

# 2003 First Year Physics Report

This report is based on final marks in UBC first year physics courses offered during the first term (September-December 2003). The study includes only students who graduated from Canadian high schools in 2002. Students must also have Physics 12 or Physics 11 requirements fulfilled. As a result, the sample used in this study represents about 72% of the total number of students enrolled in UBC first year physics courses in the Fall of 2003. This sample is representative for studying the effect of **transition from high school to university** on students' performance in physics.

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. schools (91.3%), findings are significant at the provincial level. The 2003 high school graduates from Alberta (2.2%) and Ontario (5.3%) enrolled in UBC first year physics courses are also included in the comparative analysis. This is the fourth school-by-school report on performance in first year physics courses. We also include comparisons with year 2002. The differences in average student performance from different schools are in most cases rather small. From experience with the Math survey we expect significant year over year variations in ranking.

It is hoped that the information will be of interest to people involved in physics education in BC.

## 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; only first term results are included in the analysis; the first term is a lecture course only)

**NOTE:** Since PHYS 107 and PHYS 109 are derived from PHYS 121, an Honours course that was offered in the past, data for these two courses will be combined. Results can be compared to previous years' results on PHYS 121 (2000-2001) or PHYS 107&109 (2002). Most students (89%) enrolled in both PHYS 107&109 and their average grades are included in analysis. PHYS 107 grades are considered for students who enrolled only in the lecture course, while students who enrolled only in PHYS 109 (very few) are excluded from the study.

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

**PHYSICS 100:** Introductory Physics.

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

(ONLY includes students from the 2003 graduating classes of Canadian high schools & with Physics12 or Physics11 requirement provided)

- **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 (Physics 12 requirement)**

(2002 results in brackets)

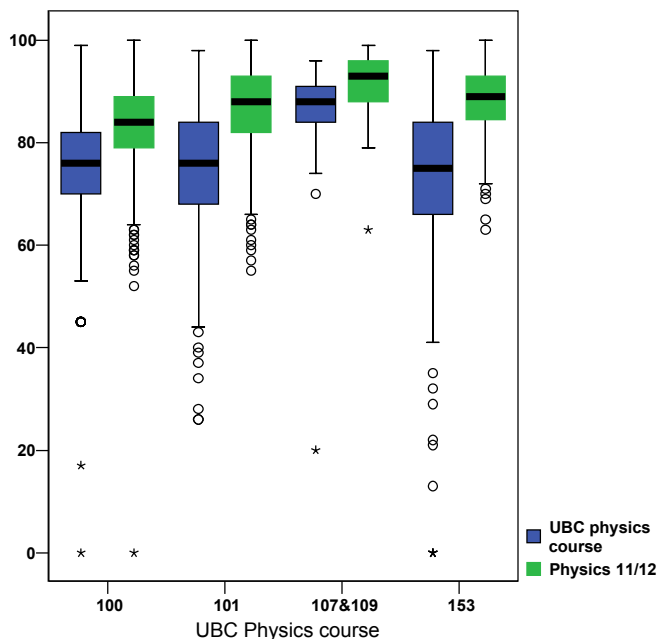
UBC Physics Course	Number of students	Percentage passing	Percentage with A standing	Average school mark <sup>®</sup> Average UBC mark
<b>101</b>	699 (698)	93 (96)	41 (39)	86 → 74 (89 <sup>®</sup> 75)
<b>107 &amp; 109</b>	44 (45)	96 (91)	77 (64)	91 → 81 (93 <sup>®</sup> 81)
<b>153</b>	524 (456)	94 (95)	37 (37)	89 → 72 (91 <sup>®</sup> 74)
<b>ALL</b>	<b>1267 (1199)</b>	<b>93 (96)</b>	<b>40 (39)</b>	<b>86<sup>®</sup> 74 (90<sup>®</sup> 75)</b>

**Table IB (Physics 11 requirement)**

(2002 results in brackets)

