UNIVERSITY OF MALTA

SECONDARY EDUCATION CERTIFICATE
SEC

PHYSICS

May 2010

EXAMINERS’ REPORT

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
Section 1: Statistical Information

During this session, 4265 candidates applied for the examination. Out of these, 2316 candidates sat for Paper I + IIA (54.3%) and 1949 candidates sat for Paper I + IIB (45.7%).

Table 1: Distribution of candidates’ grades for SEC Physics May 2010

<table>
<thead>
<tr>
<th>GRADE</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>U</th>
<th>ABS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAPER A</td>
<td>219</td>
<td>388</td>
<td>449</td>
<td>746</td>
<td>280</td>
<td></td>
<td></td>
<td>231</td>
<td>3</td>
<td>2316</td>
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<tr>
<td>PAPER B</td>
<td></td>
<td>212</td>
<td>414</td>
<td>539</td>
<td>275</td>
<td>461</td>
<td></td>
<td>48</td>
<td></td>
<td>1949</td>
</tr>
<tr>
<td>TOTAL</td>
<td>219</td>
<td>388</td>
<td>449</td>
<td>958</td>
<td>694</td>
<td>539</td>
<td>275</td>
<td>692</td>
<td>51</td>
<td>4265</td>
</tr>
</tbody>
</table>

% OF TOTAL 5.13 9.10 10.53 22.46 16.27 12.64 6.45 16.23 1.20 100

1053 candidates (24.7%) obtained grades 1-3
2708 candidates (63.5%) obtained grades 1-5
3522 candidates (82.5%) obtained grades 1-7

Section 2: Comments regarding candidates’ performance

2.1 General Comments

It is the intention of this report that teachers (and future candidates) read this report in detail and take note of observations and comments made. The scope of this report is to enhance the teaching and learning of Physics in secondary schools with the aim of encouraging more candidates to continue with their education in Physics whilst at the same time achieving an adequate level of scientific literacy as required by our country.

This year, it was observed that the gap in the average mark in Paper 1 obtained by candidates opting for P2A and P2B increased substantially when compared to previous years. Whilst the average mark in Paper 1 for P2A candidates remained more or less the same as last year, the average mark in Paper 1 for P2B candidates decreased by about 10 marks. One interpretation is that the cohort of candidates sitting for P2B was academically weaker compared to previous years. Another interpretation is that whilst P2A candidates found P1 to be of the same standard as in previous years, P2B candidates found P1 more academically challenging.

2.2 Paper 1

Table 2: Mean and Standard Deviation of raw scores in Paper 1 questions by paper choice

<table>
<thead>
<tr>
<th>Question</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper (IIA) Mean</td>
<td>7.9</td>
<td>7.2</td>
<td>7.9</td>
<td>6.8</td>
<td>6.5</td>
<td>5.9</td>
<td>6.3</td>
<td>7.1</td>
<td>8.2</td>
<td>6.2</td>
<td>69.8</td>
</tr>
<tr>
<td>S.D.</td>
<td>1.8</td>
<td>2.4</td>
<td>2.3</td>
<td>2.6</td>
<td>1.8</td>
<td>2.1</td>
<td>2.4</td>
<td>2.0</td>
<td>1.7</td>
<td>2.1</td>
<td>15.4</td>
</tr>
<tr>
<td>Paper (IIB) Mean</td>
<td>4.4</td>
<td>2.9</td>
<td>3.5</td>
<td>2.5</td>
<td>3.7</td>
<td>2.5</td>
<td>2.3</td>
<td>3.8</td>
<td>5.8</td>
<td>2.3</td>
<td>31.8</td>
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<tr>
<td>S.D.</td>
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<td>2.4</td>
<td>2.8</td>
<td>2.3</td>
<td>2.0</td>
<td>2.1</td>
<td>2.3</td>
<td>2.3</td>
<td>2.6</td>
<td>2.1</td>
<td>18.4</td>
</tr>
</tbody>
</table>
Question 1
Candidates generally did well in this question. However there were a number of candidates who failed to mention a measuring apparatus when describing how to find the volume of the toy soldier. Some referred to the use of basins or beakers that do not have graduations to measure the precise volume. In the last part of the question (d)(ii) there were some candidates who compared the density of the toy soldier that floats in water with the density of the other toy soldier which sinks in water, instead of comparing it with the density of water.

