

Transition from High School to University - 2004 Academic Year

Introduction

This report is based on final marks in UBC first year physics courses offered during the first term (September-December 2004). The study includes only students who graduated from Canadian high schools in 2004. Students must also have Physics 12 or Physics 11 requirements fulfilled. As a result, the sample used in this study represents about 65% of the total number of students enrolled in UBC first year physics courses in the Fall of 2004. This sample is useful for studying the transition from high school to university.

Following the initiative started many years ago by the UBC Mathematics Department (First Year Calculus Results), the report will compare students' participation and performance in UBC Physics courses by region, school and gender. Since the largest proportion of students graduated from B.C. high schools (92.6%), findings are significant at the provincial level. The 2004 high school graduates from Alberta (3.3%) and Ontario (2.9%) enrolled in UBC first year physics courses are also included in the comparative analysis. This is the fifth school-by-school report on performance in first year physics courses. We also include comparisons with year 2003. The differences in average student performance from different schools are in most cases rather small. From experience with the Math and previous Physics reports we expect significant year over year variations in ranking.

First Year UBC Physics courses (Term I)

A. UBC Physics courses with Mathematics 12 & Physics 12 requirements.

PHYSICS 101: Energy and Waves (combined lecture/lab course).

PHYSICS 107: Physics I.

PHYSICS 109: Introductory to Experimental Physics (lab course).

PHYSICS 153: Elements of Physics (this is a two-term course)

NOTE: Since PHYS 107 is a renumbered version of the older course PHYS 121, except that the lab that was formerly part of the course is now a separate course, Phys 109. Results can be compared to previous years' results for PHYS 121 (2000 and 2001) or PHYS 107&109 (2002 and 2003). Most students (84%) enrolled in both PHYS 107 & 109 and in this case, their average grades are included in analysis. PHYS 107 grades are considered for students who enrolled only in the lecture course, while there are no students who enrolled only in PHYS 109.

B. UBC Physics course with Mathematics 12 & Physics 11 requirements.

PHYSICS 100: Introductory Physics.

Enrolment and performance in UBC First Year Physics courses (Term I)

(includes students from the 2004 graduating classes of Canadian high schools with Physics 12 or Physics 11 requirement provided, only)

- **Table IA** compares performance for each course based on high school Physics 12. For each course, the average Physics 12 and UBC course grades are given.
- **Table IB** shows performance in PHYS 100. Physics 11 and PHYS 100 average grades are given.
- **Graph IA-B** shows the distribution of grades in all UBC vs. high-school physics courses.

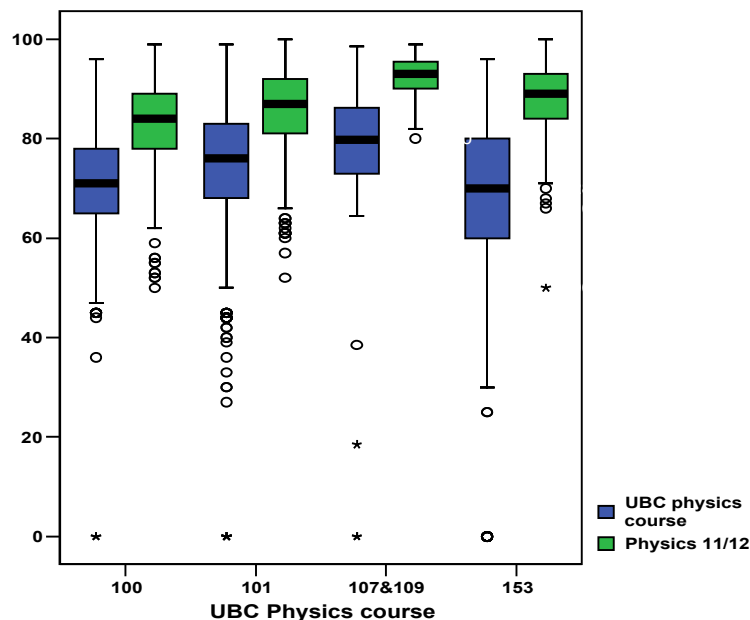
Table IA Overall Performance - courses with Physics 12 requirement (2003 results in brackets)

UBC Course	Number of students	Percentage passing	Percentage with A standing	Average school mark → Average UBC mark
101	582 (699)	94 (93)	39 (41)	86 → 74 (86 → 74)
107 & 109	45 (44)	89 (96)	53 (77)	92 → 73 (91 → 81)
153	508 (524)	87 (94)	27 (37)	88 → 67 (89 → 72)
ALL	1135 (1267)	90 (93)	34 (40)	87 → 71 (86 → 74)