UBC Physics Course	Number of students	Percentage passing	Percentage with A standing	Average school mark <sup>®</sup> Average UBC mark
<b>100</b>	397 (402)	92 (91)	37 (27)	83 → 74 (82 → 72)

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



**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).

## Enrollment and performance in UBC Physics courses by gender

(ONLY includes students from the 2002 graduating classes of Canadian high schools & with Physics12 or Physics11 grades provided)

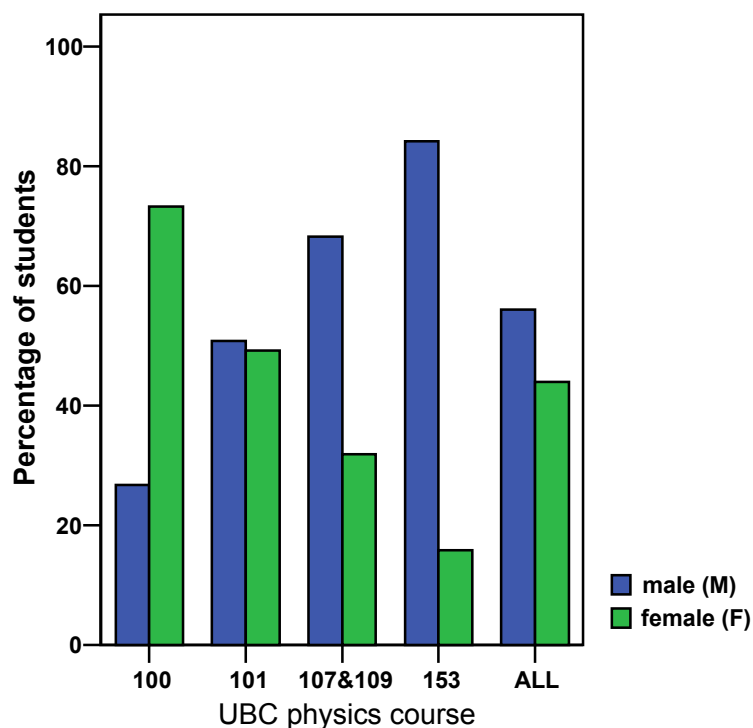
- **Table IC** compares enrollment and performance by gender in each course.
- **Graph IC** displays the gender representation in each and all courses.

**Table IC**  
(2002 results in brackets)

UBC Physics Course	Gender	Number of students	Percentage passing	Percentage with A standing	Average school mark <sup>®</sup> Average UBC mark
<b>100</b>	male	106 (118)	93 (89)	36 (34)	80 → 74 (80 → 73)
	female	291 (284)	92 (91)	37 (24)	83 → 74 (83 → 71)
<b>101</b>	male	355 (342)	91 (97)	42 (41)	87 → 74 (89 → 75)
	female	344 (356)	95 (96)	40 (37)	86 → 74 (88 → 74)
<b>107 &amp; 109</b>	male	30 (38)	97 (92)	73 (66)	91 → 81 (93 → 82)
	female <sup>a</sup>	14 (7)	93 (86)	86 (57)	91 → 81 (90 → 75)
<b>153</b>	male	441 (369)	94 (95)	37 (37)	88 → 72 (92 → 74)
	female	83 (87)	94 (95)	39 (35)	89 → 74 (91 → 74)

<sup>a</sup> Due to the small size of this group, results should be interpreted with caution.

**Graph IC**



**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 1:3), PHYS 107&109 (ratio M:F about 2:1) and PHYS 153 (ratio M:F about 5:1).

**Comparison of achievements by region and school type**  
(includes ONLY students from the 2003 graduating classes of BC high schools and  
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”.

**Ranking procedure**

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

The ranking score 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 high school students’ course choice.

