

UNIVERSITY OF MALTA

**SECONDARY EDUCATION CERTIFICATE
SEC**

PHYSICS

May 2013

EXAMINERS' REPORT

**MATRICULATION AND SECONDARY EDUCATION
CERTIFICATE EXAMINATIONS BOARD**

SEC EXAMINERS' REPORT MAY 2013

SEC Physics
May 2013 Session
Examiners' Report

Section 1: Statistical Information

The total number of candidates that registered for the Sec Physics examination in May 2013 was 3767, with 2149 sitting for a Paper I + IIA and 1665 candidates sat for Paper I + IIB. Again as was in previous years, the number of candidates sitting for SEC Physics has decreased by 3.7% from 2012. However unlike previous years this decrease is mainly to paper IIA candidates. The amount of candidates that sat for the paper IIB option decrease by 47 candidates whilst those that sat for the IIA option decreased by 97

Table 1: Distribution of candidates' grades for SEC Physics May 2013

GRADE	1	2	3	4	5	6	7	U	ABS	TOTAL
PAPER A	223	344	444	664	263			206	6	2150
PAPER B				158	329	421	193	475	41	1617
TOTAL	223	344	444	822	592	421	193	681	47	3767
% OF TOTAL	5.92	9.13	11.79	21.82	15.72	11.18	5.12	18.08	1.25	100

Section 2: Comments regarding candidates' performance

2.1 General Comments

This SEC Physics Examination report provides information on the performance of candidates. It is hoped that it will not only be useful to teachers in their teaching but also in the preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

In the second year that this new syllabus is examined, there were indications that candidates were adapting to the different demands and criteria of this syllabus. The work presented showed more appreciation of what was required. It is clear that most candidates are being prepared well for this style of paper. Candidates need to give precise answers using correct scientific terminology. Some candidates have little understanding of scientific enquiry skills and find it difficult to apply these in unfamiliar situations. It is evident that there is a major problem with communication skills, with candidates often unable to express themselves clearly. Many resorted to writing far too much, often repeating themselves, including irrelevant information. It is important that candidates understand that in many cases, 'less is more', and the ability to

Express their answer concisely as possible is important. The amount of space left for a candidate to write his/her an answer should give a clear indication of the depth and amount of answer expected.

2.2 Paper 1

Table 2: Analysis of raw scores in Paper 1 questions by paper choice

Question	1	2	3	4	5	6	7	8	9	10	Total
Paper Mean	6.6	7.35	6.13	7.72	5.21	5.71	6.48	7.49	6.96	7.87	69.4

SEC EXAMINERS' REPORT MAY 2013

(IIA)	S.D.	2.19	3.18	2.49	2.63	2.04	2.49	1.58	2.52	2.32	2.57	17.2
	Facility Index	0.66	0.73	0.61	0.77	0.52	0.57	0.65	0.75	0.70	0.79	0.69
	Discrimination Index	0.63	0.83	0.69	0.80	0.46	0.71	0.66	0.74	0.74	0.81	
Paper (IIB)	Mean	4.58	2.18	2.80	3.40	2.96	2.37	3.61	3.26	3.23	3.02	31.43
	S.D.	2.09	2.78	2.34	2.41	2.23	2.41	2.02	2.67	2.56	2.92	17.80
	Facility Index	0.46	0.22	0.28	0.34	0.30	0.24	0.36	0.33	0.32	0.30	0.31
	Discrimination Index	0.63	0.81	0.65	0.81	0.56	0.72	0.66	0.80	0.75	0.83	

Question 1

Most of the candidates were knowledgeable about the name of the planets however many made mistakes in their order. A significant number of candidates just mentioned gravity instead of “gravitational force” in the second part. Many mistakes were made in the definition of dwarf planet because candidates thought a dwarf planet is a small planet. Furthermore it seems that candidates were mistaken about the definition of a planet. Most candidates knew that a planet orbits the sun but mistakes were made about the other two properties. The last part of question one was quite straight forward and there weren't many mistakes.