Table IB Overall Performance - Physics 11 requirement (2003 results in brackets)

UBC Course	Number of students	Percentage passing	Percentage with A standing	Average school mark → Average UBC mark
100	366 (397)	92 (92)	24 (37)	83 → 70 (83 → 74)

Graph I A-B: Distribution of marks in UBC and high-school



Note: The clustered box plots offer summaries of values for separate variables. Each box contains 50% of cases and the line across the box indicates the median. The whiskers are lines that extend from the box to the highest and lowest values, excluding the outliers (cases with values between 1.5 and 3 box lengths from the upper or lower edge of the box) and extremes (values more than 3 box lengths from the box).

UBC Physics courses by gender

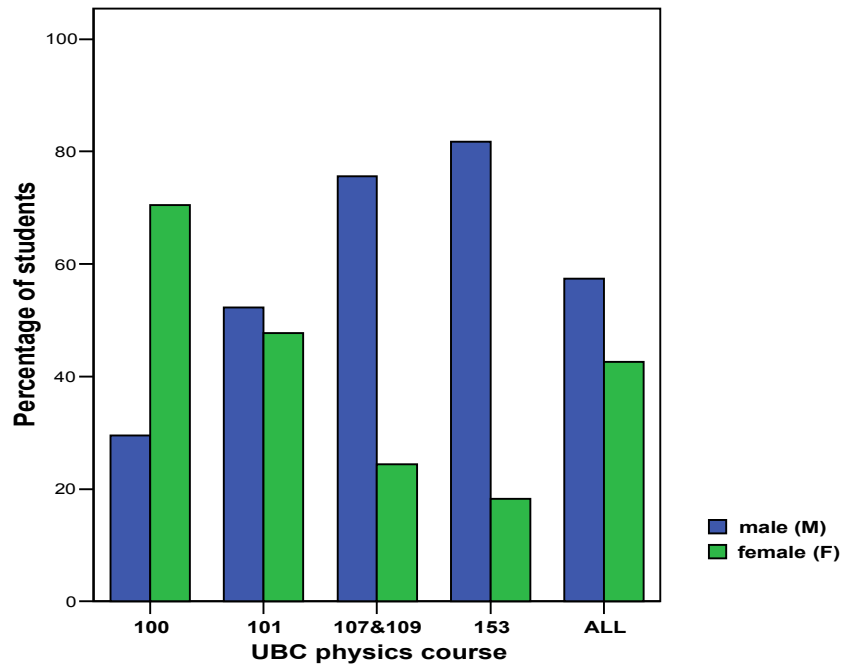
(includes students from the 2004 graduating classes of Canadian high schools with Physics12 or Physics11 grades provided)

Table IC Gender (2003 results in brackets)

UBC Physics Course	Gender	Number of students	Percentage passing	Percentage with A standing	Average school mark → Average UBC mark
100	male	108 (106)	97 (93)	31 (36)	80 → 74 (80 → 74)
	female	258 (291)	90 (92)	21 (37)	83 → 68 (83 → 74)
101	male	304 (355)	94 (91)	43 (42)	86 → 75 (87 → 74)
	female	278 (344)	93 (95)	35 (40)	85 → 73 (86 → 74)
107 / 109	male	34 (30)	88 (97)	56 (73)	91 → 74 (91 → 81)
	female	11 (14)	91 (93)	45 (86)	95 → 71 (91 → 81)
153	male	415 (441)	87 (94)	27 (37)	88 → 67 (88 → 72)
	female	93 (83)	84 (94)	28 (39)	87 → 65 (89 → 74)

^a Due to the small size of this group, results should be interpreted with caution.

Graph IC: Gender representation in UBC physics courses



Note: There is no significant statistical difference between male and female students' performance in the Physics courses. However, gender is a factor that introduces a significant difference in course participation for PHYS 100 (ratio M:F about 1:2), PHYS 107/109 (ratio M:F about 3:1) and PHYS 153 (ratio M:F about 4:1).

Comparison by region and school type

(includes students from the 2004 graduating classes of BC high schools with Physics12 or Physics11 requirement)

Table II compares results by region and school type, cumulating data for courses with Physics 12 requirement, i. e. PHYS 101, PHYS 107/PHYS 109, PHYS 153, currently included in Group A. The B.C. schools identified by region are public schools. Private and Catholic schools from all over the province form two separate groups. Vancouver schools are grouped in Vancouver east and Vancouver west. Suburban Vancouver includes Burnaby, Langley, New Westminster, Maple Ridge, Surrey, Coquitlam, Delta, North Vancouver, West Vancouver, and Richmond school districts. Vancouver Island, B. C. Interior schools and students from other provinces are grouped separately. For comparison, Ontario and Alberta high school students are included in the ranking. Only regions with at least **25** students in UBC physics courses from Group A are “ranked”.

