HKASME Science Assessment Test 2018

(Debriefing Seminar)

Date: 5 July 2018

HKASME Science Assessment Test

Purpose:

- To develop and to implement a science assessment test for S2&3 students in Hong Kong
- To analyse the test results and to provide feedback to schools/the administration on the strengths and weaknesses of students in learning science

Science Process Skills (SPS)

- Observing, measuring and recording data (SP1)
- Comparing and classifying (SP2)
- Planning and designing (SP3)
- Experimenting (SP4)
- Interpreting data / Inferring (SP5)
- Communicating (SP6)

Participations in 2018 SAT

Participants	S2	S3	Total
Boys	793	623	1416
Girls	673	503	1176
Total	1466	1126	2592

No. of Participating Schools: 77

HKASME Science Assessment Test

- Duration: 1 hour
- Paper Structure:
  - Section A: 24 MCQs
  - Section B: 2 Short-response questions
- Coverage: Science knowledge in
  - topics 1 to 11 of CDC Science Curriculum
  - S1 to S3

Weaknesses of Participants as Revealed from Their Performance

Section A

MCQ Item Analysis (1)

Q. No.	A (%)	B (%)	C (%)	D (%)	Diff. Index	Disc. Index
1	72	11	14	3	0.63	0.42
2	19	10	56	15	0.55	0.24
3	8	85	3	4	0.79	0.13
4	4	28	9	59	0.32	0.51
5	85	11	3	1	0.81	0.02
6	4	8	12	76	0.69	0.31
7	13	14	55	18	0.54	0.45
8	14	55	13	18	0.53	0.37
9	1	56	19	24	0.29	0.09
10	17	11	54	18	0.22	0.23
11	27	8	15	50	0.49	0.31
12	19	4	69	8	0.64	0.31

MCQ Item Analysis (2)

Q. No.	A (%)	B (%)	C (%)	D (%)	Diff. Index	Disc. Index
13	12	3	10	75	0.72	0.19
14	18	69	9	4	0.67	0.13
15	2	1	78	19	0.72	0.15
16	81	6	5	8	0.71	0.32
17	13	57	9	21	0.52	0.24
18	15	5	6	74	0.66	0.41
19	4	87	7	2	0.79	0.17
20	62	11	6	21	0.61	0.39
21	28	67	4	1	0.31	0.16
22	6	15	72	7	0.66	0.33
23	34	23	25	18	0.30	0.27
24	37	14	29	20	0.41	0.44

Discrimination index (DI)

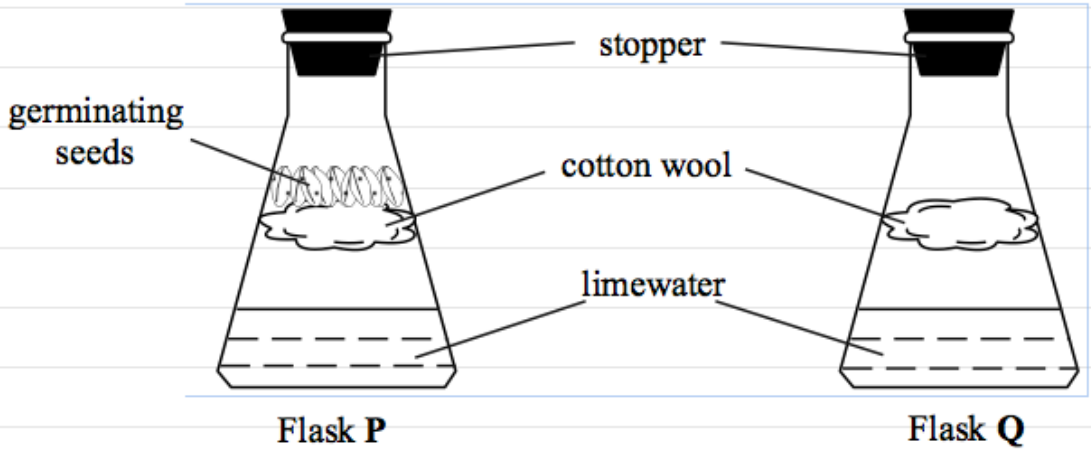
- describes the ability of an item to distinguish between high and low scorers
- ranges between -1.00 and +1.00
- expected that the high-performing students select the correct answer for each item more often than the low-performing students
- DI = (H-L) / ½ N

“ items with p-value between 30 - 70 and DI > 0.24 → “appropriate”

DI	Interpretation
≥ 0.35	Excellent
0.25 – 0.34	Good
0.15 – 0.24	Marginal
< 0.15	Poor

Skills in Scientific Investigation

Q.4 The set-up shown below was used in a certain experiment:

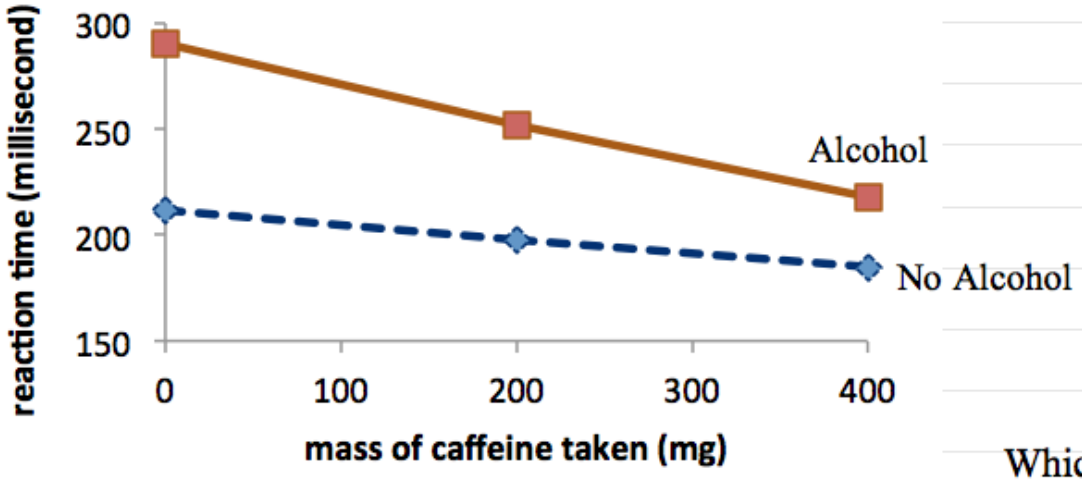


After a few days, the limewater in **P** turned milky while that in **Q** remained clear. The purpose of this experiment is to show that

(1) germination of seeds requires oxygen.
(2) germination of seeds produces carbon dioxide.
(3) carbon dioxide can turn limewater milky.

