

Standard Deviation
Composite Score
Norm-Referenced
Scaled Score
Longitudinal Test
Normative Statistics
Reliability
Composite Score
Normative Subtest
Theory
Score Statistics
Referenced
Composite Score
Intercorrelation
Tracking
Sample
Percentile Rank
Critical
Validity
Sample
Raw Score
Standard Deviation
Item Response
Intercorrelation
Rubric Norm
SEM Scaled Score
Longitudinal
Rank Reliability



PHARMACY COLLEGE ADMISSION TEST

Technical Manual

Effective: July 2016

The material in this manual is protected by U.S. federal and international copyright laws. The qualified user who has purchased the PCAT Technical Manual is hereby granted nonexclusive, revocable permission to download the PCAT Technical Manual for their sole use and not for use by any unauthorized user. Reproduction of the material is otherwise prohibited.

PEARSON

Copyright © 2004, 2008, 2012, 2016 NCS Pearson, Inc. All rights reserved.

Normative data copyright © 2016 NCS Pearson, Inc.

Warning: No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without the express written permission of the copyright owner.

Pearson, PCAT, and the **PCAT logo** are trademarks in the U.S. and/or other countries, of Pearson Education, Inc. or its affiliates.

NCS Pearson, Inc., 5601 Green Valley Drive, Bloomington, MN 55437

800.622.3231 www.PCATweb.info

Printed in the United States of America.

Table of Contents

Acknowledgments	.v
Introduction	.1
PCAT Score Standardization	.2
PCAT Scaled Scores and Percentile Ranks	.2
PCAT Writing Scores	.3
The PCAT Normative Sample	.4
General Characteristics of the Normative Sample	.4
Demographic Characteristics of the Normative Sample	.6
The 2015 Norms	19
PCAT Scaled Scores and Percentile Ranks for the 2015 Norms	19
Comparing Scaled Scores and Percentile Ranks for the 2011 and 2015 Norms	22
Compendium Tables	24
Comparing Current and Older Composite Scores	29
Glossary	31
Tables	
Table 1 Distribution of PCAT Scaled Scores and Writing Scores by Subtest for 2011–15 Norm Group ($n = 64,652$)	.4
Table 2 Normative Sample Scaled Scores and Writing Scores by Testing Cycle	.5
Table 3 Normative Sample Writing Score-Point Distributions	.5
Table 4 PCAT Score Statistics by Number of Attempts	.6
Table 5 PCAT Score Statistics by Current Level of College Education	.7
Table 6 PCAT Score Statistics by Years of College Biology Completed	.8
Table 7 PCAT Score Statistics by Years of College Chemistry Completed	.8
Table 8 PCAT Score Statistics by Cumulative Undergraduate GPA	.9



Table 9	PCAT Score Statistics by Most Recent Type of College or University Attended	10
Table 10	PCAT Score Statistics by Most Recent Level of College or University Attended	10
Table 11	PCAT Score Statistics by Age Group	11
Table 12	PCAT Score Statistics by Sex.	12
Table 13	PCAT Score Statistics by Citizenship Status	12
Table 14	PCAT Score Statistics by Linguistic Background.	13
Table 15	PCAT Score Statistics by Ethnicity	14
Table 16	PCAT Score Statistics by Race	15
Table 17	PCAT Score Statistics by Parent’s or Guardian’s Highest Educational Level Attained	15
Table 18	PCAT Score Statistics by Examinee Residence	17
Table 19	PCAT Percentile Ranks and Scaled Scores	20
Table 20	Biological Processes Percentile Ranks and Scaled Scores for the 2011 and 2015 Norms.	24
Table 21	Chemical Processes Percentile Ranks and Scaled Scores for the 2011 and 2015 Norms.	25
Table 22	Critical Reading Percentile Ranks and Scaled Scores for the 2011 and 2015 Norms.	26
Table 23	Quantitative Reasoning Percentile Ranks and Scaled Scores for the 2011 and 2015 Norms.	27
Table 24	Composite Percentile Ranks and Scaled Scores for the 2011 and 2015 Norms.	28
Table 25	Comparisons of the 2015 Composite Percentile Ranks (CPR) Computed Without the Verbal Ability Subtest (CPR4) to Composite Percentile Ranks Computed With the Verbal Ability Subtest (CPR5) for Selected Composite Scaled Score (SS) Ranges	30