Table II Region and School Type (2003 results in brackets)

School Type or Region ranking	Students in Group A courses	% Passing	% with A Standing	Avg. school mark → Avg. UBC mark	% stud in Group A courses
1. Burnaby (7)	109 (101)	93 (96)	39 (36)	86 → 74 (86 → 75)	82 (77)
2. Vancouver west (2)	106 (118)	94 (98)	39 (44)	88 → 74 (88 → 77)	73 (72)
2. Vancouver east (1)	126 (134)	92 (98)	36 (49)	85 → 74 (85 → 77)	73 (65)
4. Richmond (4)	137 (138)	93 (96)	39 (42)	87 → 73 (86 → 76)	77 (80)
5. Vancouver Is. (13)	29 (52)	97 (87)	28 (29)	87 → 74 (90 → 70)	83 (81)
6. North Vancouver (4)	36 (48)	92 (92)	33 (56)	89 → 73 (90 → 79)	78 (72)
7. Delta (7)	46 (51)	93 (92)	28 (45)	90 → 71 (87 → 74)	78 (77)
7. Catholic (2)	31 (39)	87 (92)	32 (56)	86 → 71 (88 → 78)	50 (63)
9. Surrey (11)	88 (120)	86 (90)	32 (32)	87 → 70 (87 → 72)	75 (77)
10. Coquitlam (6)	106 (104)	88 (95)	28 (49)	88 → 70 (90 → 76)	79 (88)
10. B. C. Interior (11)	64 (108)	88 (90)	28 (33)	88 → 70 (88 → 72)	71 (76)
12. Private (10)	64 (48)	83 (90)	30 (40)	87 → 66 (86 → 71)	77 (74)
Alberta	46 (33)	87 (94)	33 (27)	NA→70 (NA→71)	94 (87)
Ontario	28 (74)	100 (91)	43 (31)	NA→74 (NA→72)	64 (84)

Ranking procedure

The ranking is based **ONLY** on students’ participation in Group "A" courses (courses with Physics 12 requirement: PHYS 101, PHYS 107/PHYS 109, PHYS 153).

The ranking is determined by equally weighting ranks in the categories:

- a) % passing in Group A courses
- b) % with A standing (A-, A, A+) in these courses
- c) the relative change of average grades in high school vs. UBC Physics courses.

High values of % passing, % with A standing, as well as small variation in grades would contribute to higher ranks. Regions or schools are first ranked in each category (a-c) and then a total rank is computed.

Tables also show the % of students in Group A courses vs. total number of students in UBC physics courses. These data are not considered in ranking, but provide additional information about students’ course choice.

School-by-school results

The school-by-school Tables (III, IV, V) include ranking of schools with at least 10 students in UBC physics courses with Physics 12 requirement (PHYS 101, PHYS 107/PHYS 109, PHYS 153) in September 2003. Results are organized in three tables: Vancouver schools, Suburban Vancouver schools and B. C. schools outside Metropolitan Vancouver. Schools outside Metropolitan Vancouver (Table V) are not ranked, since the number of students was too small (results given in alphabetical order).

Ranking procedure

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- a) % passing in Group A courses
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Tables also show the % of students in Group A courses vs. total number of students in UBC physics courses. These data are not considered in ranking, but provide additional information about students' course choice.

Table III Vancouver Schools (2003 results in brackets)

School Ranking	Students in Group A courses	% Passing	% with A Standing	Avg. school mark → Avg. UBC mark	% stud in Group A courses
1. Windermere	13	100	54	86 → 80	81
2. Killarney (1)	14 (17)	93 (100)	57 (71)	85 → 77 (85 → 82)	67 (74)
3. Sir Winston Churchill (2)	31 (39)	94 (100)	42 (54)	82 → 76 (83 → 79)	63 (62)
4. University Hill (10)	18 (16)	100(100)	39 (25)	88 → 77 (88 → 71)	86 (80)
5. Eric Hamber (4)	21 (20)	90 (100)	52 (45)	86 → 75 (85 → 76)	64 (57)
6. Prince of Wales (7)	18 (32)	100 (97)	33 (38)	88 → 74 (88 → 76)	64 (80)
7. David Thompson (7)	12 (26)	100 (96)	25 (35)	88 → 75 (84 → 76)	80 (90)
8. Point Grey (9)	13 (16)	92 (94)	38 (44)	88 → 74 (88 → 76)	72 (59)
9. Magee Sec (2)	16 (12)	94 (100)	25 (58)	85 → 69 (89 → 83)	84 (63)
10. Gladstone Sec	13	85	23	86 → 71	76
11. Vancouver Tech (11)	14 (10)	86 (90)	7 (30)	84 → 68 (85 → 72)	82 (56)