A.	(1) only	(4%)
*B.	(2) only	(28%)
C.	(1) and (3) only	(9%)
D.	(2) and (3) only	(59%)

Q.24 A scientist investigated the effect of consumption of caffeine on the reaction time of people who have drunk and who have not drunk alcohol. The graph below shows the results of the investigation:



Which of the following statements can be deduced from the results of the investigation?

(1) The reaction time of people increases after drinking alcohol.
(2) The reaction time of people increases after taking caffeine.
(3) People's judgment will be greatly affected after taking caffeine together with alcohol.

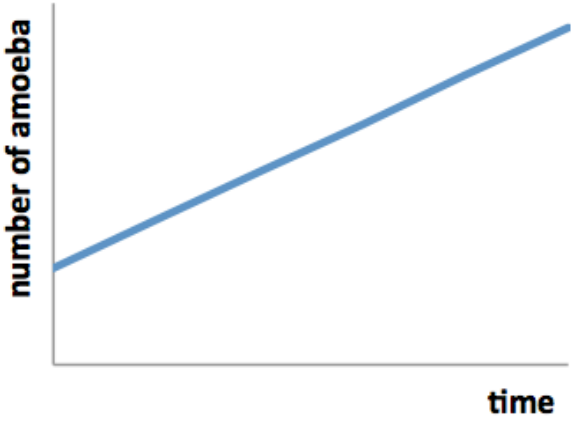
*A.	(1) only	(37%)
B.	(2) only	(14%)
C.	(1) and (3) only	(29%)
D.	(2) and (3) only	(20%)

Q.9 Amoeba multiplies by cell division. A sample of amoeba is allowed to multiply in a petri dish under controlled experimental conditions. Which of the following graphs best represents the variation of the number of amoeba in the petri dish with time?

A.

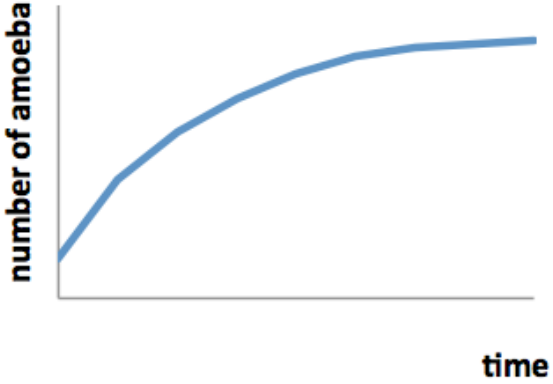
(1%)

B.



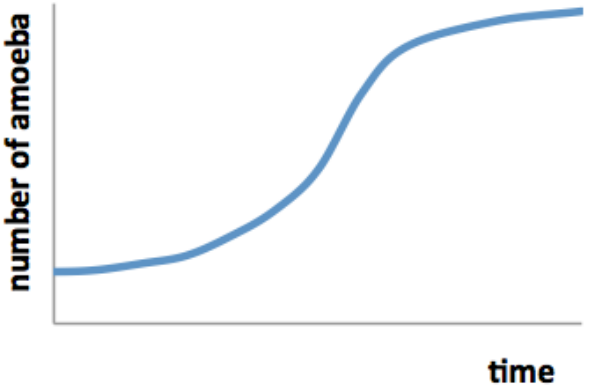
(56%)

C.



(19%)

*D.

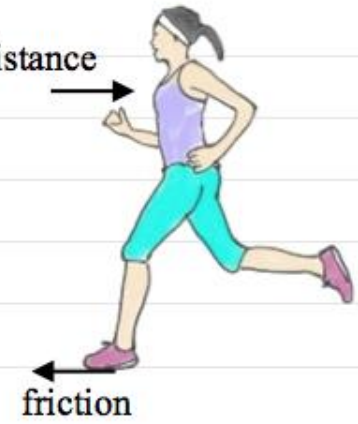


(24%)

Understanding of Abstract Science Concepts

Q.21 Sandy is running on a horizontal road. Which of the following diagrams best illustrates the directions of the air resistance and the friction acting on her foot?

*A.

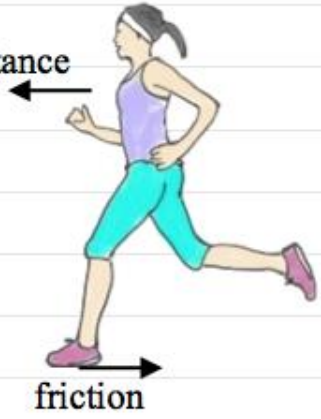


(28%)

B.

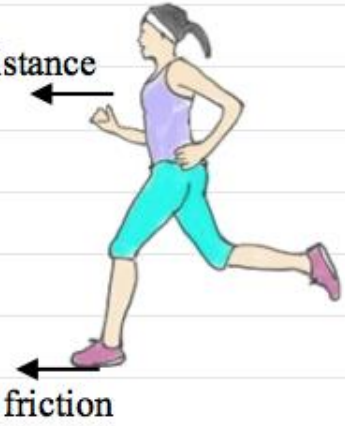
(67%)

C.



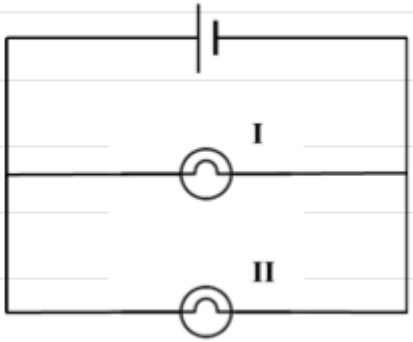
(4%)

D.



(1%)

Q.23 Consider the following circuit, in which the two light bulbs, **I** and **II**, are of different resistance:



Which of the following descriptions about the circuit is correct?