Acknowledgments

This Technical Manual was prepared by the following members of the Pearson Clinical Assessment group:

Donald G. Meagher, EdD
Senior Research Director

Tianshu Pan, PhD
Psychometrician

Rachel Wegner, MA
Test Development Manager

Jeffrey R. Miller, MA
Editor



Introduction

In an effort to ensure the continuing relevance and usefulness of the *Pharmacy College Admission Test* (PCAT®) for assessing the prerequisite knowledge and skills of candidates for admission to professional pharmacy programs, Pearson is introducing new norms in 2016. These new norms include updated PCAT percentile ranks that reflect the performance of the current candidate population, while leaving the scaled score range of 200–600 unchanged.

When the current scaled score range of 200–600 was first determined based on a 1998–2003 normative sample, the means were all fixed at 400. During subsequent years, a changing population of PCAT candidates has resulted in scaled score means that vary from the original mean of 400. However, because scaled scores reflect the actual performance of examinees, the PCAT scaled scores represent unchanging criteria against which candidates can be evaluated from year to year going back to March 2004.

Though changes in the population of PCAT candidates do not affect the relevance of the scaled scores, population changes do require that new percentile ranks be calculated periodically based on the performance of a current normative sample. The normative data presented in this Manual are based on all first-time PCAT candidates who took the test between July 2011 and January 2015 ($n = 64,652$), and the new percentile ranks are in effect for all PCAT test administrations beginning in July 2016. Pearson will continue to closely monitor PCAT score trends and will renorm the test periodically as necessary.

During the 2011–2015 normative sample period, the PCAT consisted of a Writing subtest and five multiple-choice subtests: Verbal Ability, Biology, Chemistry, Reading Comprehension, and Quantitative Ability. However, beginning with the July 2016 PCAT administration, the test no longer contains a Verbal Ability subtest, and the four remaining multiple-choice subtests have been renamed as Biological Processes, Chemical Processes, Critical Reading, and Quantitative Reasoning. So that the information in this Manual remains current and relevant going forward, references to the multiple-choice subtests will be to the four that remain.

Available only to qualified professionals, this Manual contains detailed data for the current normative sample, the current 2015 percentile ranks, and compendium tables that can be used to compare percentile ranks and scaled scores for the current 2015 norms to those for the previous 2011 norms. Other publicly available documents that can be downloaded from the PCAT website include the following: PCAT Basics, with information about PCAT history, contents, structure, administration, and score reporting; PCAT Reliability and Validity, with information and research results related to the reliability and validity of the test; and Interpreting PCAT Scores, with information useful in interpreting all PCAT scaled scores, percentile ranks, and Writing scores.

To request additional copies of this Manual, or to offer suggestions regarding the PCAT or about this or any other related publications, contact PCAT Customer Relations at Scoring.Services@Pearson.com.

PCAT Score Standardization

The PCAT is a norm-referenced standardized test that has been and continues to be developed to measure the abilities, aptitudes, and skills that pharmacy schools deem essential for success in basic pharmacy curricula. The PCAT score data reported in this Manual are current for the normative sample—all first-time PCAT candidates from July 2011 through January 2015 ($n = 64,652$). These include scaled score data for four multiple-choice subtests (Biological Processes, Chemical Processes, Critical Reading, and Quantitative Reasoning), a Composite score (an unweighted average of the four subtest scores), and a Writing score (see Tables 1–18). In addition to the subtest scaled score and Writing score data, this Manual also contains the current scaled-score-to-percentile-rank table (see Table 19).