Question 2

This question made use of an industrial situation in which a machine pushes boxes into a container. Candidates were asked to work out a number of calculations related to mechanical energy and work. In general most candidates did very well in this question, which involved more descriptive responses. In other parts of the question marks were lost due to lack of units. In question 2(a) many did not change the distance from cm to m;. In question 2(b) certain candidates did not provide the proper equation and the same can be said to question 2(c). In 2(d) many did not convert the unit and many mistakes were made because they did not use the new height but continued using the 0.5 cm of part 2(a). In the last part of the question, on a positive note most candidates had no problem in making the velocity subject of the formula and some did not use the equation of Kinetic Energy but used the equation of motion, $v^2 = u^2 + 2as.n$ This was deemed to be correct.

Question 3

This question focused on electrostatics. In general candidates did well showing that they were well prepared. A significant number of candidates had a problem to give clear and concise answers to the questions asked. Even though the candidates figured out that the cloth had a positive charge many did not provide a good explanation. They stated that it gained protons from the ruler or somehow implied that the positive charges moved. In part (c) candidates did not simply say repulsion or attraction but most provided an explanation. Even if the candidates made mistakes in part (c) they knew the law of charges and they stated it in part (d). In part (e) most candidates lost marks because they did not know any of the reasons. They could not make the connection between this question and the questions before. Few candidates knew the three reasons but most knew that charges are given so that the paint is attracted to the refrigerator. However instead of explaining that the spray spread

SEC EXAMINERS' REPORT MAY 2013

evenly they commented about the job being nicely done or smooth and lasts a lifetime. Many candidates said that this process is done so that the fridge becomes magnetic. The following are some of these: 'so that the refrigerator does not give you an electric shock', 'to be sterile', 'to kill bacteria', 'so that the doors close better', and 'to gain magnetism' It is evident that candidates are still finding it difficult to apply their physics to practical situations

Question 4

This is one of the best answered questions. Most candidates knew that ice is less dense than water and many attempted to explain why this happens although some candidates explained that ice floats because it has smaller mass. Obviously this is a wrong explanation. Part (b)i. was answered correctly by almost all candidates. In (b)ii most candidates gave an answer without showing their working however in this case this was not penalised. In the next part many worked out the change in temperature but did not convert the unit of mass. A good number of candidates tried to find the specific heat capacity rather than the heat absorbed and so changed the value of "c" with "Q".

Question 5

In general this question was well answered. The majority of the candidates predicted that block A would increase its temperature and block B would decrease its temperature. Most candidates explained that block A would gain heat and increase its temperature whereas block B would lose heat and decrease its temperature. However, the time factor was not taken into consideration and most candidates did not explain that after such a long time, both blocks would lose heat to the surroundings until they reached room temperature. In the last part of the question the absolute majority of candidates realised that the wax would melt but not all of them mentioned that blocks B and C would fall off.

Question 6

In general this question about lenses was well answered. Surprisingly, many did not label the focal length or gave a wrong answer. Similarly, many failed to draw arrows on the ray to show its direction. Some measurements from the given scale were not read correctly. As regards the last part of the question, many just mentioned glasses/spectacles but the expected answer was rarely mentioned.

Question 7

Most candidates managed to draw a well labelled graph which covered three quarters of the graph paper. Some candidates chose an awkward scale and found it difficult to plot a straight line graph. Only a few candidates interchanged y-axis with x-axis. In part (b)i most candidates concluded that Pressure is directly proportional to height but did not mention that p and g are constants. There were a number who said that if Pressure increases height increases, this was not considered correct if they did not specify proportionality. In part (b)ii most of the candidates did not change pressure from kPa to Pa and yet gave answers in Pa/m or did not give the unit at all. Hence when working out part iii they did not get a true value of density of sea water.

