates the industries that use quicklime?



- Name the economically valuable by-product of the production of quicklime and state one use of it.
- The release of the by-product of the production of quicklime into the environment leads to an environmental hazard. What is that environmental hazard?

8. (i) Endothermic (01 mark)
- (ii) • Surface area of reactants increases **(01)**
 • Thermal decomposition becomes easier/ undecomposed CaCO_3 is not left / Amount of undecomposed CaCO_3 left is less/ Interaction with heat is efficient **(01)**
(02 marks)
- (iii) • Mixing with ash
 • Leaving of undecomposed CaCO_3
 • Incomplete decomposition
 • Not exposed to heat well
 • Takes a longer time
 • Releases CO_2 to the environment
(Give one mark each for any two) (02 marks)
- (iv) • Capital incurred / Capital expenditure
 • (Continuous) supply of raw materials
 • (Continuous) supply of fuel
 • Supply of power (energy)
 • Control of environmental pollution during disposal of effluents (wastes)
 • Control environmental pollution when obtaining raw materials (continuously)
 • Availability of a market
 • Infrastructure / electricity / transport facilities
 • The way of maintaining the kiln
 • Labourers
(Give one mark each for any three) (03 marks)
- (v) $\text{CaCO}_3 \longrightarrow 40 + 12 (16 \times 3) / 100$ **(01)**
 Molar mass = $100 \text{ g mol}^{-1} / 0.1 \text{ kg mol}^{-1}$ **(02 marks)**
- (vi) (01 mol of CaCO_3 gives 01 mol CaO)
 $\text{CaO} \longrightarrow 40 + 16 = 56$ **(01)**
 mass of CaO = 56 g
(01 mark for the unit) (03 marks)
- (vii) Bio gas **(01 mark)**
- (viii) X – calcium carbide / CaC_2 **(01)**
 Y – slaked lime / Ca(OH)_2 **(01)**
 Z – bleaching powder / calcium oxychloride / calcium hypochlorite / Ca(OCl)_2 **(01)**
 Award marks even if X, Y and Z are missing provided the products are given in the correct sequence **(03 marks)**
- (ix) carbon dioxide / CO_2
 Uses
 • production of dry ice / Any specific use of dry ice
 • production of soft / fizzy drinks / aerated water
 • As a raw material for chemical industries
 • Extinguishing fires
 • Creating artificial rains
(01 mark for any one) (01 mark)
- (x) Global warming **(02 marks)**
(20 marks)

Overall observations and conclusions regarding the answers to Question 8 :

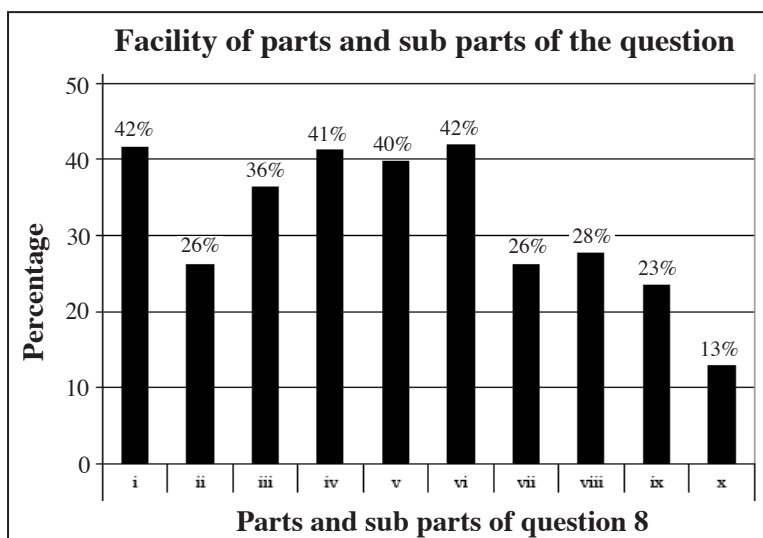


The percentage of candidates selecting question 8 is 78%. Total mark allocated for the question is 20.

The percentage scoring marks within the four intervals given below are as follows.

0 - 5	–	57%
6 - 10	–	26%
11 - 15	–	13%
16 - 20	–	4%

The percentage of candidates obtaining more than 16 for this question is 4% whereas the percentage getting less than 5 is 57%.