Question 2
The majority of candidates performed moderately well in this question. However there were some candidates who failed to write down the units or gave the wrong units. There were some candidates who wrote ‘kinetic energy’ instead of ‘potential energy’ in part (a) (iii). In part (d) there were some candidates who mixed up power output with power input or used work done by lifter – many candidates did not use the formula to find the efficiency of the motor. In the last part of this question (e) there were a number of candidates who gave irrelevant answers and failed to explain that energy is converted to work done against friction.

Question 3
Generally candidates did well in this question. In part (a) a complete definition was required. The rest of the question was mainly calculation. Most candidates faired well in the calculations, however marks were deducted when incorrect units were given or were omitted.

Question 4
Although this question was also based on calculations, most candidates performed less well than the previous question, since it was not as straightforward. Again, marks were deducted whenever incorrect units were given or were omitted. In part (c) Newton’s 3rd law was not so commonly mentioned by the candidates. In parts (d) and (e) some candidates could not explain clearly how the ‘crumple zones’ made the car safer. Seat belts were commonly mentioned as a feature that makes cars safer.

Question 5
Most candidates found no difficulty to draw an appropriate graph for this question. Most graphs had their axes correctly labelled, covered a good area of the graph paper and were plotted precisely. In part (c) a good number of candidates had mathematical difficulties in squaring the value on the x-axis to obtain the tension. In part (d), very few candidates obtained any marks, even though this question was a repetition of one which featured a few sessions ago.

Question 6
Candidates faired least well in this question. In part (a) candidates had to explain why a tile floor feels colder than a carpet in terms of conduction and insulation. Most candidates gave correct answers for part (a) (ii). Answers provided for part (b) showed that candidates are not familiar with the application of knowledge to new situations. Candidates need to learn how to transfer basic scientific knowledge to new situations. In part (i) an explanation was sought of how conduction is prevented by a vacuum. Part (ii) dealt with the property of aluminium as a reflector of radiation. Knowledge about the conductive property of copper metal was sought in part (iii).

Question 7
In general, candidates did badly in this question. In part (a)(i) a lot of candidates did not indicate the direction and/or left out the normal. A number of candidates had errors with the refraction diagram, either refracting light away from the normal when entering glass or not writing the name of the medium light was travelling to and from. In parts (a)(ii & iii) the angle of incidence and reflection were in general marked correctly, but some candidates marked the angle of incidence and refraction wrongly. Hardly anyone marked ‘air’. Quite a number of candidates wrote mirror in the first diagram, but not quite next to the mirror. In the second diagram, only a few candidates wrote ‘glass’.

In part (b), most candidates drew the emerging ray, but quite a number forgot to indicate its direction. Hardly anyone showed the angle of incidence or reflection, or that the incident and reflected ray were at 90 degrees. In part (b)(ii) some of the candidates did mention the critical angle but a very small minority mentioned the fact that light has to be travelling to a less dense medium.

Question 8
Generally candidates did well in this question. In part (a)(i) some candidates still wrote red and black for the live and the neutral wires. In (ii) most candidates answered correctly. In part (b) most candidates obtained 1
mark since the components were connected in series but very few candidates drew the symbol for the fuse correctly. Some did not use symbols for the components. In part (ii) quite a number of candidates wrote ‘the circuit wouldn’t work’ but did not specify whether it wouldn’t work when the fuse had blown or not. Some introduced a bulb in their circuit and said that the bulb wouldn’t light. Some suggested to smell the fuse or to look at it closely. In (iii) very few candidates mentioned the variable resistor. Various answers included voltmeter, diode and ac supply. In (iv) a lot of candidates wrote ‘near the’, ‘infront of’, ‘behind’, cell/ammeter/fuse. Some did mention ‘in series’. In (v) since very few candidates had mentioned the variable resistor, even less answered this part correctly. Those who had written ‘voltmeter’ said that they could vary the voltage from the voltmeter!

Question 9
Overall candidates did quite well in this question especially in part (a). However there were still candidates who confused the source of energy with the practical application related to that source; for instance they mention wind turbine instead of wind as a renewable source of energy. As to part (b), many Paper I+IIB candidates lost most marks in (iv), which was an ‘application’ type of question requesting a higher level of thinking in the cognitive domain. It seemed they did not understand that if the aircraft’s engines failed, it was the wind turbine which was to provide energy. Therefore in many cases the energy flow diagram did not make sense.