Table IV Suburban Vancouver Schools (2003 results in brackets)

School Ranking	Students in Group A courses	% Passing	% with A Standing	Avg. school mark → Avg. UBC mark	% students in Group A courses
1. Burnaby Central	16	100	63	89 → 80	76
2. Richmond Sec (5)	35 (22)	100(100)	54 (36)	86 → 78 (79 → 74)	83 (85)
3. Burnaby Mountain	13	100	38	84 → 74	93
4. Burnaby North (19)	23 (38)	96 (97)	39 (29)	87 → 77 (87 → 75)	79 (84)
5. Moscrop Secondary	14	93	36	79 → 71	88
5. R. C. Palmer Sec	10	90	70	87 → 74	77
7. Hugh McRoberts Sec	14	100	36	88 → 72	78
8. Burnaby South (15)	27 (31)	85 (94)	37 (48)	86 → 72 (87 → 75)	79 (89)
9. Gleneagle Sec (15)	15 (14)	100(100)	27 (50)	88 → 72 (93 → 77)	83 (93)
10. Handsworth Sec (2)	11 (10)	100 (90)	18 (80)	87 → 73 (93 → 84)	92 (77)
11. Port Moody Sec (13)	34 (24)	91 (96)	29 (50)	87 → 72 (88 → 76)	83 (89)
11. Robert McMath Sec	10	90	30	85 → 70	67
13. Delta Sec	10	100	30	92 → 72	91
13. J. N. Burnett Sec (20)	27 (21)	93 (95)	30 (38)	90 → 73 (89 → 74)	90 (84)
15. North Delta Sec (6)	16 (17)	94 (94)	19 (59)	90 → 74 (89 → 77)	67 (77)
15. Seaquam (6)	14 (18)	86 (94)	36 (56)	88 → 68 (87 → 76)	82 (86)
15. Semiahmoo Sr. Sec (10)	13 (13)	85 (92)	31 (54)	85 → 69 (83 → 75)	93 (93)
18. Centennial (23)	19 (21)	84 (95)	32 (38)	90 → 72 (92 → 73)	83 (84)
19. Pinetree Sec (25)	13 (17)	85 (82)	23 (35)	87 → 67 (86 → 70)	65 (81)
20. Johnston Heights (26)	13 (16)	77 (81)	31 (25)	90 → 69 (90 → 71)	100 (80)
21. Steveston Sec (18)	11 (31)	82 (94)	18 (39)	90 → 67 (89 → 76)	73 (91)

Table V Schools Outside Vancouver Area- (alphabetical order)

School	Students in Group A courses	% Passing	% with A Standing	Avg. school mark → Avg. UBC mark	% in Group A courses
BC Advanced Placement	33	88	45	91 → 75	80
Mount Boucherie Sec	5	100	60	87 → 80	83
St. Michaels Univ School	7	86	14	81 → 63	100
Yale Senior Secondary	5	80	40	90 → 70	63

Summary and Implications

Significance

This report gives an overview of enrolment and performance in UBC First Year Physics courses. The sample used in this report is represented by high school graduates from the Class of 2004 accepted into UBC first term physics courses on the basis of high school pre-requisites (Physics 12 or Physics 11 depending on the UBC physics course). This is the most common route for students to enter first year physics courses. In 2004, this route included about 65% of the total student population in the first year first term physics courses, as compared to 72% in 2003, 80% in 2002, 87% in 2001 and 67% in 2000. Therefore, this study concerns the transition from high school to university.

Enrolment Issues

a) First year physics courses can be grouped into three profiles, each with specific student enrollments (Tables IA-B):

- PHYS 100 is a preparatory course enrolling about 24% of students in the study.
- PHYS 101&107/109 are physics courses that are primarily taken by **science** students, and enroll about 42% of students in the study, with 39% in PHYS 101 and only 3% in PHYS 107/109. Since 2002, PHYS 107/109 replaced PHYS 121.
- PHYS 153 is a physics course for **engineers** and enrolls about 34% of students in the study. The number of engineering students has increased recently due to the provincial double the opportunity program.

