TASMANIAN

SECONDARY

ASSESSMENT

BOARD

SC786

Physical Sciences

2000 External Examination Report

Statistical Summary

Award Summary

Outstanding Achievement (OA)	171
High Achievement (HA)	378
Satisfactory Achievement (SA)	497
Reassessed into neighbour	185
Total candidates	1231

Gender Breakdown

Males	707
Females	523

Ratings awarded (internally and externally)

Criterion	A			B			C			D	
	int	ext		int	ext		int	ext		int	ext
Criterion 1	554			422			235			11	
Criterion 2	461	295		500	595		256	299		12	10
Criterion 3	485			467			262			13	
Criterion 4	366			477			350			27	
Criterion 5	763			321			139			6	
Criterion 6	503			435			249			20	
Criterion 7	289	170		428	402		464	511		43	116
Criterion 8	343	300		340	296		440	358		94	243
Criterion 9	319	165		392	300		431	527		79	207
Criterion 10	313	143		302	311		434	410		163	322

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General Comments

The exam was considered by the markers to be of adequate length. There was no evidence to suggest students ran out of time with most candidates attempting most sections of the paper. This exam was the first year in which students used an information sheet as a reference rather than their textbook for the Chemistry section. No major changes in the students' performance were noted.

Chemistry again proved to be the more difficult part. The exam indicated many students still poorly understand the important areas of stoichiometry and equation writing. For borderline candidates the requirement to obtain at least one C (or a B for an HA) in the Chemistry criteria often proved to be their stumbling block. When borderline papers are reviewed a more favourable outcome usually occurs if an attempt at most questions on the paper has been made, rather than focusing on just a few questions.

Some markers are concerned about the number of students using pencil to answer questions. It is surprising to see that some students cannot correctly interpret their calculators' representation of answers in scientific notation mode.

Question 1

(a) Some students took air resistance into account, and some didn't. Either was acceptable. A lot of students considered what would happen after the ball had hit the ground. As a rule students should not read more into a question that is stated.

(b) Students should look for clues in the question. Key words are *petrol*, *up a hill* and *increasing speed*. The examiner wants discussion involving stored chemical energy in petrol being converted into increasing amount of gravitational potential energy and kinetic energy. There was no need to consider where the petrol came from or what happens over the hill! Similarly with b(iii), electric means electrical energy. Boil water means heat energy is produced. Many students seem to be under the mistaken impression that the only forms of energy are kinetic and potential energy.

(c) This part was very poorly done and may not have been taught in all classes. The information provided in the question means it is an easy question to get full marks on.

(d) Much confusion exists about the medical advantages of this gamma source as a diagnostic tool. Its advantages are that it is weakly ionizing, has a short half-life and is penetrating so it can be detected.

(e) Very few students realized that they all have the same half-life and even less were able to explain the reason. Radioactivity is a property of the nucleus of the atom and the electron configuration has no effect on the half-life. Since the nuclei are identical, they will all decay at the same rate.

Question 2

(a) Few candidates analyzed the forces acting on the nuts. Most identified Newton I as being important.

(b) Concern about changing magnitude of the weight vectors through the question.

(i) Confusion between **g**, **F** and gravitational force (weight).

(ii) Very few recognized that the elastic restoring force exceeds the weight.

(iii) Most candidates thought for the child to move up after leaving the trampoline, there must still be a force acting upwards. Forces suggested were **Fg**, air resistance and thrust.

(c) Minority of candidates could explain what no external forces meant. Very few applicable examples given.

(d) (i) Many could not deal with the combinations of series and parallel circuits.

(ii) Confusion reigned. Few justified their answers.

(iii) Most correct.

- Very few identified I_3 decreases due to an increase in R_{total}.
- Some predicted I_2 would increase but explanations were usually wrong.

Question 3

This question was seen as being fairly straightforward with very few blank papers; almost every student found something they could do and gave it a go. A pleasing number of perfect scores were obtained.

There were some common errors:

- transformation skills were very poor,
- Far too many students omitted units for quantities, or gave incorrect units.
- Vectors: directions were almost invariably omitted. As no angles were involved this was a simple task but frequently not done.
- Changing minutes to seconds was a surprisingly common problem (some failed to do it, others multiplied by 100).
- Many students "dropped" the index in cases where values were squared e.g. 2.6^2 was altered to 2.6.

(a) (iii) Charge is not expressed in volts, Hz, A, m or colons.

(b) Students failed to appreciate the mathematical nature of half-life, and some concluded that 2 half-lives = 1 life. One student explained the problem well with a diagram showing a square being successively bisected, and expressed the remaining area as a fraction of the whole. Some students had marked the word "proportion" and several replaced it with "fraction"; perhaps the word was not well understood.

(d) (ii) Most students obtained realistic answers, although one obtained a value for the force involved in catching a ball which was of the order of 10^{19} N. This should have rung alarm bells in the student's mind. The SI unit of force is not the New Ton.

(e) (i) Some students assumed the situation was one of free-fall under gravity. While this gave a correct value for the horizontal velocity, an energy argument needed to be advanced to justify why a vertical velocity under conditions of free-fall could be used as a horizontal velocity after falling in an arc. Many students assumed the answer in (ii) to derive (i).

(iii) For some reason many students seemed to believe that 1.5 x 0 = 1.5.