Question 10
Generally speaking candidates did not do well in this question. Loss of marks in part (a) indicated that candidates did not even observe a demonstration of the experiment, let alone doing it themselves. Although time constraints in the final year is a real issue one cannot but stress the importance of practical work especially when done by the candidates themselves. On the other hand candidates’ replies for part (b) showed that the electric bell – a practical application of electromagnetism – is either being covered during lessons or else candidates have acquired the necessary skills to understand the circuit, analyze it and answer the questions. In (ii), some candidates mistakenly mentioned attraction between the hammer and the gong confusing the latter with the iron core. Many candidates made a very common mistake in (iv) where their answer was simply “it goes back to its original position” disregarding completely demagnetisation and/or the effect of the spring.

2.3 Paper II

Table 3: Mean and Standard Deviation of raw scores for Paper IIA and Paper IIB questions

<table>
<thead>
<tr>
<th>Question</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper (IIA)</td>
<td>Mean</td>
<td>12.9</td>
<td>11.5</td>
<td>10.9</td>
<td>11.0</td>
<td>12.9</td>
</tr>
<tr>
<td>S.D.</td>
<td>4.3</td>
<td>4.1</td>
<td>4.1</td>
<td>3.7</td>
<td>3.9</td>
<td>16.4</td>
</tr>
<tr>
<td>Paper (IIB)</td>
<td>Mean</td>
<td>7.2</td>
<td>12.0</td>
<td>7.5</td>
<td>8.4</td>
<td>9.6</td>
</tr>
<tr>
<td>S.D.</td>
<td>4.3</td>
<td>4.1</td>
<td>4.1</td>
<td>4.1</td>
<td>3.7</td>
<td>19.8</td>
</tr>
</tbody>
</table>

Question 1
Overall most candidates performed well in this question, drawing correct symbols for most of the electrical components. For part (b) there were no problems except for lack of a clear explanation as to why a fuse of 5 A is needed. In part (c) calculations again were straight forward and in the majority of cases correct. In part d (i) candidates showed to have a good grasp of the topic and the calculations entailed, however some candidates lost marks as they gave incorrect units or omitted the units completely. The main problems were related to part d (ii) and (iii) where candidates mixed up the relationship between resistance and thickness of wire involved. A good number of candidates seemed to believe that the longer the wire the easier it is for the current to flow meaning that resistance will be at its minimum.

Question 2
Overall candidates scored average marks in this question as there were a number of problems related to specific questions. Candidates in Paper 2B performed generally better as the question was structured differently. Part (a) and (b) were answered correctly by the majority of candidates. The only problem was in the quality and
detail of answers given, such as, stating gravity only in part (b) instead of gravitational pull or else in part (a) stating simply that the Earth rotates about its axis and around the sun and omitting the time it takes to do so in both cases. In part (c) there was again lack of scientific detail – most candidates were aware that there are two types of satellites and quoted them by name but otherwise give little explanation about their positions and functions. Part (d) again proved at times problematic for there was little scientific explanation as to how a star is born and what follows after its birth. In part (d) (iii) however most candidates gave correct differences between stars and planets. For part (e) very few candidates gave a correct statement that a galaxy is made up of different solar systems – many stated simply that it is made up of a group of planets orbiting a sun. In part (ii) nearly all candidates were familiar with the term Milky Way. The main problems were again seen in part (f) where the candidates although familiar with the red shift phenomenon failed to give correct explanations to parts (ii) and (iii) – in the majority of cases candidates scored no marks since the answers given were the same for that given in part (g) – meaning they only stated that after the big bang the universe is still expanding.

Question 3

Most candidates scored low in this question. In part (a)(i) the majority used other items which were not mentioned in the introduction – like iron filings, permanent magnets with known poles, iron bars and pins etc. Perhaps this should have been emphasised in the question – ‘using only items found in the small room mentioned in the introduction’. Candidates attempting Paper 2B also had difficulty to give the correct sequence in the table provided. In part (ii) most candidates answered correctly; however some still gave iron as being permanently magnetised. Most candidates scored well in part (iii) drawing very good magnetic fields. A few paper 2b candidates had an incorrect direction of the field. In part (iv) some candidates gave lengthy answers, describing how to use a magnetic compass to draw the magnetic field round the magnet. The best answers included simply the fact that the compass needle’s arrowhead is a N-pole and it points to the S-pole of the magnet.

In (b)(i) only a small number of candidates managed the correct answer – ‘electrostatic induction’. Most candidates simply said electrostatics. Some candidates confused magnetism with electrostatics. In part (ii) a good number of candidates understood the question and gave a correct answer. Some candidates, however, did not understand that they were expected to use the apparatus given and started by stating that they had to get two charged rods as a starting point – one negatively and the other positively charged. In part (iii) most candidates gave the correct answers, although a few gave opposite answers, thinking that Perspex became negatively charged while polythene positively charged. In part (iv) a small number of candidates managed to answer correctly – showing they have a good grasp of the subject. However the majority found this question too difficult, their main difficulty appeared to be in understanding that they were to mention that the danger had to be eliminated and they were expected to explain how this had to be done.