Question 8

In general answered correctly. Most candidates managed to arrive at the expected answer in the calculation parts. A number of candidates used the equation whereas others reasoned it out since they knew the definition of frequency. Candidates were aware of how the frequency and amplitude changed with louder sounds however the quality of the sketches was extremely poor.

SEC EXAMINERS' REPORT MAY 2013

Question 9

Surprisingly many candidates did not know what a beta particle is and simply replied it is a beta particle. The properties listed however were in general correct. In spite of the instruction not to mention medical uses, some still gave such uses. The rest tried to give a practical use, however the description or the link how the radiation is actually being used, was rather vague.

Question 10

The performance of the candidates in this question was either excellent or very poor. Some candidates got mixed up in part (a)iii where they had to add 0 kgm/s of the stationary ball. Again in part (b)ii many candidates got mixed up where they had to add the mass of the two balls after collision. Most candidates stated the correct principle of momentum in part iii and even stated that the condition for the principle of conservation of momentum is that no external forces act.

2.3 Paper II

Table 3: Analysis of raw scores for Paper IIA and Paper IIB questions

Question		1	2	3	4	5	Total
Paper (IIA)	Mean	14.63	11.73	11.67	10.46	10.02	60.45
	S.D.	4.25	3.67	5.62	3.63	4.54	17.43
	Facility Index	0.73	0.59	0.58	0.52	0.50	0.60
	Discrimination Index	0.83	0.82	0.82	0.74	0.80	
Paper (IIB)	Mean	8.23	6.87	5.83	6.84	7.70	34.71
	S.D.	4.22	4.20	4.62	3.04	3.76	17.06
	Facility Index	0.41	0.34	0.29	0.34	0.39	0.35
	Discrimination Index	0.85	0.87	0.84	0.76	0.80	

Paper IIA

Question 1

There is still confusion as to whether an ammeter should be connected in series or in parallel. A number of candidates did not distinguish between the conceptual differences between circuits in series and circuits in parallel. This relates in the main to whether the current and the potential difference varies across each branch, determination of the total current and the potential difference in each branch. In relation to the question querying the use of the fuse, a good number of candidates appear to have a strong notion of what is the result of having a fuse but not what the purpose of the fuse is. Most candidates in fact replied by stating what would happen to the fuse. In determining the appropriate fuse rating most candidates replied correctly in determining the current and the fuse value.

SEC EXAMINERS' REPORT MAY 2013

Question 2

The majority of the candidates stated Hooke's law correctly in a (i). In a (ii), candidates had to state a precaution to prevent damage to the spring. the majority of candidates stated simply that the loads must be added slowly or gently lacking qualitative detail entailing the importance that the elastic limit is not exceeded once again. In a (iii), to check that at the end of the experiment the spring was not damaged candidates had to mention two points mainly to unload the weights and then check that the spring returned to its original length. Very few candidates managed to work out the spring constant correctly in a (iv). Many converted the mass to weight but few managed to calculate the extension of the spring in m and hence could not obtain the correct value of the spring constant For part (a) (v) most candidates are aware that a vector has both magnitude and direction however a substantial number just mention that it has direction only.

In part (b)i most candidates stated that when the ruler is in equilibrium the total clockwise moments are equal to the total anticlockwise moments, however very few candidates mentioned that upward forces must be equal to downward forces. Most candidates worked out the calculation in (d)ii correctly. Very few candidates explained why the weight of ruler was ignored in (b)iii. The weight of the ruler does not create a moment since the pivot is at centre of gravity. No problems were evident in part (b)iv where candidates correctly stated that F_2 must be moved closer to the pivot at the same time that F_1 must be moved away from it. In part (c) many candidates explained this idea in term of pressure rather than in terms of increasing distance and hence producing a bigger moment.