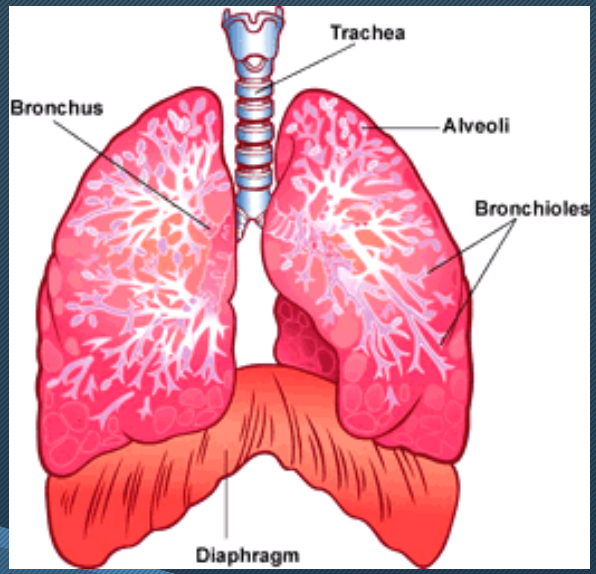
(1) The current passing through **I** and that through **II** are the same.
(2) The current passing through **I** and that through **II** are different.
(3) The voltage across **I** and that across **II** are the same.
(4) The voltage across **I** and that across **II** are different.

A.	(1) and (3) only	(34%)
B.	(1) and (4) only	(23%)
*C.	(2) and (3) only	(25%)
D.	(2) and (4) only	(18%)

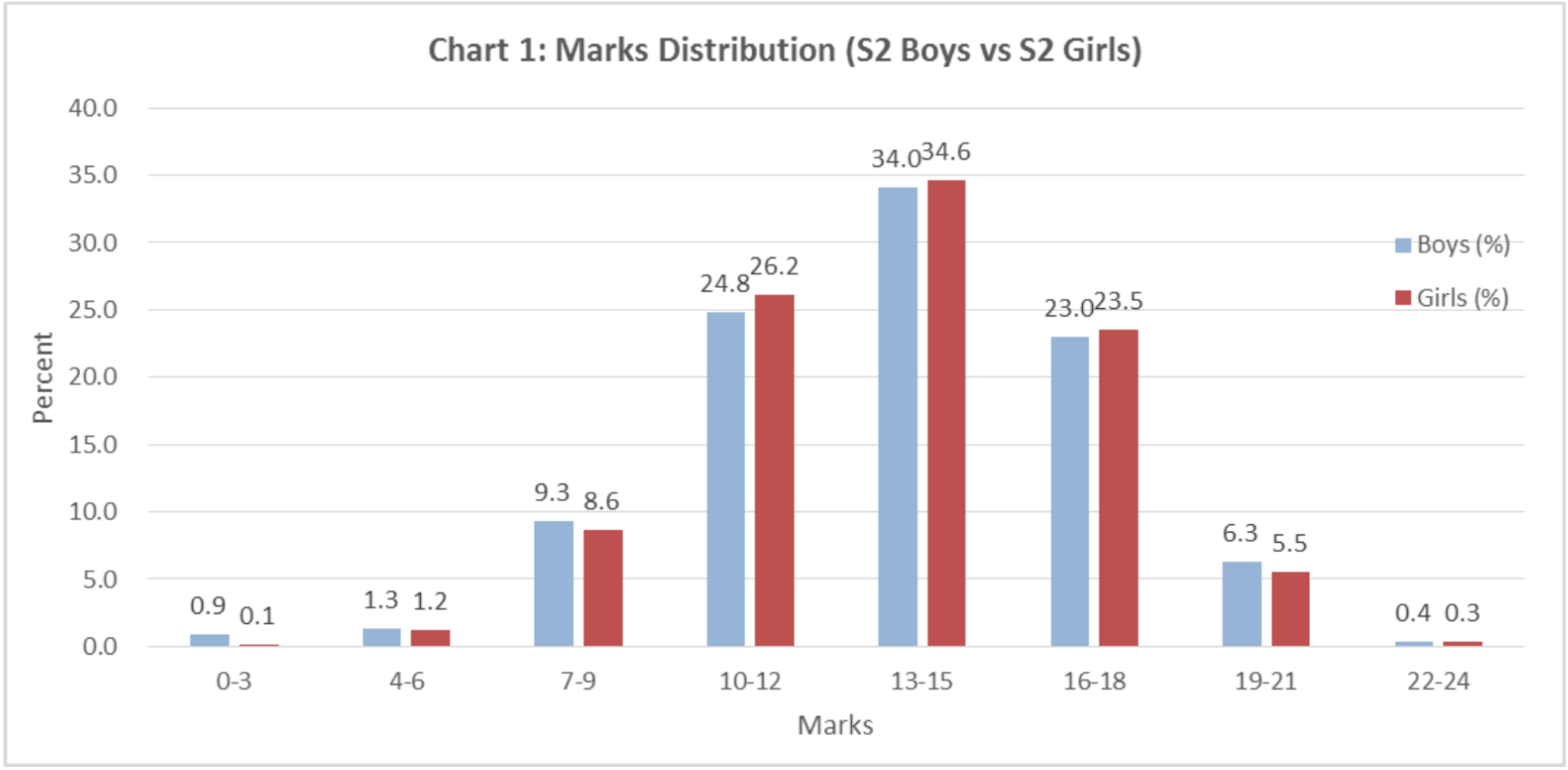
Understanding of Science

Q.10 When we inhale, what happen to our diaphragm muscle and the pressure inside our lungs?