This question comprises 10 sub parts. Of them, the facility is greater than 40% for the sub parts (i), (iv), (v), (vi). For the remaining six sub parts, the facility is less than 36%. The most difficult sub part of this question is (x) for which the facility is 13%.

The facility of sub part 8(ii) is 26%. Describing the advantage of putting pulverised limestone into the kiln has been difficult for students. The ability of describing how the physical nature of reactants affect the rate of a reaction was at a lower level. This implies a weakness of transfer of training where students fail to apply once learned principle to a new situation. Therefore such situations need to be surfaced and discussed as much as possible during teaching.

The facility of sub part 8(iii) is 36%. This means that only 36% were successful in stating the disadvantages of the production process prevailing in a traditional lime kiln. In order to enable students to compare the effectiveness of the lime production using modern technology and traditional methods and to promote their knowledge and understanding in this area, the students could be given an opportunity to observe a traditional lime kiln and explore its action.

The facility of sub part 8(vii) is 26%. This facility would have gone so low because of the inadequacy of the knowledge in substitutes for fuels and ignorance of the fact that methane (CH_4) is the major constituent in bio gas. So, it is recommended that when organising field trips, opportunity should be given to observe a bio gas generator and strengthen knowledge and understanding about its action.

The facility of sub part 8(viii) is 28%. Seemingly the students' knowledge about the industries carried out using quicklime (calcium oxide) is not satisfactory. Students' awareness about the industries conducted using quicklime has to be raised.

The facility of sub part 8(ix) is 23%. The reason for this situation is the lack of students' understanding about the uses of the by - products of chemical industries, use of carbon dioxide as a fizzing agent only in the production of carbonated beverages and the properties and uses of carbon dioxide.

The facility of sub part 8(x) is 13%. The students lack proper understanding about the main environmental problem created when the main by - product of lime production is released into the environment. Many have given the greenhouse effect as an answer for this but they are unaware of the fact that greenhouse effect is not an environmental problem.

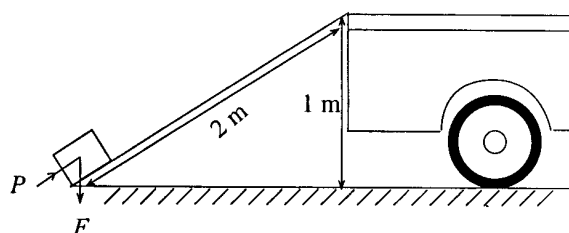
This situation can be rectified by making the students clearly understand how the atmosphere can be maintained in a way favourable to the living beings.

Objectives for Question 9

- Testing the knowledge in the magnitude of the force created by gravity on a mass.
- Testing the understanding of potential energy possessed by an object due to gravitational force.
- Examining the ability to calculate the work done by a force.
- Inquiring into the ability of determining the mechanical advantage and velocity ratio of simple machines.
- Examining the ability to identify a pair of forces relevant to Newton's third law.
- Examining the knowledge in the equilibrium of a pair of forces.
- Examining the ability to use Archimedes' law of floatation.
- Examining the understanding of the influence exerted by the density of a fluid on upthrust.

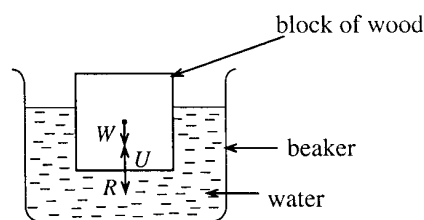
Question 9

9. (A) The diagram shows how a smooth, 2 m long plank is used as an inclined plane to raise a block of ice of mass 100 kg to the deck of a lorry. The deck of the lorry is 1 m above the ground. (Acceleration due to gravity, $g = 10 \text{ m s}^{-2}$)



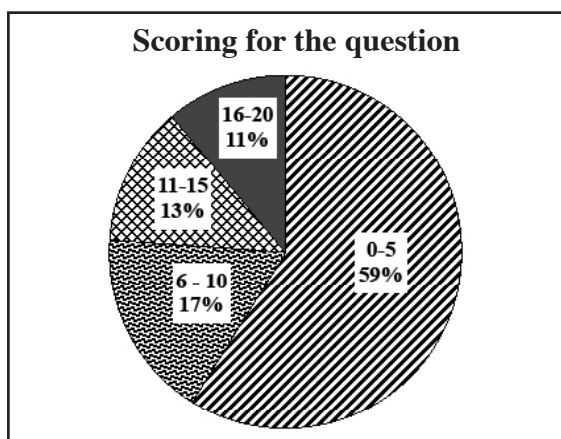
- What is the gravitational force (F) on the block of ice acting towards earth?
- What is the potential energy of the block of ice on the deck of the lorry if its potential energy at the lower end of the inclined plane is considered zero?
- If the minimum force (P) required to push the block of ice upwards **along the inclined plane** is 600 N, calculate the work done in raising it to the deck.
- This inclined plane is a simple machine. Calculate its mechanical advantage.
- What is the velocity ratio of this machine?