Question 3

A good number of candidates answered the first part of the question correctly, however others used the formula getting an incorrect answer. Since the term 'terminal velocity' is not explicitly stated in the syllabus the marks assigned to a(ii) were given to all candidates. Many candidates did manage to find the time of fall of the sphere correctly, however some did not give the answer to three decimal places whilst there were a good number that did not write the unit. An incorrect answer to a(iii) was not reflected in the formula to obtain the velocity. Hence this part of the question was well answered by most candidates. In the second part of the question candidates thought that the mass does affect the time of fall. Some stated that the time was one-third the time in (a) as the mass is triple that in (a). Whilst most candidates found no difficulty in parts (ii), (ii) and (iv) a good number of candidates found difficulty in part (v) since 16.2 N were given as an answer.

Question 4

Nearly all candidates gave the correct sequence of the spectrum of colours and know that the velocity of light is higher than that of sound in air. In parts (a) (iii) and (iv) majority of answers were again correct however there are a small number of candidates who confuse red with violet in terms of which has the longest wavelength and which has the highest frequency. In part (b) (i) and (ii) most candidates do not give a good description of the experimental setup required to project the spectrum of light on a screen. Diagrams lack detail when drawing rays of light. On the other hand nearly all candidates know that a prism is needed to show the spectrum of light and once again the correct deviations ranging from infra red to ultra violet are shown. In part (b)iii a good number of candidates state that the purpose of the convex lens is to produce a clear image of the colours but lack scientific detail as to the fact that the convex lens is producing parallel rays. They simply state that the convex lens together with the prism separates the colours.

For part (b)iv the candidates mention dispersion but then confuse reflection with deflection and refraction. This once again shows that candidates are not that familiar with the behaviour of light. In the last part of section (c) only one or two candidates correctly state what needs to be done to recombine the white light again. The majority of answers included the placing of another lens, a prism or an inverted one and also removing the screen and doing the experiment backwards.

SEC EXAMINERS' REPORT MAY 2013

Question 5

This was an application question and many candidates fared well when they could describe and explain the correct sequence of how each device worked. Many candidates correctly explained how the device can measure the speed of moving air in a (ii), once they realised the correct sequence of steps; that is starting from the rotation of the plastic cups which made the magnet turn, cutting lines of flux and inducing a voltage in the coil which is measured by the a.c. voltmeter. Candidates still use the terms current and voltage interchangeably and hence stated that current was measured by the a.c. voltmeter! Not all candidates could correctly identify the variables in a (iv) showing that candidates are still lacking experience in designing their own experiments. Many correct answers were given in a (i), (iii) and (iv). Part (b) proved to be a challenging question but many candidates applied the principles of mutual induction to explain how the mobile phone is charged. In b (ii) many candidates explained that is important to have a continuously changing magnetic field but failed to explain that this produces an alternating emf in secondary coil. Most work out the calculation correctly in part b (iii) but poor answers were suggested in part b (iv).

Paper IIB

Question 1

Most of the candidates obtained an average mark in this question. In fact the mean of this question is the highest of all five for paper IIB candidates. However a good number of candidates stated an incorrect definition: of electric current. There is still confusion as to whether a voltmeter should be connected in series or in parallel. Many candidates connected the voltmeter in series and also candidates showed that they have not yet grasped the concept of resistance in series and in parallel since many candidates answered that the total "resistance increases" when two resistors are connected in parallel. A number of candidates still stated that the colour of a live wire is red. This was not accepted. The majority of the candidates have a good idea of the fuse's purpose but found it difficult to explain properly. In fact, most of them wrote that "the fuse melts when a large current flows" instead of writing that this happens when the current exceeds a certain value.

Question 2

In part (a)i, most candidates knew that force and extension are directly proportional, however, a considerable number from the cohort, swapped the proper answers showing that candidates have a tendency not to read the questions well. In (b)i, c, (d)ii, (d)iii and (d)iv most candidates answered well. However, hardly any candidates were able to obtain full marks in part (c), as most of the candidates forgot to convert the 6 cm into m and were not able to find the units for the spring constant. It is interesting to note that in question (v) the majority knew that the forces must be moved, nonetheless, they lost marks as they did not specify in which direction F_2 or F_1 must be moved. In question (e), there were multiple answers and most candidates realised that the screw driver is longer and thus there is a greater distance, but they associated this larger distance with a greater force rather than a magnified turning effect. It is worthy of note that a considerable amount of candidates tried to explain the use of the screw driver in terms of pressure and area.