Question 4

Most candidates managed the first part of the question where they had to state the three types of radiation and their symbols although candidates did mix up the mass and atomic number. Some candidates are not too sure on the meaning of isotopes since they did not manage to identify the correct pair of isotopes presented.

In part (a) (i) some candidates gave poor answers – indicating that they are not studying definitions enough. In part (ii) most candidates found this part difficult – they failed to understand the question missing the main hint completely i.e. they could trace the passage of the radioactive water by means of a G-M tube. They described how to ‘observe’ the water passing through the plant by colouring the water, missing the whole concept of radioactive material tracing completely. In part (iii) a number of candidates are still stating ‘no eating or drinking should be done’, when this behaviour is expected in all kinds of labs, whatever the experiments being performed. Most candidates gave correct answers to part (iv) but some did not elaborate enough, giving such answers as ‘same thickness paper’

In part (b) (i) most candidates obtained all the 4 marks allotted in this question. In part (ii) some candidates gave answers such as ‘time for substance to become half dead’, showing that important definitions are not being studied well enough. Some candidates failed to work out the problem in part (iii), giving the impression that this topic is being ‘skimmed’ in some schools. In part (iv) very few candidates managed to realise they had to discuss the dangers of each of the three radiations given off by radioactive material. Some able candidates however had very detailed and elaborated answers.

Question 5

The overall performance of the candidates in this question was an average one. Most candidates found difficult the first part of the question. Candidates assumed that on the moon there is no gravity and hence objects will just
‘float’. This obviously led to the wrong answer. In part (a) (i) many candidates answered ‘both’ but quite a number assumed that the feather touched the ground first because it is lighter. Some candidates thought that the hammer would touch the ground first. Quite a number of candidates replied ‘none’ because the objects remain suspended in a vacuum. In part (ii) most candidates answered correctly but quite a number did not mention air resistance. Many candidates gave incorrect reasons such as ‘because the mass and the weight is larger’. There were also quite a number of candidates who said that the gravitational force will be greater on objects of larger masses.

In part (b)(i) only a small amount of candidates replied that the initial velocity was zero. Many just said ‘dropped’ means ‘let go’. Other candidates specified that no force except gravity was applied. Most candidates gave correct answers for part (ii). Quite a number mentioned the stopwatch only while others included the matchbox with marbles. Most candidates answered part (iii) correctly. In part (iv) some candidates mentioned repeated readings but quite a number of candidates mentioned the centisecond timer or electronic method of measuring time.

In parts (c) (i) and (ii) many candidates replied correctly but some just drew the ball, centisecond timer and electromagnet on its own. Others did not label the trapdoor, a few included light gates. A good number of candidates had problems with the calculation part of this question. Part (iii) was correct for the absolute majority of candidates.

2.4 Comments regarding school-based Practical Coursework

During this year twenty-six schools were chosen for moderation of laboratory scripts. This represented about 18.4 % of all the scripts presented. A number of candidates’ interviews were held to verify the authenticity of the laboratory work presented by the candidates. The following points, though recurrent in the last few years, need to be repeated.

- Practical work as being done in some of the schools visited is recommended. Such good practice was evident through the variety of the experiments presented and the originality of some of the experiments. The candidates’ work was fairly assessed and comments were written by the teacher as a guide to the candidate to improve his/her work. Repeated readings and graphs were presented whenever the experiment led to such work. The experiment done was explained by means of a few sentences that described the method and a clear diagram of the equipment was drawn. Precautions were listed; a table or results and a conclusion ended the experimental write-up.

- A teacher demonstration can never replace the students actually during an experiment except in exceptional cases where the school does not have enough of the required equipment. In all other experiments, all students are expected to set up the apparatus, observe and take readings, write their own method and precautions, draw graphs if applicable and write the conclusion. Teachers may aid the students by providing a handout that complements the experiment.

- Whenever the standard of the experiments presented was too low or the experiments were not of SEC level, marks were reduced for all the candidates of the particular school or class.

- As from this year, a larger number of candidates than in previous years were called for an interview about the laboratory work which they presented. It is expected that more candidates (private and schools-presented) will be asked for an interview for the coming sessions.

- 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, which are required to be of the same standard as those presented by the other candidates.

Chairperson
Markers’ Board
July 2010