- (B) When put into a beaker of water, a block of wood floats. The weight of the block of wood is W . The force exerted by it on water is R and the upthrust is U . (Acceleration due to gravity, $g = 10 \text{ m s}^{-2}$)



- Of the forces W , U and R indicated in the diagram, name the pair of forces which conforms to Newton's third law.
- Equalling of which pair of forces makes the object float on water?
- Name the laboratory equipment made to measure the volume of the displaced water in an occasion like this.
- Using such an equipment, it was found that the mass of water displaced by the block of wood was 0.5 kg. Find the value of force U .
- Name the law which you used to decide the value you gave for (iv) above.
- What is the weight of the block of wood?
- What change in the submerged depth of the block of wood will occur, if the water in the beaker is replaced by a concentrated salt solution?

Overall observations and conclusions regarding the answers to Question 9 :



Forty seven per cent have selected question 9 to which 20 marks have been allocated.

The percentage of candidates whose marks fall into the following four intervals are :

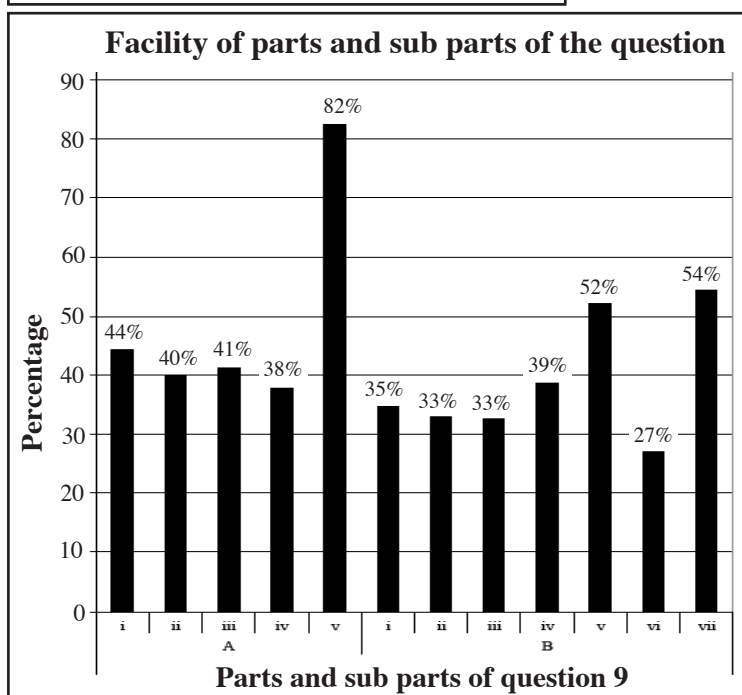
0 - 5 — 59%

6 - 10 — 17%

11 - 15 — 13%

16 - 20 — 11%

The percentage scoring above 16 for this question is 11% while 59% have scored below 5.



Question 9 comprises 12 sub parts and the facility of six of them is above 40%. The most difficult sub part of this question is B(iv) for which the facility is 27%. The easiest sub part has been A(v). Its facility is 82%.

The facility of sub part A(ii) is 40%. The facility would have gone down owing to the inadequacy of students' understanding about the factors affecting the potential energy and their relationships and weaknesses in calculation. Thus, offering more opportunities for students to solve problems connected with this relationship is recommended.

The facility of sub part A(iv) is 38%. Students have failed to discern correctly the relations among the factors affecting the mechanical advantage of an inclined plane, a simple machine. A remedial measure is getting students to do more computations and reinforce the understanding of the above relationship.

The reported facility for sub part B(i) is 35%. Identifying the pair of forces in accordance with Newton's third law had been a difficult task. The teachers should emphasize the pair of force does not act on the same object.

The facility of sub part B(ii) is 33%. So, most of the students were unable to understand that an object floats on water because of the equilibrium set by the equalled weight and upthrust.