Question 3

Candidates found this question rather taxing and did not perform very well. The vast majority scored a low mark even if a mark for question 3a (ii) was awarded to everyone since it referred to 'terminal velocity'. A good number of candidates did not even attempt this question. Unfortunately candidates

SEC EXAMINERS' REPORT MAY 2013

are still not familiar with including units with their answer or else they state wrong units. Most candidates did not use the proper equation of motion but simply divided the height of Pisa tower by 10. This showed a poor understanding of the concepts of acceleration due to free fall. Once more this was showed since very few candidates realised that the 60 kg object takes the same time as the 20 kg object to fall through.

Question 4

Most candidates performed well in questions 4(a), (b)i, (b)iv, (b)v and (e)iv. On the other hand, very few candidates knew how to define dispersion properly and explain why light is dispersed. As a rule, candidates wrote that dispersion is barely the *splitting of white light* and jotted down that *it is dispersed because white light is made of the 7 colours*. In parts (c) and (d), most candidates were able to answer correctly what would be observed but failed to answer why. In part (e), candidates performed very badly and most candidates obtained no marks. Nearly all of the drawings did not include the normal.

Question 5

Whilst a considerable number of candidates understood the concept of wind energy converted to electrical energy, a number had clear difficulty in grasping the precise role of the magnet, iron core and the ensuing processes. In fact very few candidates managed to suggest ways of a more efficient.

With respect to wireless charging, few candidates managed to give correct explanations for the conditions required to produce a current. Many candidates stated ways of increasing the induced current instead. With respect to the importance of having an a.c. supply, most candidates clearly showed they were not aware that an a.c. supply is required to have a continuously changing flux.

Some candidates still have the habit of not listing the units in their answers resulting in loss of marks. On the concept of unplugging a phone once it is completely charged, there appears to be a lack of understanding as to what is really happening, with most candidates replying that once it is completely charged it is better to unplug it otherwise it would overheat.

2.4 Comments regarding school-based Practical Coursework

As per normal procedure a number of school candidates had their practical work moderated since approximately 20% of the schools were moderated. The practical work of private candidates was corrected by MATSEC examiners. Apart from this all private candidates were also interviewed regarding their practical work. Interviews help the examiners to verify the authenticity and level of the laboratory work presented. The following points, though recurrent in the last few years, need to be repeated.

- It is very clear that most school are carrying out their laboratory sessions in a satisfactory manner. Most schools that were moderated had their original mark retained which reflects objective marking. An increasing number of investigations were noted.
- Examiners once again encourage teachers to show the distribution of the marks per practical report. This will definitely add value to the formative learning of the candidate.
- As in previous years it must be stressed that a teacher demonstration can never replace the candidates actually performing an experiment. Although it is very evident that these have been reduced considerably. However candidates are expected to set up their own apparatus, observe and take readings, write their own method and precautions, draw graphs if applicable

SEC EXAMINERS' REPORT MAY 2013

and write a conclusion. Teachers may aid the candidates by providing a handout that complements the experiment but ultimately the candidate should arrive at his/her own conclusions.

- In the case of private candidates, all the above instructions apply. Private candidates are treated in the same way as other candidates and are expected to perform their own experiments. These are required to be of the same SEC standard as those presented by the other candidates. It must be stressed that doing 15 experiments in a couple of days, is not the correct way of doing such practice. Although a minority some candidates reported that they did not do the experiments but copied off the report from the board. This was not accepted for obvious reasons.

Chairperson
2013 Examination Panel