	Diaphragm muscle	Pressure inside our lungs	
A.	relaxes	increases	(17%)
B.	relaxes	decreases	(11%)
C.	contracts	increases	(54%)
*D.	contracts	decreases	(18%)



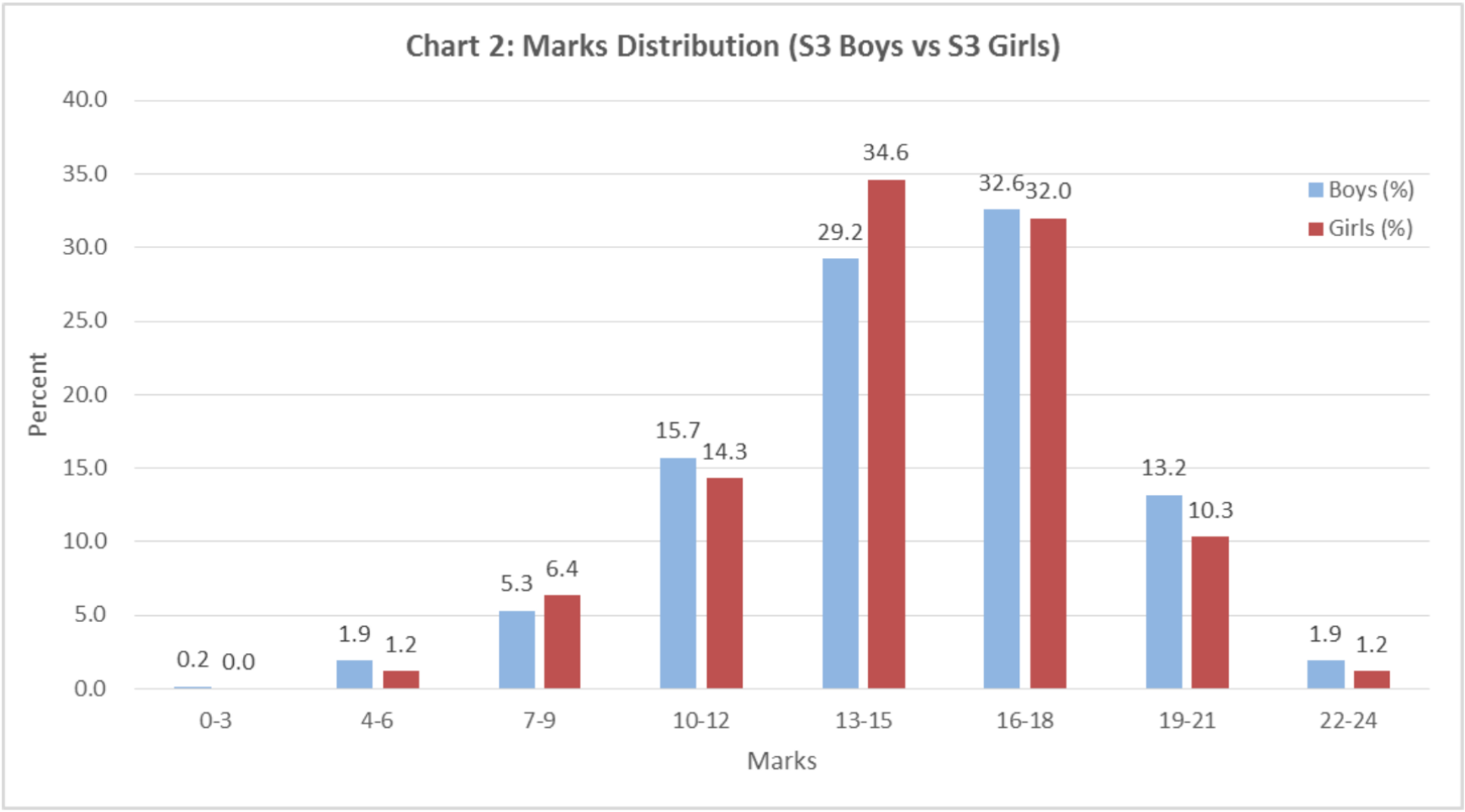
Performance of S2 Students in Section A



- Percentage of boys and girls getting ≥14 MCQ correct are 47.7% vs 47.1% respectively.

(Mean = 13.6; S.D. = 3.35)