The facility of sub part B(iii) is 33%. Only 33% have written correctly that the equipment used to measure the volume of a liquid displaced by a floating object is the eureka can. Students have written the name of various apparatus. There are suitable apparatus for a particular task performed during laboratory experiments. The teachers should take care to use such apparatus when conducting such experiments. In case an alternative is used, student' attention should be drawn to the name of the correct piece of apparatus.

Poor skill of translating units could have been the reason for the low facility (39%) of sub part B(iv). The facility of sub part B(vi) is 27%. The reason for this situation is the students' ignorance that weight is a force and its unit is Newton.

The skill of applying Archimedes' law should be developed practically. Students' knowledge and understanding in this aspect can be elevated by using the correct apparatus (e.g. eureka can) and consolidating the knowledge of upthrust through practical work.

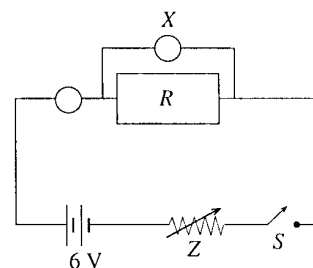
Objectives for Question 10

- Examining the knowledge of connecting a voltmeter to a circuit to measure the potential difference.
- Examining the knowledge and understanding of how the current flowing in a circuit changes with resistance.
- Examining the application of Ohm's law.
- Testing the ability of calculating the energy spent in a resistor.
- Examining the knowledge about the apparatus used to generate electrical energy by hydroelectricity.
- Examining the knowledge and understanding of the strategy used to increase the potential of an alternating current.
- Examining the knowledge and understanding about the way the bulbs and switches are connected in domestic circuits.
- Testing the ability of computing the amount of electrical energy spent when the power of an electrical appliance is known.
- Examining the knowledge about the safety provided by using a mini circuit breaker.

Question 10

10. (A) The diagram shows an electrical circuit constructed to find the value of an unknown resistor. The resistor is indicated by R and a 6 V battery, a variable resistor / rheostat (Z) and a switch (S) are used in the circuit.

- Name the equipment X .
- When the switch S was closed (switched on) the ammeter reading was 2.5 A. In order to decrease this reading to 2 A, what change in the resistance should be made in the variable resistor Z ?
- When the ammeter read 2 A, the voltmeter reading was 5 V.
 - Name the law you use to find the value of resistor R .
 - Find the value of R .
- When the ammeter reading was 2 A and the voltmeter reading was 5 V, the switch S was kept closed (switched on) for 4 minutes. How much electrical energy is spent in the resistor during this time?



- (B) One of the main methods of producing electricity in Sri Lanka is the conversion of water's potential energy to kinetic energy and generation of electricity using that kinetic energy.

- What is the name of the equipment used to convert water's kinetic energy to electrical energy?
- The alternating current (AC) so generated is stepped up to a high voltage and connected to the main electrical grid in the country. What is the equipment used to step up the potential?
- Of the alternating electrical supply to a house, one wire is called the live wire (L) whereas the other is called the neutral wire (N).

You are provided with two switches ($\text{---}\swarrow\searrow\text{---}$) and two bulbs ($\text{---}\otimes\text{---}$). Indicating as L and N the two wires supplying electricity to the house, draw a circuit diagram to show how the bulbs and switches can be connected in the **same circuit** so that the two bulbs can be lit independently.

- In a domestic electrical circuit, a 100 W bulb lights 4 hours a day. Calculate the electrical energy spent for this per day.
- What is the safety ensured by fixing mini circuit breakers (MCB) in the domestic electrical circuits?

10. (A)(i) Voltmeter (01 mark)

(ii) (The resistance) should be increased (02 marks)

(iii) (a) Ohm's law / ($V = IR$) / Stating the law (01 mark)

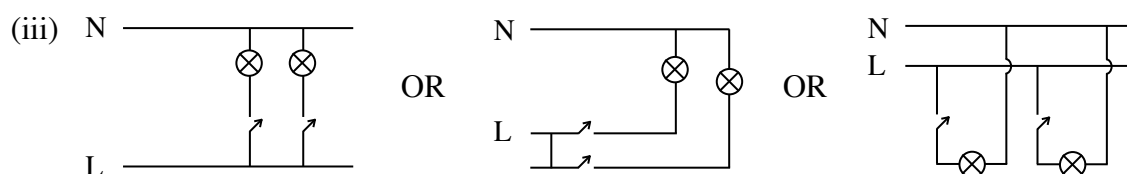
(b)
$$\left. \begin{array}{l} V = IR \\ 5 = 2 \times R \\ R = 5/2 \Omega / 2.5 \Omega \end{array} \right\} \begin{array}{l} \text{(For identifying / substituting) (01)} \\ \text{(02)} \end{array} \right\} \begin{array}{l} \text{(If the unit is not given deduct 01 mark)} \\ \text{Award 03 marks if the correct answer is given with the unit} \end{array} \quad (03 \text{ marks})$$