PCAT Scaled Scores and Percentile Ranks

The PCAT scaled score data and the percentile ranks included in this Manual reflect the general academic ability and specific content knowledge of the candidates in the current normative sample. During the normative sample period, 13 unique PCAT test forms were administered. Even though consistent procedures were followed in selecting items for each form, a given raw score—the number of operational items answered correctly—for two different test forms does not always reflect exactly the same level of performance. To adjust for these differences, raw scores have been converted to scaled scores calculated on a common scale. As a way to rank candidates' scaled score performances, psychometric procedures have also been used to develop the PCAT percentile ranks—the percent of candidates in the current norm group who received a scaled score lower than a given score.

Scaled Scores

The method used to determine the PCAT scaled scores and the scale on which they are reported (200–600) has remained unchanged since March 2004, making the PCAT scaled scores especially useful for longitudinal tracking. As a result of this process, PCAT scaled scores represent equal units on a continuous scale, ranging 200–600. Scaled scores are calculated separately for each of the PCAT multiple-choice subtests, with a total Composite score representing an unweighted average of the multiple-choice subtest scaled scores.

The 40 operational items selected for each multiple-choice subtest are analyzed using Item Response Theory (IRT; the Rasch model) to determine ability estimates for each possible raw score total (0–40). These ability estimates represent an estimate of the ability of candidates who answer a given number of items correctly out of the 40 possible per multiple-choice subtest. The ability estimates are then translated linearly into scaled score points to create a raw-score-to-scaled-score table for each subtest. In this way, a separate set of raw-score-to-scaled-score tables is created for each unique PCAT test form.

Because they represent equated scores, subtest scaled scores earned for a given subtest during one PCAT test administration are comparable to scaled scores earned for the same subtest during another test administration, even though different forms of the test are administered. However, the Composite

scaled scores earned from July 2016 on (and displayed in data shown in this Manual) are based on an average of the four multiple-choice subtest scaled scores currently administered, rather than the five previously administered (which included Verbal Ability). For this reason, the Composite scaled scores earned prior to July 2016 can only be directly compared to other Composite scores earned prior to that date, not to Composite scores earned July 2016 or after. Similarly, Composite scaled scores earned July 2016 and after are only comparable to those earned after that date, and not to Composite scores earned prior to July 2016 (see “Comparing Current and Older Composite Scores” and Table 25).

Percentile Ranks

In addition to the raw-score-to-scaled-score table, a scaled-score-to-percentile-rank table has also been created for each subtest, based on the performance of all PCAT candidates who make up the current normative sample. Percentile ranks range from 1 to 99 for each of the four multiple-choice subtests and for the PCAT Composite score. Because percentile ranks are based on performance relative to the current norm group, they are comparable across the multiple-choice subtests. The current scaled-score-to-percentile-rank table (see Table 19) will be used with every PCAT test form administered from July 2016 until new norms are introduced at a future date.

Because percentile ranks indicate performance relative to the current normative sample, they are more useful than the scaled scores for comparing individual candidates and for determining a candidate’s relative strengths and weaknesses. The subtest percentile ranks are most useful for comparing abilities in the specific subject areas, and the Composite percentile rank is most useful for general comparisons. However, because the current percentile ranks are not directly comparable to those earned by candidates prior to the introduction of the current norms in 2016, Compendium Tables are provided in this Manual that allow the comparison of previously earned percentile ranks to the current percentile ranks.

PCAT Writing Scores

When used appropriately, the PCAT Writing subtest scores represent valuable information in the admissions process that can be used to identify students’ written communication skills and as guides for placement purposes. However, because these scores are reported for performances on specific prompts (topics) that differ from one test administration to another, comparisons between candidates’ Writing scores must be made with caution. No equating method is applied to Writing scores to make them precisely equivalent, as is done with the multiple-choice subtest scaled scores. Nevertheless, the score for each PCAT essay response is determined using a scoring rubric (detailed descriptions of each score point), and specific verification procedures are followed during the scoring process to ensure the consistency and reliability of the scores assigned.