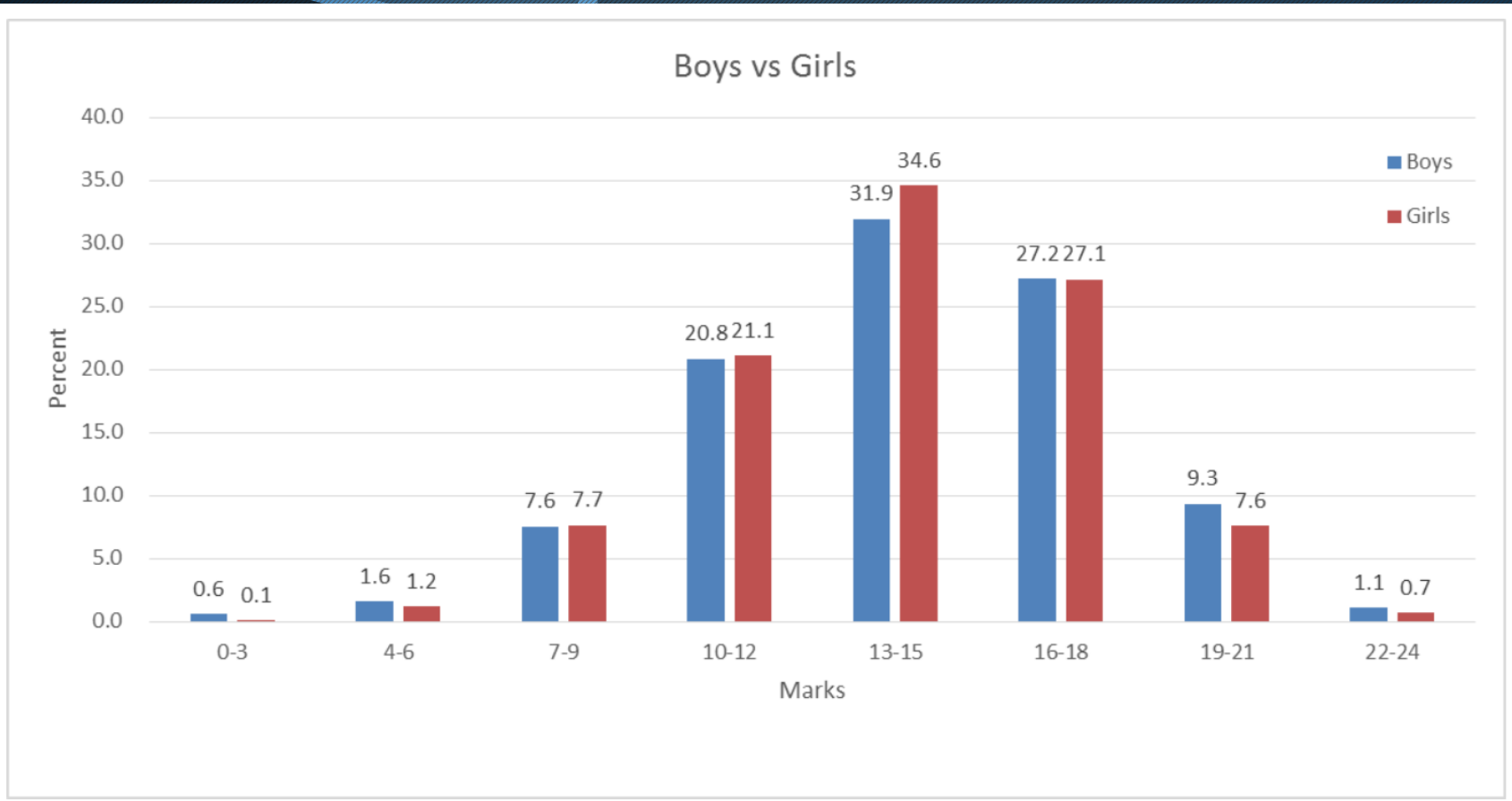
Performance of S3 Students in Section A



- Percentages of boys and girls getting ≥14 MCQ correct are 68.1 and 69.6 respectively.

(Mean = 14.9; S.D. = 3.43)

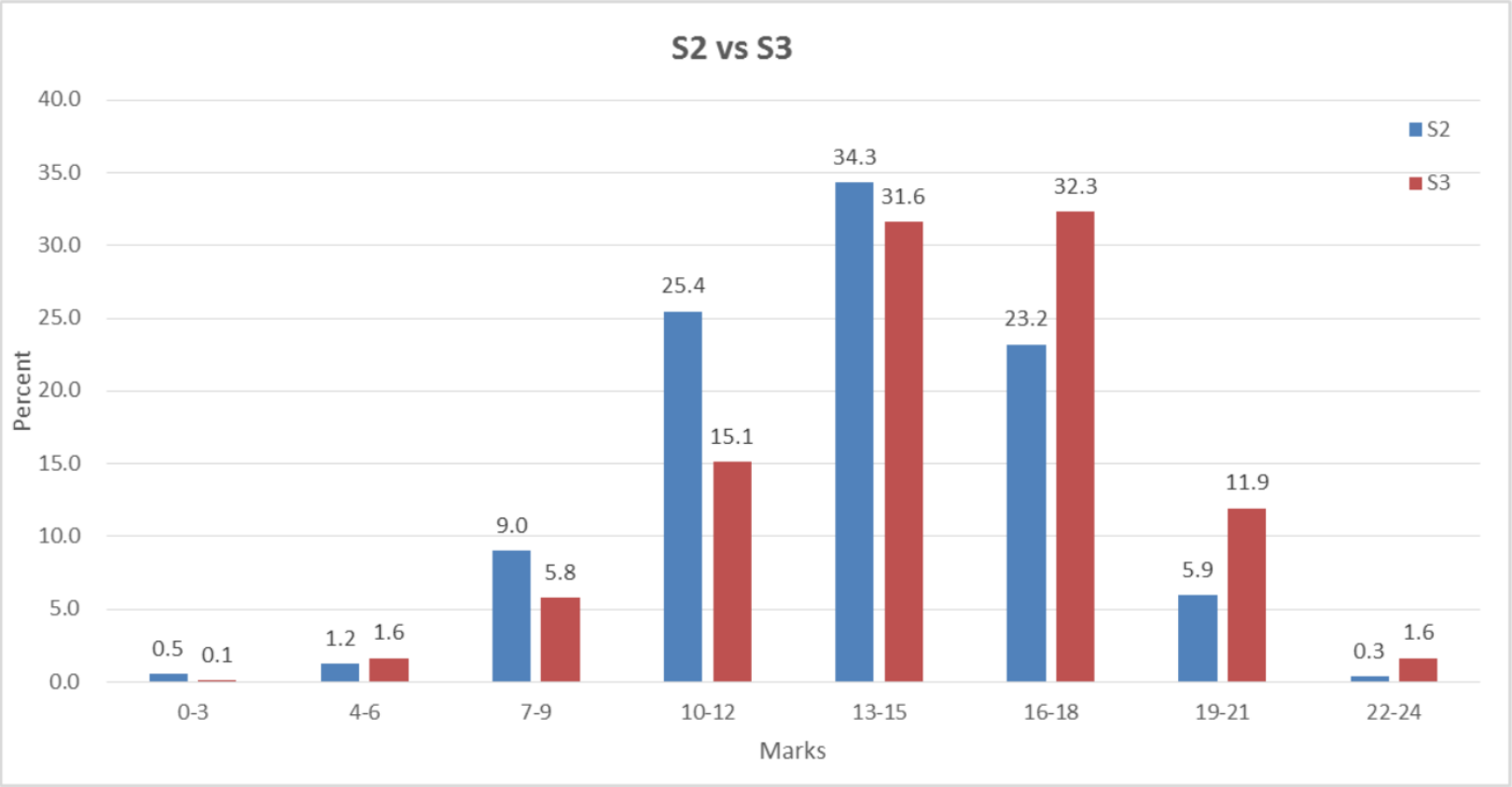
Performance of Whole Group in Section A



- Percentages of boys and girls getting ≥14 MCQ correct are 59.3 and 60.0 respectively.
- The performance of boys and girls shows no significant difference in MCQ.

(Mean = 14.2; S.D. = 3.44)

Comparing S2 and S3 students' Performance in Section A



- Percentages of S2 and S3 students getting ≥14 MCQ correct are 52.6 and 68.7 respectively.
- It is apparent that S3 students perform better than S2 students, especially at the higher end (difference ~ 16.1%).