**Table II - all courses with Physics 12 requirement (Group A)**  
(2002 results in brackets)

School Type or Region ranking	No. of Students in Group A courses	% Passing	% with A Standing	Avg. school mark → Avg. UBC mark	% stud in Group A courses
1. Vancouver east (8)	134 (154)	98 (95)	49 (36)	85 → 77 (88 → 74)	65 (72)
2. Catholic (1)	39 (26)	92 (100)	56 (42)	88 → 78 (90 → 77)	63 (52)
2. Vancouver west (3)	120 (132)	98 (95)	44 (45)	88 → 77 (90 → 76)	72 (76)
4. Richmond (1)	144 (136)	96 (97)	42 (46)	86 → 76 (89 → 76)	80 (74)
4. North Vancouver (6)	48 (50)	92 (98)	56 (40)	90 → 79 (91 → 76)	72 (71)
6. Coquitlam (6)	104 (90)	95 (98)	49 (41)	90 → 76 (91 → 76)	88 (84)
7. Burnaby (10)	101 (88)	96 (92)	36 (39)	86 → 75 (89 → 73)	77 (78)
7. Delta (8)	51 (40)	92 (98)	45 (33)	87 → 74 (90 → 74)	77 (66)
9. West Vancouver (11)	33 (35)	94 (97)	36 (23)	88 → 76 (90 → 74)	87 (85)
10. Private (3)	48 (41)	90 (98)	40 (46)	86 → 71 (92 → 75)	74 (84)
11. Surrey (3)	120 (92)	90 (97)	32 (41)	87 → 72 (89 → 75)	77 (68)
11. B. C. Interior (11)	108 (104)	90 (94)	33 (38)	88 → 72 (92 → 75)	76 (67)
13. Vancouver Island (13)	52 (55)	87 (96)	29 (18)	90 → 70 (89 → 70)	81 (85)
Alberta	33 (33)	94 (97)	27 (52)	NA→71 (NA→77)	87 (94)
Ontario	74 (63)	91 (98)	31 (40)	NA→72 (NA→75)	84 (83)

## 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*

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

The ranking score 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 an additional information about high school students' course choice.

## Vancouver Schools

**Table III - all courses with Physics 12 requirement:  
PHYS 101, PHYS 107 & PHYS 109, PHYS 153  
(2002 results in brackets)**

School ranking	No. of Studs in Group A courses	% Passing	% with A Standing	Avg. school mark → Avg. UBC mark	% stud in Group A Phys courses
1. Killarney (6)	17 (29)	100 (97)	71 (34)	85 → 82 (87 → 74)	74 (91)
2. Sir Winston Churchill (8)	39 (39)	100 (92)	54 (41)	83 → 79 (87 → 76)	62 (68)
2. Magee Sec (9)	12 (15)	100 (100)	58 (27)	89 → 83 (90 → 75)	63 (83)
4. Eric Hamber (3)	20 (25)	100 (96)	45 (48)	85 → 76 (87 → 78)	57 (64)
5. Lord Byng (13)	15 (15)	100 (80)	53 (47)	89 → 76 (91 → 68)	100 (79)
6. Vancouver College	13	92	54	89 → 80	76
7. David Thompson (10)	26 (15)	96 (93)	35 (33)	84 → 76 (87 → 70)	90 (54)
7. Prince of Wales (6)	32 (23)	97 (96)	38 (43)	88 → 76 (91 → 77)	80 (70)
9. Point Grey (12)	16 (22)	94 (95)	44 (27)	88 → 76 (92 → 73)	59 (92)
10. University Hill (1)	16 (12)	100 (100)	25 (75)	88 → 71 (92 → 84)	80 (86)
11. Vancouver Technical Sec	10	90	30	85 → 72	56
12. St. George's Sec School	11	82	18	80 → 64	69

## Suburban Vancouver Schools

**Table IV - all courses with Physics 12 requirement :  
PHYS 101, PHYS 107&PHYS 109, PHYS 153**

(2002 results in brackets)