(iv)
$$\left. \begin{array}{l} H/W/E = V I t \quad \text{(For identifying) (01)} \\ = 5 \times 2 \times 4 \times 60 \text{ J} / 2400 \text{ J} \quad \text{(02)} \end{array} \right\} \begin{array}{l} \text{(03 marks)} \\ \text{(If the unit is not given deduct 01 mark)} \end{array} \quad (03 \text{ marks})$$

Award 03 marks if the correct answer is given with the unit

(B)(i) Dynamo (02 marks)

(ii) (Step up) transformer (02 marks)



(marking of N and L is necessary)

Connecting switches to L (01) }
Connecting bulbs in parallel (01) } (02 marks)

(iv) $100 \times 4 \times 60 \times 60 \text{ J} / 1440000 \text{ J}$

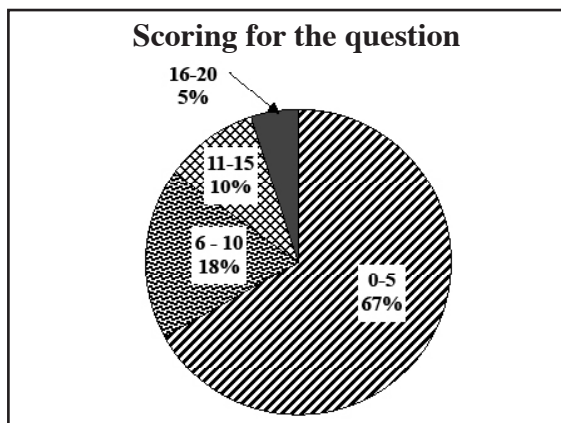
OR

$\frac{100}{1000} \times 4 \text{ kWh} / 0.4 \text{ kWh} \quad \text{(If the unit is not deduct 01 mark)} \quad (02 \text{ marks})$

- (v) • Disconnecting the circuit when a high current flows
• Disconnecting the circuit when short - circuited
• To prevent fires
• To prevent over loading
• To prevent damage caused to cables (wires) / circuit / insulation when a high current flows

(for any one) (02 marks)
(20 marks)

Overall observations and conclusions regarding the answers to Question 10 :



Percentage selecting question 10 is 42%. The mark allocated for the question is 20.

The percentage of candidates whose marks fall into the following four intervals are :

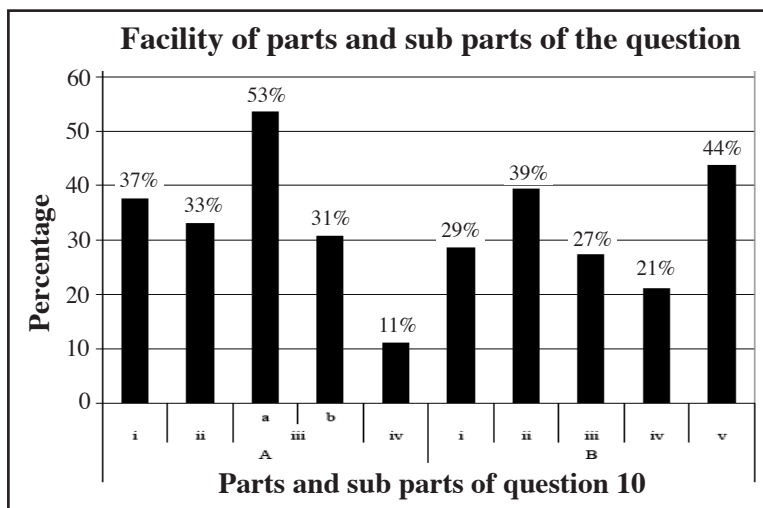
0 - 5 — 67%

6 - 10 — 18%

11 - 15 — 10%

16 - 20 — 5%

The percentage scoring above 16 for this question is 5%. The percentage scoring below 5 is 67%.