Comparison of the Performance of Boys and Girls in Section A

≥14 correct	S2	S3	Whole group
Boys	52%	68%	59%
Girls	53%	70%	59%

Median (correct to the unit digit) = 14

Weaknesses of Participants as Revealed from Their Performance

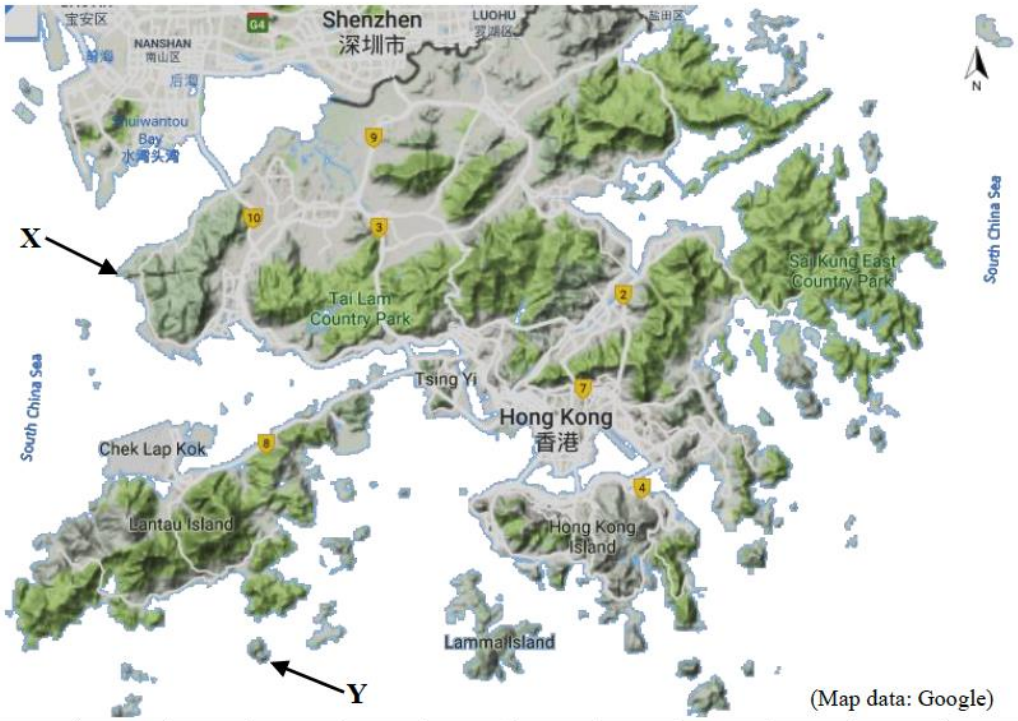
Section B

Q2

Building an Incinerator in Hong Kong

Waste is a problem that will not go away, and Hong Kong is not an exception. Currently, most of our solid wastes are buried in landfill sites. However, this means of waste disposal will no longer work in metropolitans like Hong Kong.

The HKSAR government is now planning to build a new generation incinerator for treating solid wastes. Two sites have been proposed for building the incinerator. These sites are shown in the map below as **X** and **Y**. In site **X**, the incinerator will be built near the coast. In site **Y**, the incinerator will be built on a reclaimed artificial island.



(Map data: Google)

Month of Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dominant Wind Direction												

Mean = 4.0;
S.D. =1.80

Q2 (a) Suggest why treating solid wastes by landfilling will no longer work in Hong Kong. (2 marks)

	(2 marks for a complete answer covering insufficient land + reason)	No. of responses	%
20	Insufficient land for building landfill sites + demand of land to house the growing population.	104	4.0%
21	Insufficient land for building landfill sites + decomposition of solid wastes takes a long time	175	6.8%
22	Landfill sites will soon be used up + the rate of waste production is very fast in metropolitans, like Hong Kong	376	14.5%
23	Landfill sites will soon be used up + other reasons	4	0.2%

	(1 mark for incomplete answers)	No. of responses	%
10	No land available for building landfill sites	1451	56.0%
11	A lot of land is required for building houses for the large population.	15	0.6%
12	Decomposition of solid wastes takes a long time.	72	2.8%
13	The rate of production of wastes in Hong Kong is fast.	59	2.3%
14	Other incomplete answers	1	0.0%
98	Incorrect answers such as landfilling causes pollution problems, it is costly to build landfill sites.	246	9.5%
99	*Unattempt*	*89*	*3.4%*

Mean marks for part (a) = 1.1 (out of 2)

Q2(b)(ii) The new generation incinerator to be built has certain advantages over the previously used incinerators in treating solid wastes. Suggest ONE such advantage. (1 mark)

93	The new incinerator will be built far away from crowded areas.

The incinerators far away from the people who live so that less people will be affected.

位置很郊區，並沒有很多人居住。

98	Other irrelevant answers

處理垃圾的需時較短。

The wastes which produce by the incineration can go to the sea.

這樣能減少堆填區的負擔，与香港的居住問題得以改善。

新一代焚化爐污染會更完善。

新一代焚化爐選址偏僻，不用擔心該處建屋的問題。

When the technology in Hong Kong improve now, the government can use natural gas or electricity to reduce the emittion of the poison gas.

The cost of building new generation incinerators is cheaper than the old one's as those incinerators start to become popular amount the whole world.

Mean: 0.3

Q.2(c) With reference to the above info, suggest why X and Y are considered suitable sites for building the incinerator. (2 marks)

(c) (ii) *Answers related to the location of the incinerator far away from the densely populated areas are coded by **P**; those related to the wind direction are coded by **W**.*

		No. of responses	%
P1	Both sites are far away from residential areas.	1840	71.0%
P8	Incorrect answers related to population	349	13.5%
P9	Answers not covering the location of the incinerator	290	11.2%
W1	In Hong Kong, the wind mostly blows from the East. As **X** is on the far West of Hong Kong and **Y** on the South Western part of Hong Kong, any pollutants emitted from the incinerator will be blown to the sea.	774	29.9%
W8	Incorrect answers related to wind direction	235	9.1%
W9	Answers not covering the wind direction	1470	56.7%
99	*Unattempt*	*113*	*4.4%*

Mean marks for part (c) = 1.0 (out of 2)

Q.2(d) Apart from building incinerators, suggest TWO means the government can adopt to reduce solid wastes in Hong Kong. (2 marks)

(d) Any **TWO** of the following *(double-digit coding not applicable for this part)* **2, 1 or 0**

- Facilitate the recycling used products, e.g. batteries, electronic goods, paper, used plastics etc. (recycling boxes)
- Educate (broadcasting and advertising) the public to reuse used objects/reduce the use of disposable items.
- Provide incentives to industries to reduce solid wastes.
- Impose a tax/tariff on the use of plastic bags, the disposal of electronic goods, the amount of wastes to be dumped into the landfill sites.
- Expand the areas of the landfill sites as a temporary measure.
- Other reasonable answers

		No. of responses	%
2	*Two correct answers given*	737	28.4%
1	*One correct answer given*	1075	41.5%
8	Irrelevant answers	620	23.9%
9	*Unattempt*	*160*	*6.2%*

Mean marks for part (d) = 1.0 (out of 2)

Q.2(d) Some Irrelevant Answers

We can use less plastic product, decrease the waste of plastic in landfill.