School ranking	No. of Studs in Group A courses	% Passing	% with A Standing	Avg. school mark → Avg. UBC mark	% stud in Group A Phys courses
1. Terry Fox Senior Sec	16	100	81	92 → 85	94
2. Argyle Sec (8)	10 (16)	90 (100)	70 (50)	88 → 80 (91 → 79)	77 (84)
2. Handsworth Sec (8)	10 (10)	90 (100)	80 (60)	93 → 84 (94 ® 78)	77 (63)
4. Carson Graham (16)	10 (12)	100 (100)	50 (33)	91 → 81 (93 → 75)	77 (71)
5. Richmond Sec (11)	22 (25)	100 (96)	36 (48)	79 → 74 (88 → 75)	85 (86)
6. Matthew McNair Sec	11	100	36	82 → 76	85
6. Seaquam (22)	18 (16)	94 (94)	56 (25)	87 → 76 (89 ® 72)	86 (67)
6. North Delta Sec	17	94	59	89 → 77	77
6. West Vancouver Sec (23)	13 (17)	92 (94)	62 (18)	90 → 78 (88 → 72)	93 (85)
10. McMath Secondary (14)	15 (14)	93 (100)	47 (36)	85 → 79 (91 → 76)	83 (82)
10. Semiahmoo Sr. Sec (6)	13 (17)	92 (94)	54 (53)	83 → 75 (89 → 79)	93 (81)
12. Cambie Sec.	14	93	50	85 → 77	74
13. Port Moody Sec (5)	24 (23)	96 (100)	50 (52)	88 → 76 (89 → 79)	89 (77)
14. Sutherland Sec	10	90	60	90 → 77	71
15. Burnaby South (21)	31 (29)	94 (90)	48 (38)	87 → 75 (90 → 71)	89 (76)
15. Gleneagle Sec (24)	14 (17)	100 (88)	50 (29)	93 → 77 (89 → 69)	93 (94)
17. New Westminster Sec (4)	10 (11)	100 (100)	50 (64)	93 → 75 (96 → 81)	77 (61)
18. Steveston Sec (10)	31 (22)	94 (100)	39 (50)	89 → 76 (91 → 76)	91 (61)
19. Burnaby North (18)	38 (22)	97 (95)	29 (33)	87 → 75 (91 → 72)	84 (79)
20. J. N. Burnett Sec (1)	21 (15)	95 (100)	38 (67)	89 → 74 (91 → 81)	84 (83)
20. Charles London (11)	15 (15)	93 (100)	40 (40)	89 → 73 (89 → 75)	75 (94)
22. Sentinel Sec (16)	20 (18)	95 (100)	20 (28)	86 → 74 (92 → 75)	83 (86)
23. Centennial (19)	21 (18)	95 (100)	38 (33)	92 → 73 (95 → 74)	84 (86)
24. Fleetwood Park Sec	13	85	31	85 → 72	87
25. Pinetree Sec (3)	17 (16)	82 (100)	35 (63)	86 → 70 (91 → 81)	81 (84)
26. Johnston Heights Sec	16	81	25	90 → 71	80
27. Fraser Heights Sec	16	88	13	87 → 66	89

## B.C. Schools outside Metropolitan Vancouver

**Table V - all courses with Physics 12 requirement (alphabetical order)**

School	No. of Studs in Group A courses	% Passing	% with A Standing	Avg. school mark → Avg. UBC mark	% stud in Group A Phys courses
Penticton Secondary	11	91	27	88 ® 71	100
Howe Sound Secondary	8	100	50	91 ® 75	67
Yale Senior Secondary	7	86	14	85 ® 71	70
Alberni District Secondary	6	100	0	90 → 69	100
Dover Bay Secondary	6	83	0	87 → 63	67
Kelowna Secondary	6	100	33	89 → 76	100
Kwalikum Beach Secondary	6	67	50	94 → 62	100
Sardis Secondary	5	80	20	89 → 65	83
W. J. Mouat Secondary	5	100	60	94 → 77	50

## Summary and Implications

### Significance of the Study

This report gives an overview of students' enrollment and performance in UBC First Year Physics courses. The sample used in this report is represented by high school graduates from the *Class of 2003* accepted in 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 get into first year physics courses. In 2003, this route included about 72% of the total student population in the first year & first term physics courses, as compared to 80% in year 2002, 87% in year 2001 and 67% in year 2000. Therefore, the conclusions of this study would reveal issues on physics instruction related to the **transition from high school to university**.