Question 10 comprises 10 sub parts. Of them, the facility of 2 sub parts is greater than 40%. A(iv) is the most difficult sub part of this question. Its facility is 11%. The easiest sub part is A(iii)(a). Its facility is 53%.

The facility of sub part A(i) of question 10 is 37%. This means that only 37% had the understanding that a voltmeter has to be connected to a circuit parallelly to measure the potential difference. This implies that students have little knowledge even in the basic concepts of current electricity. The knowledge and understanding of students in these aspects can be strengthened by constructing circuits in the laboratory to measure the current, potential difference and resistance and explain getting the students to draw the circuit diagrams while the experiment is conducted.

The facility of 33% for the sub part A(ii) implies that 33% have understood that the current in a circuit decreases with increasing resistance. Many factors might have contributed to the low achievement of the students here. They would have been ignorant of the function of the variable resistor; or might be deficient of the knowledge that ammeter is used to measure the current and current decreases with the increasing resistance.

The facility of sub part A(iii)(a) is 53%. This is the most facile part of question 10. That is, 53% were aware of the fact that Ohm's law is used to find the value of a resistor. Nevertheless, the facility of sub part A(iii)(b) has become 31%. Though 53% were comfortable in stating that Ohm's law can be used to find the resistance, only 31% were capable in working problems related to it. Hence students should be directed to do numerical exercises on principles.

The minimum facility (11%) for the question is held by the sub part A(iv). The ability of calculating the electrical energy dissipated by a resistor was at a very poor level. This again corroborates the need of giving opportunities for students to solve problems.

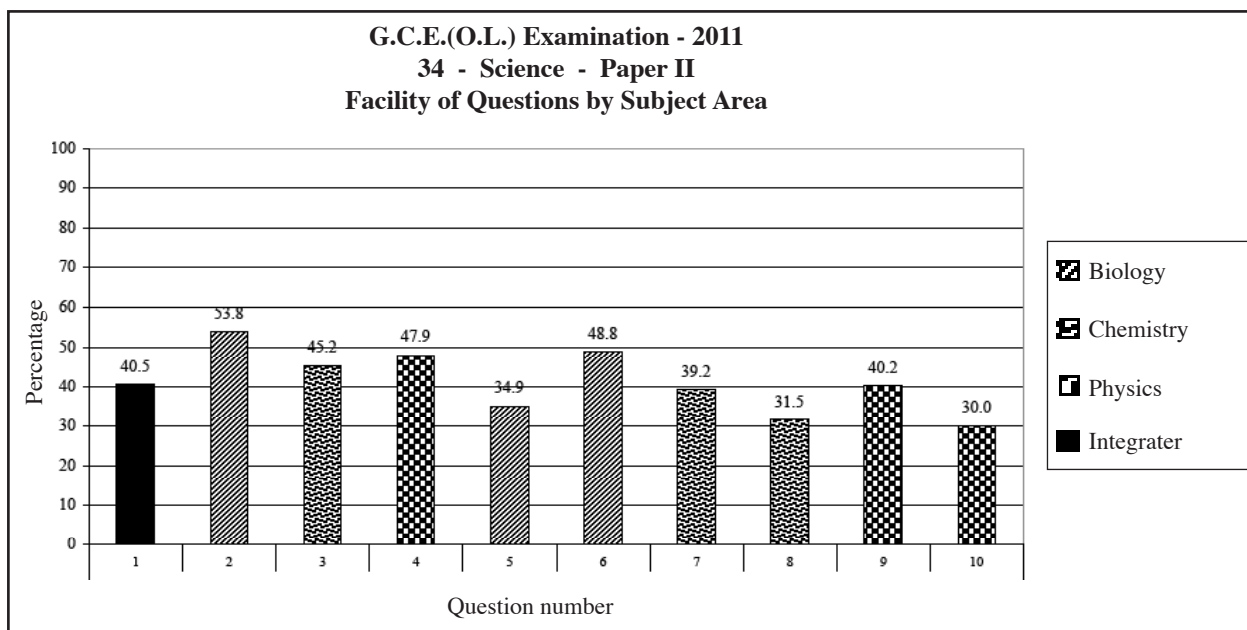
The facility index for sub part B(i) is 29%. The reason for this situation would be the lack of knowledge about the apparatus used to produce hydroelectricity. During the learning teaching process correct names should be used for the equipment.

A facility of 39% holds for sub part (ii). The probable reason for this situation could be the poor level of knowledge and understanding about the strategy used to raise the potential of an alternating current.