We can bring our own bag to go shopping.

回收，专廢物循環再用。減少浪費。

回收固體廢物並再造使用。

用來當建築物內的裝飾品。

Put the solid waste into the recycle box and reuse the solid waste if they can use.

1. 可回收固體廢物活動。
2. 拍賣場。把二手貨清洗乾淨後，去拍賣，一舉二得。

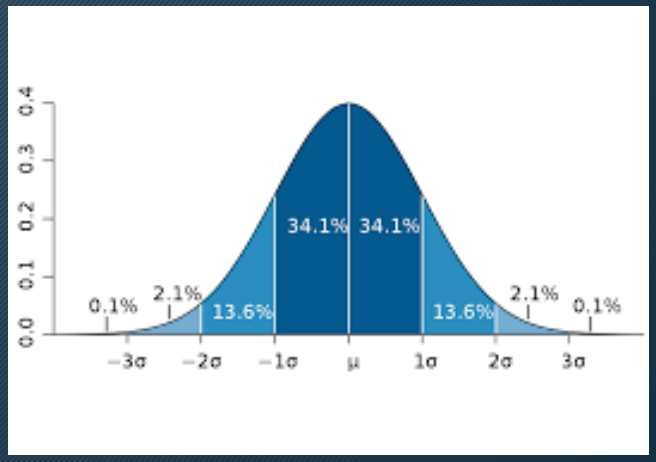
Use the 3R (recycle, reuse, remake)

不售卖罐装饮料.

建造固体废物垃圾箱.

Analysis of 2018 SAT Results

	Mean	SD
Section A	14.2 (59%)	3.44 (14.3%)
B1	5.6 (56%)	2.30 (23.0%)
B2	4.0 (50%)	1.80 (22.5%)
Section B	9.6 (53%)	3.45 (19.2%)



Comparison of Performance of S2 and S3 Students

	Section A		Section B	
	Mean	S.D.	Mean	S.D.
S2	13.6 (57%)	3.35 (14.0%)	9.1 (50%)	3.25 (18.0%)
S3	14.9 (62%)	3.43 (14.3%)	10.2 (57%)	3.60 (20.0%)

2018 Science Assessment Test

- Bronze Award based on a criteria-based model
- Introducing a Diamond Award (top 5%)
- Expert judgment for Gold, Silver and Bronze Award
- QP and students' performance on individual questions available to participating schools
- More informative school reports

2018 SAT Award Scheme

HKASME set up an expert panel to determine the cut-off based on the performance of the participants.

	Bronze	Silver	Gold	Diamond
Paper score / marks	24.5 — 31.5	32.0 — 36.0	36.5 — 41.5	≥42.0
Section A / MCQs	≥ 10	≥ 10	≥ 10	≥ 10
Section B / marks	≥ 5	≥ 5	≥ 5	≥ 5

(Paper score = 1.5 × Mark in Section A + Mark in Section B)

2018 SAT Awards

Award type	Number
Diamond	147 (5.7%)
Gold	497 (19.2%)
Silver	610 (23.5%)
Bronze	832 (32.1%)
Appreciation (or	506 (19.5%)

School-based Report —Appendix I

“Analysis of Participants’ Responses to the Multiple-choice Questions (MCQs)

Q. No	Skills assessed	Key	% correct		Strength / weakness
			WG	School	
1	Interpreting data; Inferring	A	72.0	93.0	S
2	Planning & Design; Predicting	C	56.4	83.7	S
3	Understanding; Inferring	B	84.5	93.0	-
4	Planning & Design;	B	27.6	41.9	*D*
5	Predicting	A	85.3	69.8	W
6	Identifying variables	D	76.4	67.4	-
7	Understanding;	C	55.2	79.1	S
8	Making hypothesis	B	55.2	51.2	-
9	Interpreting graph; Predicting	D	24.4	16.3	*D*
10	Understanding; Predicting	D	17.6	30.2	*D*

Q. No	Skills assessed	Key	% correct		Strength / weakness
			WG	School	
20	Understanding	A	61.9	89.2	S
21	Understanding	A	27.5	73.0	D, S
22	Interpreting graph; Inferring	C	72.0	75.7	-
23	Understanding	C	25.2	18.9	D
24	Interpreting graph; Inferring	A	37.4	37.8	-

Strength in a question (indicated by "S") means that the school got a higher correct % by 15% or more on that question compared to the whole group in 2016 SAT.

Weakness in a question (indicated by "W") means that the school got a lower correct % by 15% or more on that question compared to the whole group in 2016 SAT.

Questions that are poorly answered by the whole group (≤1/3 correct) are represented by "D"

“Question(s) showing “weaker” performance as compared to WG

	WG		School	
Q. No.	Key	Most Popular	Key	Most Popular
2	C (56.4%)	A (18.7%)	C (27.9%)	D (37.2%)
4	B (27.6%)	D (59.3%)	B (11.6%)	D (72.1%)
7	C (55.2%)	D (17.9%)	C (32.6%)	D (32.6%)

Analyzing student responses & identifying their problems

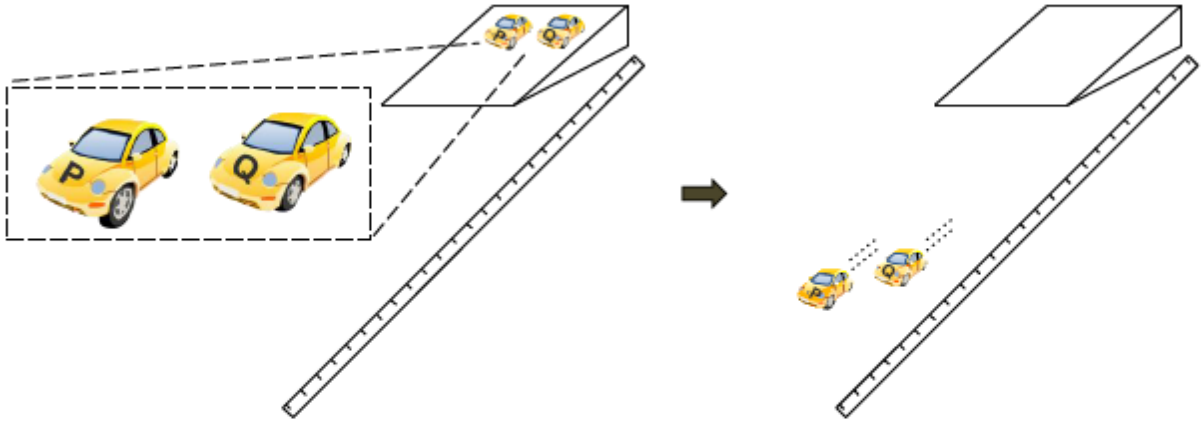
7. The photo below shows an ice lolly placed in air:

Which of the following combinations correctly describes the movement of air around the ice lolly and the reason behind?