### Enrollment 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 45% of students in the study, with 42% in PHYS 101 and only 3% in PHYS 107/109. Since 2002, PHYS 107/109 replaced PHYS 121, an Honours course.
- PHYS 153 is a **physics course** for engineers that enrolls about 31% of students in the study.

The course enrollment distribution did not change significantly over the years:

Year 2002: PHYS 100 - 25% ; PHYS 101 - 44% ; PHYS 107/109 - 3% ; PHYS 153 - 28%.

Year 2001: PHYS 100 - 27% ; PHYS 101 - 45% ; PHYS 121 - 3% ; PHYS 153 - 25%.

Year 2000: PHYS 100 - 27% ; PHYS 101 - 42% ; PHYS 121 - 5% ; PHYS 153 - 26%.

b) Gender distribution pattern for each course (Table IC):

PHYS 100, a preparatory course that requires only Physics 11, has a 73% female student enrollment, which suggests that girls disproportionately elect not to take Physics 12.

PHYS 101 is balanced with respect to gender distribution (49% female student enrollment).

PHYS 107 has only 32% female students, which suggests that high schools and the university are not successful in attracting women into more challenging physics courses. In 2003, the fraction of female students in PHYS 107 increased from 15.6% (2002) to 31.8%.

PHYS 153, a course for engineers showed a small decrease in the proportion of female students in year 2003 (15.8%) compared with 2002 (19.1%).

The female student enrollment did not change significantly compared to previous two years:

Year 2002: PHYS 100 - 79% ; PHYS 101 - 51% ; PHYS 107/109 - 16% ; PHYS 153 - 19%

Year 2001: PHYS 100 - 69% ; PHYS 101 - 45% ; PHYS 121 - 32% ; PHYS 153 - 17%

Year 2000: PHYS 100 - 76% ; PHYS 101 - 50% ; PHYS 121 - 26% ; PHYS 153 - 19%.

## Performance Issues

All UBC physics courses have a large percentage of passing students: 93% for general and applied physics courses and 92% for PHYS 100.

The average percentage of students with A standing is about 40% for the group A courses. PHYS 107/109 presents the highest percentage with A standing (77%) and the highest average grades of all the first year courses: 91%. The percentage with A standing has increased as compared to previous years: 66% (2002), 53% (2001) and 54% (2000).

PHYS 153 has significantly decreased the percentage of A standing to 37% in 2003, as compared to 53% (2001) and 45% (2000). In 2002, the percentage of A standing was also 37%.

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

In 2003, the percentage with A standing in PHYS 100 is 37% - larger than the last two years' values: 27% (2002) and 33% (2001), and closer to the highest 38% observed in year 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 13% for all courses, but there are significant course differences in the drop of grades (i.e., as low as 11% for PHYS 100 and as high as 19% for PHYS 153).

The distribution of grades (Graph I A-B) suggests that PHYS 107/109 shows the least variability with respect to both high school and university achievements, followed by PHYS 153 and PHYS 101.

There is no significant difference in performance (% of passing and % with A standing) by gender. PHYS 153 followed by PHYS 100 present the least gender differences in performance. In the case of PHYS 101 and PHYS 107/109, one can observe larger differences in the percentage of passing. PHYS 101 has 95% of female students as compared to 91% of male students passing. PHYS 107/109 has 93% of female students a compared to 97% of male students passing the course. The proportion of female students with A standing is higher for all courses, except PHYS 101.

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 8-12 % (i. e. Vancouver east, Catholic, Richmond, North Vancouver) and as high as 18-22% (apparently for regions located farther from UBC). In 2003, almost for all B.C. regions students scored better than Alberta and Ontario students.

## Contact

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