Candidates taking the PCAT during the current normative sample period received either one or two Writing scores: From July 2011 through January 2012, separate scores were reported for Conventions of Language and Problem Solving on a scale of 1.0–5.0, with 5.0 representing the highest earned score possible and 1.0 representing the lowest earned score possible; from July 2012 through January 2015, a single Writing score was reported on a scale of 1.0–6.0, with 6.0 representing the highest earned score possible and 1.0 representing the lowest earned score possible. In all cases, candidates’ essays were scored as 0 (invalid) only if left blank or otherwise deemed unscorable. Please note that the Writing score data included throughout this Manual only include scores earned since July 2012 when the current 6-point scale was introduced, and do not include scores earned prior to July 2012 that were reported on the previous 5-point scale.

The PCAT Normative Sample

The current PCAT normative sample consists of all first-time test-takers from across the United States, Canada, Puerto Rico, and a few other international sites who took the PCAT between July 2011 and January 2015. The PCAT score data reported in Tables 1–18 reflect the performance of 64,652 PCAT candidates on the current four multiple-choice subtests. Please note that during the 2011–15 normative sample period, the four current subtest scores were reported as Biology, Chemistry, Reading Comprehension, and Quantitative Ability, but were changed to those listed here and throughout this Manual beginning with the July 2016 PCAT test administration. Also note that Writing score data included here are only for scores earned since July 2012 ($n = 47,787$) when the current 6-point scale was introduced.

General Characteristics of the Normative Sample

Tables 1–3 present score data for the norm group by subtest, by testing cycle, and by Writing score point. Table 1 shows descriptive statistics for the current normative sample, including the observed scores, median and mean score, and standard deviation (*SD*) for each subtest.

Table 1 Distribution of PCAT Scaled Scores and Writing Scores by Subtest for 2011–15 Norm Group ($n = 64,652$)

Subtest/Composite	Observed scores		Median	Mean	SD
	Minimum	Maximum			
Biological Processes	326	502	408	408.3	20.7
Chemical Processes	317	526	408	408.9	24.1
Critical Reading	251	512	396	395.6	21.1
Quantitative Reasoning	297	524	402	402.3	19.7
Composite	314	487	403	403.9	16.9
Writing	1	6	3.5	3.34	0.73

As shown in Table 1, the scaled score means obtained from the 2011–15 normative sample vary from subtest to subtest, ranging from 395.6 for Critical Reading to 408.9 for Chemical Processes. These scaled score means have all changed somewhat relative to 400, the mean that was established for each multiple-choice subtest and for the Composite score when the current scaled score range of 200–600 was introduced in 2004. Most of the scaled score means shown in Table 1 have also changed somewhat from those observed for the previous 2007–11 normative sample (Biology = 405.0; Chemistry = 403.1; Reading Comprehension = 399.1; Quantitative Ability = 402.8; Composite = 402.5).

The standard deviations shown in Table 1 have also become somewhat smaller than the original 25 for the five multiple-choice subtests and 20 for Composite established in 2004, indicating changes in scaled score variability since 2004, with more scores closer to the mean. In addition, the subtest standard deviations have changed slightly from those of the 2007–11 normative sample (Biology =

21.1; Chemistry = 23.3; Reading Comprehension = 21.0; Quantitative Ability = 20.3; Composite = 16.8), suggesting slight changes in scaled score variability since 2012.

Table 1 also shows the mean and standard deviation for the Writing subtest score, which represents an average of two assigned scores. These scores are not directly comparable to the previous normative sample data, which included separate scores for Conventions of Language and Problem Solving earned on 5-point scales.