	Movement of air around the ice lolly	Reason
A.	The air close to the ice lolly lifts while that further away sinks.	Cold air is denser than warm air.
B.	The air close to the ice lolly lifts while that further away sinks.	Water vapour in air condenses on a cold surface.
C.	The air close to the ice lolly sinks while that further away lifts.	Cold air is denser than warm air.
D.	The air close to the ice lolly sinks while that further away lifts.	Water vapour in air condenses on a cold surface.

Q. No.	A	B	C	D	Right Ans.	Correct %	Wrong %	Diff. Index	Disc. Index
07	13.2%	13.3%	55.2%	17.9%	C	55.2%	44.4%	54.4%	0.45

8. Harry carried out an experiment to study the distance travelled by two toy cars, **P** and **Q**, when they were released from the top of an inclined plane. The diagram below shows the results obtained:



Which of the following can be a hypothesis of Harry's experiment?

A. **P** rolls a longer distance than **Q**.
B. A car with larger wheels rolls a longer distance than one with smaller wheels.
C. To show that the car having a greater mass will roll a longer distance.
D. The results of the experiment may be different if the cars roll down from a greater height.

Qn. No.	A	B	C	D	Right Ans.	Correct %	Wrong %	Diff. Index	Disc. Index
08	14.4%	55.2%	12.7%	17.5%	B	55.2%	44.5%	53.6%	0.37

Analysis of Participants' Performance in Short-response Questions — Appendix II

- Mean and standard deviation

	Whole Group (WG)		School	
	Mean	SD	Mean	SD
Question 1 *(out of 10)*	5.6 (56%)	2.30 (23.0%)	5.1 (51%)	1.94 (19.4%)
Question 2 *(out of 8)*	4.0 (50%)	1.80 (22.5%)	3.7 (46%)	1.91 (23.9%)
Section B *(out of 18)*	9.6 (53%)	3.45 (19.2%)	8.7 (48%)	2.90 (16.1%)

Double-digit coding system for Q1(d)(i)

" Plot a graph to show the relationship of the data in (c)."

CODE	ITEM	Number of Response	
		WG	School
Correct Responses		1285 (49.6%)	14 (38.9%)
G10	A curve passing through all points	416 (16.0%)	10 (27.8%)
G11	A graph with line segments joining all points	869 (33.5%)	4 (11.1%)
Incorrect Responses/Nil Response		1307 (50.4%)	22 (61.1%)
G90	No line/curve shown on the data points	65 (2.5%)	0 (0.0%)
G91	All or some of the points are incorrectly plotted (and failure to curve)	517 (19.9%)	12 (33.3%)
G92	A straight line instead of a curve passing through all points	115 (4.4%)	0 (0.0%)
G93	The 1st data point of the curve connected to origin by a straight	142 (5.5%)	7 (19.4%)
G94	The 1st data point of the curve connected to the y-axis / the last connected to the x-axis by a straight line	79 (3.0%)	0 (0.0%)
G95	A graph showing a histogram/bar chart/pie chart instead of a	91 (3.5%)	0 (0.0%)
G98	Other mistakes related to graph (e.g. multiple lines)	64 (2.5%)	1 (2.8%)
G99	Unattempt	234 (9.0%)	2 (5.6%)

School-based Report — Appendix IV

(1) Diamond, Gold, Silver and Bronze Awards in 2018

Award type	Number
Diamond	147 (5.7%)
Gold	497 (19.2%)
Silver	610 (23.5%)
Bronze	832 (32.1%)

** Appreciation or Participation — 506 (19.5%)

(2) Overall Performance of School

	Whole Group (WG)	School
Mean score: *(out of 54)*	30.8 (57%)	28.6 (53%)
Standard deviation:	7.58 (14.0%)	7.58 (14.0%)

Student Performance Report (Sample)

HONG KONG ASSOCIATION FOR SCIENCE AND MATHEMATICS EDUCATION
2018 SCIENCE ASSESSMENT TEST
STUDENT PERFORMANCE REPORT

Student Name:	CHAN Tai Man		
School:	ABC College		
Class:	2B	Class No.:	14

Section A

Question No.	Key	Your Answer	Whole Group (WG) Correct Percentage
1	A	A	37%
2	B	B	35%
3	A	A	62%
4	D	C	42%
5	A	C	34%
6	C	C	36%
7	B	B	70%
8	B	B	51%
9	B	B	68%
10	C	A	15%
11	A	A	47%
12	C	C	79%
13	C	D	55%
14	D	D	69%
15	D	D	52%
16	C	C	76%
17	D	D	63%
18	D	D	82%
19	B	B	57%
20	B	B	73%
21	A	A	58%
22	C	A	31%
23	D	D	46%
24	A	A	76%
Score in Section A	24	Your Score	19
		Mean Score (WG)	13.1

Section B

Question No.	Total Score	Your Score	Mean Score (WG)
1	10	9	6.8
2	8	3	3.0
Score in Section B	18	12	9.8

Paper Score (1.5 x Score in Section A + Score in Section B)

Full Score	54	Your Score	40.5	Mean Score (WG)	29.5

Documents received by participating schools

- Student Performance Report
- Certificate of Award for students
- 2018 SAT Question Paper & Answer Sheet
- 2018 SAT Marking Scheme for School
- 2018 SAT Score Summary for School
- School-based Report/ General Report of 2018 SAT

Thank you