The facility registered by the sub part (iii) is 27%. Students have little knowledge and understanding as to how bulbs and switches should be connected in domestic electrical circuits. Though this is related to day to day life, the understanding is at the low ebb. Reinforcing the knowledge by relating sections such as this with everyday life would be more effective. Explanation is needed why such relationships are highlighted.

The facility of sub part (iv) is 21%. Majority of students are unable to calculate the electrical energy spent by an appliance of known power. More opportunities need to be given to students to solve problems.

2.2.3 Overall observations and conclusions regarding the answers to paper II

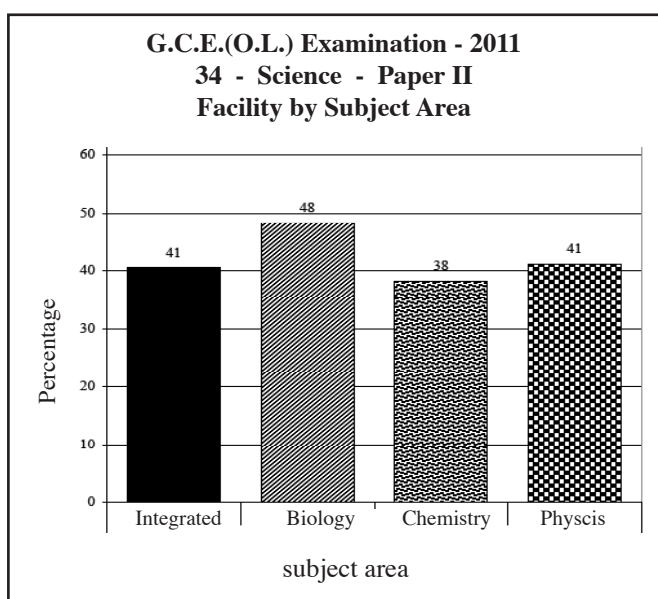


In the structured essay section, 53.8% have answered the Biology question successfully. Percentages of successes in answering the question in Physics and Chemistry are 47.9% and 45.2% respectively. The lowest percentage, that is 40.5%, is reported for the integrated question.

As regards the essay questions, under Biology, question 5 and 6 hold a facility of 34.9% and 48.8% respectively.

Of Chemistry questions, 39.2% have succeeded in answering question 7. In the case of Physics, question 9 shows a facility of 40.2% while the facility of question 10 is 30%.

As far as the essay questions are concerned, students were more successful in answering the questions under Biology testifying a better level of cognition and comprehension in life sciences relative to other sections. However, this is low for Chemistry.



When the facility indices for the questions in paper II of G.C.E.(O.L.) 2011 are considered, the percentages of students presenting satisfactory answers for the three sections are as follows.

Biology	-	48%
Chemistry	-	38%
Physics	-	41%
Integrated	-	41%

So, compared to Chemistry and Physics, students have better assimilated the subject matter in Biology.

Hence, if the learning teaching process is geared to lay a greater emphasis on the areas identified as weaker, one can be hopeful in promoting the level of achievement in Science.

Part III

3 Facts to be considered when answering questions and suggestions :

3.1. Facts to be considered when answering :

Common instructions :

- * The candidates should read the basic instructions given in the question paper. They should be considerate as to the facts such as how many questions be answered in each section, which questions are compulsory, what time is affordable and how much can be scored. They also should read the questions carefully and select the questions with a clear mind set.
- * When responding to the questions in paper I, one response which is the most correct needs to be selected. Also, only one cross must be marked clearly.
- * When answering questions in paper II, every new question should be started in a new page.
- * Answers could be written in clear and correct handwriting.
- * The candidate's index number should be written in every page in the relevant box.
- * Numbers of questions, parts and sub parts should be indicated correctly.
- * Long descriptions shouldn't be given when short specific answers are expected. Similarly short answers should be avoided in places where descriptive answers are preferred.
- * According to the way the question is posed, facts should be presented logically and analytically.
- * When answering paper II, all the sub parts given under the main question should be read carefully and only the target answer relevant to each sub part should be written.
- * Care should be taken to manage time properly when answering questions.
- * Candidates shouldn't use red and green pens in writing answers.