Table 2 lists the mean (*M*) scores for the normative sample by annual July–January testing cycle (2011–15). The score performance of PCAT candidates remained relatively stable across testing cycles during this period, with the greatest variance for the Chemical Processes subtest of a 5.3 increase in mean scaled score points between 2011–12 and 2014–15. This relative stability suggests that this group constitutes an appropriate normative sample.

Table 2 Normative Sample Scaled Scores and Writing Scores by Testing Cycle

Subtest/Composite		Testing cycle			
		2011–12	2012–13	2013–14	2014–15
Biological Processes	<i>M</i>	407.1	408.3	408.5	409.2
	<i>SD</i>	21.4	20.1	20.3	21.0
Chemical Processes	<i>M</i>	406.9	407.5	409.5	412.2
	<i>SD</i>	23.5	22.1	24.0	26.5
Critical Reading	<i>M</i>	397.4	395.2	394.8	395.1
	<i>SD</i>	19.6	21.4	21.2	22.3
Quantitative Reasoning	<i>M</i>	403.1	400.6	402.4	403.3
	<i>SD</i>	18.6	19.3	19.9	21.0
Composite	<i>M</i>	403.7	403.0	403.9	405.1
	<i>SD</i>	16.5	16.3	16.8	18.1
Writing	<i>M</i>	—	3.28	3.36	3.38
	<i>SD</i>	—	0.75	0.72	0.70
<i>n</i>		16,865	16,641	16,053	15,093
% of normative sample		26.1	25.7	24.8	23.3

Table 3 shows a score point distribution for all the valid Writing scores earned during the normative sample period (i.e., no 0 scores). As shown in this table, most of the scores (78.5%) are in the middle of the distribution (3.0–4.0), with a relatively smaller proportion (18.7%) at the lower end (1.0–2.5) and an even smaller proportion (2.8%) at the upper end (4.5–6.0).

Table 3 Normative Sample Writing Score-Point Distributions

	Writing score points										
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
<i>n</i>	280	313	4,787	3,536	11,832	8,351	17,330	1,030	278	9	41
% of normative sample	0.6	0.7	10.0	7.4	24.8	17.5	36.3	2.2	0.6	0.0	0.1

Demographic Characteristics of the Normative Sample

Tables 4–18 provide normative sample scaled score and Writing score data according to various demographic characteristics. Information regarding each candidate’s PCAT attempt status (Table 4), age (Table 11), and residence (Table 18) are collected on all candidates. For all other tables in this section, candidates provided their demographic information voluntarily, with the “Unknown” columns representing cases of missing data. Thus, the “% of Normative Sample” statistics in Tables 4–18 represent percentages of candidates for whom the indicated information was available for each demographic category. At least 78% of the candidates provided the requested demographic information for each category.

Table 4 provides PCAT score data for candidates who took the test only once and for candidates who took the test multiple times during the normative sample period. Please note that while the normative sample only includes candidates’ first attempt at the PCAT, candidates’ subsequent attempts at the test, as shown in Table 4, illustrate a general pattern. This pattern observed over the years has been that candidates who take the PCAT only once tend to score higher than those who take it more than once. For candidates who take the PCAT more than once, scores earned on a second attempt tend to improve over scores earned on the first attempt, with results varying from relatively modest increases to increases that may be enough to affect admissions decisions. The data in Table 4 support these conclusions. Other historical data suggest that, on average, candidates’ scores do not tend to increase after their second attempt.

Table 4 PCAT Score Statistics by Number of Attempts

Subtest/Composite		Only 1 attempt	More than 1 attempt	
			1st	≥ 2nd
Biological Processes	<i>M</i>	412.1	400.6	406.5
	<i>SD</i>	21.6	16.4	17.8
Chemical Processes	<i>M</i>	413.3	400.3	405.7
	<i>SD</i>	25.5	18.2	20.5
Critical Reading	<i>M</i>	398.9	389.1	390.8
	<i>SD</i>	21.7	18.3	19.3
Quantitative Reasoning	<i>M</i>	405.2	396.7	400.0
	<i>SD</i>	20.6	16.3	17.2
Composite	<i>M</i>	407.5	396.8	400.9
	<i>SD</i>	17.9	12.0	13.8
Writing	<i>M</i>	3.38	3.25	3.30
	<i>SD</i>	0.72	0.74	0.71
<i>n</i>		42,997	21,655	40,504
% of normative sample		66.5	33.5	—