(iv) The expression "immediately after the collision" was interpreted somewhat creatively by some students, who argued that "immediately' meant 0 seconds after collision, in which case they concluded that the collision would not yet have had any effect (as it had only had 0 seconds to do so). Sadly, the philosophy of this thinking was often far more sophisticated than the student's attempt at the question. Many students failed to add the mass of plasticine to that of cart.

Question 4

Overall this question was quite discriminatory with marks ranging reasonably evenly from 0 to 20. A pleasingly large number of students gained at least 18/20 for this question.

(a) Most students were able to start parts (i) and (ii) with the correct choice of formulae. A surprisingly high number were unable to apply the appropriate algebra skills to arrive at the correct answer. Overall a well answered question.

(b) (i) Very well answered.

(ii) A little ambiguity existed in the question so the answer of 2s (for 36 km/h) and 1.33s (for 54 km/h) were accepted for full marks. Far too many students didn't convert from km/h to m/s or if they did their communication of how they did it was poor. Using the gradient of the distance/speed graph to equal t was a rarely used but good technique.

(c) (i) This was well answered apart from the calculation of the final displacement of 0.48 km NW.

(ii) Average speed of 16.7 m/s was fine. Average velocity of 0.417 m/s NW caused far more problems and was only correctly determined by the minority of students. A number had the magnitude correct but failed to communicate a direction.

(d) A significant number of candidates obviously had no idea about components or projectile motion. For those that did :

(i) This was well done. A number of students had their calculators set on 'grads' rather than 'degrees'.

(ii) Algebra once again was the main problem here with the calculation of the final vertical velocity. The majority said the horizontal velocity remained constant.

(iii) Most knew to recombine the components to obtain the answer. Far too many students only attempted to calculate a magnitude but no direction.

Question 5

(a) SO_3 is sulfur trioxide, not sulfite ion (SO_3^{2-}).

(b) The symbol for an ion includes the charge i.e. Na^+.

(c) (i) Electron dot diagrams should show only (and all) outermost electrons.

(ii) Too many wrote everything they knew on covalent and ionic properties whereas they should have focused on electron transfer or sharing.

(iii) Formulae do not represent structures well but just answering “no” is not worth any marks!

(d) (i) Referred to SiO_2 and CO_2 as liquids (which is possible), these are both covalent molecular.

(ii) The properties of the oxides needed to be discussed.

(iii) The difference in the physical properties needs to be explained in terms of the bonding of the compounds.

Question 6

(a) Not well done. Rather than focusing on dissociation and the number of mobile charged particles, students were distracted by molar mass, and other irrelevancies. Wrong statements included delocalised electrons and H_2SO_4 being an ionic substance.

(b) Reasonably done. Common error was showing 3 H atoms on the Cl atom for 1-ethyl-3-chloro-cyclohex-1-ene.

(c) (i) Poorly done. The addition of HCl proved an obstacle. Many used HCl as a functional group. Several wrote the same isomeric molecule in a different form and creatively named them.

(ii) and (iii) Relatively well done.

(iv) Very poorly done. Most common answer was actually polyethylene.

(v) Poorly done. Students focused on the breakup of intra-molecular bonds rather than intermolecular ones.

(d) Many creative answers which had nothing to do with the actual question. Of those who addressed the question the major errors were the confusion of plastics with ionic compounds; and listing the plastic as thermoplastic with weak intermolecular forces.

Question 7

Overall marks for this question were disappointing with many low scores. It would seem more effort is needed on chemical calculations.

(a) Generally done well although a surprising number used the atomic number of Al instead of its relative atomic mass. Also a large number made errors when using their calculator by not taking the order of operations into account - e.g. 46 was often given.

(b) Also done well although many students lost marks for apparently failing to check that the empirical formula was also the molecular formula. Part (ii) gave rise to some creative naming and many wild guesses due to exposure to organic nomenclature.

(c) This section was generally poorly done. The first problem was converting the milligram to gram, the second was using a mass/volume measure for concentration - many students failure to convert to moles before using the formula. In part (iii) the volume needed ranged from the thousands of litres to a fraction of a millilitre. Many forgot the original litre already present.

(d) Poorly done. Many found the reacting masses of all species in the equation! More practice of stoichiometric problems is indicated including sequential setting out of answers.

(e) (i) Also a problem. Many were unable to correctly find the number of moles of acid involved and many did not seem to be aware of the importance of the molar ratio between the acid and the hydroxide. One answer of 10^{24}g showed little understanding of exponential notation.

(ii) A number of students attempted to find the percentage of potassium in potassium hydroxide.

(iii) Poorly done. Very few realized the important fact was that now both compounds are involved in a reaction. Many did not make the connection to the first part of the section.

Question 8

In general this question was not well done.

(a) Instead of answering the question in a direct way, students looked for traps that were not there. Simple, straight forward answers were best. A few even wrote about bonding and forces.

(b) (i) Well done.

(ii) Common mistake was NH_4 for ammonia.

(iii) Common mistakes HSO_3 and H_2SO_3 instead of SO_2 and H_2O. A few wrote Na_2S instead of Na_2SO_3.

(c)
- HCl - quite a few didn't mention pH changes.
- Mg was well done.
- $AgNO_3$ - wrong observation but correct equation.

(d) Quite a few got the right answer for (i) but then for (ii) seemed confused as to what reaction to use.

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