Enrollment Distribution (%)				
	Phys 100	Phys 101	Phys 107/109	Phys 153
2000	27	42	4.9	26
2001	27	45	3.4	25
2002	25	44	2.8	28
2003	24	42	2.6	31
2004	24	39	3.0	34

b) Gender distribution (Table IC):

PHYS 100, a preparatory course that requires only Physics 11, has a 70% female student enrolment, which suggests that girls continue to disproportionately elect not to take Physics 12. PHYS 101 is balanced with respect to gender distribution (48% female student enrolment).

PHYS 107 has only 24% female students, which suggests that high schools and the university are not successful in attracting women into more challenging physics courses. In 2004, the gender distribution was less balanced compared to 2003.

PHYS 153, a course for engineers, continues to attract low proportions of female students (i.e., 18% in year 2004 as compared to 16% in year 2003, 19% in year 2002, 17% in year 2001 and 19% in year 2000).

Proportion of Women (%)				
	Phys 100	Phys 101	Phys 107/109	Phys 153
2000	76	50	26	19
2001	69	45	32	17
2002	79	51	16	19
2003	73	49	32	16
2004	70	48	24	18

Performance Issues

All UBC physics courses have a large percentage of passing students: 90% for general and applied physics courses and 92% for PHYS 100.

The average percentage of students with A standing is about 34% for the group A courses and has decreased as compared to 49% in year 2003. PHYS 107/109 continues to present the highest % with A standing: 53%, although this percentage has decreased as compared to the last years: 77% (2003), 66% (2002), 53% (2001) and 54% (2000).

PHYS 153 has significantly decreased the percentage of A standing from 53% in 2001, to 37% in years 2002 and 2003, and 27% in 2004. In 2000, PHYS 153 had 45% of students with A standing.

Meanwhile, PHYS 101 is extremely stable: 39% (2004), 41% (2003), 39% (2002), 35% (2001), 37% (2000).

In 2004, the percentage with A standing in PHYS 100 is 24%, the lowest observed in 5 years: 37% (2003), 27% (2002), 33% (2001), 38% (2000).

Students' grades in UBC physics courses are consistently lower than their corresponding grades in Physics 12 or Physics 11. The relative change is about 19% for all courses and has increased compared to year 2003 (13%). There are significant course differences in the drop of grades (i.e., as low as 14% for PHYS 101 and as high as 24% for PHYS 153).

The distribution of grades (Graph I A-B) suggests that PHYS 107/109 shows the least variability with respect to high school achievements, although university grades are more dispersed. It is followed by PHYS 153, which also shows disproportional high school and university achievements. PHYS 100 and PHYS 101 show less difference between high school and university in terms of variability of achievement.

In 2004, we notice more pronounced differences in performance by gender, although high school average grades are comparable or, in the case of PHYS 100 and PHYS 107&109 courses, female students have even obtained better scores at high school level. The most noticeable difference at the university level consists in the higher proportions of male students with A standing, for all courses, except PHYS 153. Proportions of students passing are higher for male students in PHYS 100 and PHYS 153, for female students in PHYS 107&109.

In the case of PHYS 100, female students started with better high school averages, but their university grades dropped by 18%; only 21% of them obtained A standing. Similarly, although female students obtained much higher grades in high school, their average grades dropped by 25% in the case of PHYS 107/109; only 45% of female students obtained A standing as compared to

56% of their male counterparts. The most comparable performance by gender is observed in the case of PHYS 153 and PHYS 101.

Overall, as compared to 2003, high school performance as reflected by average grades has not changed. However, in 2004, both female and male students have obtained much poor results (e.g., PHYS 107&109, PHYS 153 and PHYS 100 female students), and this tendency has been more pronounced for female students. The 2004 achievement results reinforce the need to revise teaching methods and course content in high school, as to ensure better preparation and some continuity in students' learning at the university level. Also, the gender differences in performance observed in 2004 raise questions about how well female students' learning is supported in the department.

The school-by-school performance in UBC physics courses was measured by:

- percentage of passing students → no significant difference by region or school
- percentage of students with A standing → differences by region and school
- relative change in physics grades from high school to university → as low as 13-15 % (i. e. Vancouver east, Vancouver Island) and as high as 20-24% (Delta, Coquitlam, BC Interior, Private schools). In 2004, Ontario students scored much better, while Alberta students scored comparable to B.C. students.

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