Special instructions :

- * The technical terms in science should be used in appropriate places.
- * The illustrations should be drawn very clearly and labelled.
- * In calculations, steps should be indicated clearly.
- * At relevant places, correct units should be given.
- * Standard forms should be used when writing scientific names and symbols.
- * When writing equations at relevant places, they should be balanced always.
- * When drawing graphs, the axes 'x' and 'y' should be named correctly and where necessary the unit should be stated.

3.2. Comments and suggestions about the teaching learning process :

- * The teacher should begin teaching science to the pupil with an understanding of the subject. It is a process that depends both on the meticulous observations of the existing phenomena as well as the theories formulated to make those observations meaningful. Therefore, when teaching science, the most appropriate method should be adopted to develop the respective concepts. The essential factors and facts should be systematically built up in the student for forming concepts.
- * Scientific knowledge is a result of man's incessant curiosity about his environment, inquisitiveness about the world and attempts to understand it. Scientific knowledge transcends the common knowledge of everyday practice owned by a majority. Hence, unlike in other subjects, appropriate methods should be used to impart scientific knowledge.
- * The principal aim of teaching science is to incline students toward the **process of science**. Scientific method consists of the salient steps namely initial observation, formulation of hypotheses, assumption, testing of hypotheses and arriving at conclusions through re - testing. The teacher's task is to identify the process in science and familiarize students with its usage. Then, the students would pursue its application in solving problems.
- * When going through how the students have answered the G.C.E.(O.L.) Science paper, it seems that the students' understanding about the scientific method is scant. Apparently, the capacity to understand problems has been undermined by the lack of correct concept building. If scientific method is fittingly used in the classroom, students can acquire a host of competencies.
- * Developing in students the competencies related to understanding of functioning, scientific information, scientific attitudes, interest toward science, and science ethics can be considered the major learning output in science. Science teacher should teach science in such a way that the above competencies are instilled in students.
- * The science teacher's role is somewhat complex. In addition to the normal learning teaching process taking place in the classroom, many exercises such as group activities, laboratory experiments, field work, projects, field trips and exhibitions are involved in this subject. In all these pursuits the teacher should organise his/her learning teaching process ensuring the maximum and right participation of students allowing for try outs.
- * According to the facilities available modern technological devices such as videos, computer software, internet and multimedia projectors can be used to strengthen knowledge.
- * In the learning teaching process of science, the methods of learning are more important than the content learnt. When inspecting the aims and objectives of the science syllabus, it is noticeable that there is a specific system of aims to be achieved by the learning teaching process. Those aims are set out mainly with a view to promoting knowledge, attitudes and skills relevant to day - to - day life. In addition to this, the learning outcomes are envisaged to be internalised so that they become 'life habits' strengthening the interpersonal relations. Thus the teacher should make it a point to adopt different teaching methods so that these aims are realized.

- * In the classroom, opportunities should be offered for team work under the supervision of the teacher. This enables students to share and exchange their knowledge with other members of the group.
- * A student will be able to understand most of the abstract concepts he would come across in science only if he has systematically grasped the basic concepts which lay the foundation for them. To realize this, the teacher should appropriately and efficiently use learning aids. He/she should probe into the experiences and prior knowledge of students and let them have opportunities to establish them.
- * In order to make students understand some concepts in science, laboratory experiments are indispensable. In such instances usage of the laboratory should be compulsorily integrated into the learning teaching process. Moreover, every instance possible, the teachers should be keen in correlating learning outcomes with life experiences.
- * When involved in practical experiments in classrooms only the specified instrument should be used for the intended task. If alternatives are used in absence of the standard instrument, students should be made aware of the right instrument.
- * During the learning teaching process of science, always the skills and knowledge need to be developed in students so that they can link scientific principles with day - to - day events and experiences. This can be done by giving feedback to students by assessing them during the learning teaching process.
- * The teacher should assess the students during the learning teaching process. This enables the teacher to understand students' abilities, weaknesses and proficiencies when they are involved in learning in the classroom. Thus, the teacher should identify students' weaknesses during learning itself and draw out plans to implement feedback programmes for them.
- * When teaching science, the role set of the teacher involves the communication of its findings to students in simple terms. No specified method has been put in place for it and depending on the teacher's competence, different methods can be adopted. Modification of methods according to the aim, based on the guideline set out in the teacher instruction manuals will pave way for a successful learning teaching programme.
- * The most important in teaching science is the building up of basic concepts correctly in students. If not what happens is something like asking students to climb a ladder with broken rungs. When evaluating the classroom learning teaching process today, it is seen that this is a point of great concern of the science teacher.