Table 5 shows mean PCAT scores by candidates' current educational status, which is defined as the year of current enrollment or, if not currently enrolled, the last year completed. Nearly 80% of the PCAT candidates were fairly evenly distributed between the second year of college and college graduates. Among candidates indicating their current level of education, college graduates averaged the highest scores for Biological Processes, Chemical Processes, and Composite, and candidates in their first year of college averaged highest for Critical Reading, Quantitative Reasoning, and Writing.

Table 5 PCAT Score Statistics by Current Level of College Education

Subtest/Composite		None	Current year of college				College graduate	Unknown
			1	2	3	4		
Biological Processes	<i>M</i>	402.3	404.1	403.8	407.6	409.3	414.3	409.4
	<i>SD</i>	22.9	17.5	18.8	20.6	20.4	21.9	22.0
Chemical Processes	<i>M</i>	403.7	405.8	406.5	409.8	408.6	410.8	411.2
	<i>SD</i>	26.1	19.8	22.2	24.7	23.9	25.8	25.5
Critical Reading	<i>M</i>	390.4	399.4	394.9	395.7	395.1	396.5	394.0
	<i>SD</i>	21.3	19.0	20.2	21.0	21.1	22.7	21.6
Quantitative Reasoning	<i>M</i>	404.4	407.3	402.8	402.4	400.0	400.4	404.8
	<i>SD</i>	23.3	18.2	18.6	19.5	19.5	20.3	21.0
Composite	<i>M</i>	400.3	404.3	402.1	404.0	403.4	405.6	405.0
	<i>SD</i>	19.1	14.4	15.5	17.3	16.9	18.1	18.0
Writing	<i>M</i>	3.31	3.55	3.37	3.35	3.29	3.27	3.29
	<i>SD</i>	0.84	0.64	0.72	0.72	0.75	0.73	0.73
<i>n</i>		183	5,121	13,100	14,268	12,682	11,419	7,879
% of normative sample		0.3	7.9	20.3	22.1	19.6	17.7	12.2

Tables 6 and 7 report mean PCAT scaled scores by the number of years of college-level biology and chemistry coursework completed. A large majority of PCAT candidates in the normative sample completed more than one year of college biology and chemistry coursework. Though the mean PCAT Biological Processes and Chemical Processes scores generally increased as the number of years of coursework increased, this trend was reversed for the other three subtest scores, with mean scores first increasing and then declining, similar to the patterns seen in Table 5.

Table 6 PCAT Score Statistics by Years of College Biology Completed

Subtest/Composite		Years completed			
		0	≤1	>1	Unknown
Biological Processes	<i>M</i>	398.4	401.3	409.5	409.3
	<i>SD</i>	19.2	17.8	20.7	21.9
Chemical Processes	<i>M</i>	403.9	404.7	409.4	411.2
	<i>SD</i>	23.2	20.7	24.3	25.4
Critical Reading	<i>M</i>	397.6	397.0	395.6	394.1
	<i>SD</i>	20.6	20.3	21.2	21.6
Quantitative Reasoning	<i>M</i>	405.3	403.4	401.6	405.0
	<i>SD</i>	20.7	18.5	19.6	21.0
Composite	<i>M</i>	401.4	401.7	404.2	405.0
	<i>SD</i>	16.6	15.1	17.1	17.9
Writing	<i>M</i>	3.44	3.43	3.33	3.29
	<i>SD</i>	0.69	0.71	0.73	0.73
<i>n</i>		836	8,418	47,474	7,924
% of normative sample		1.3	13.0	73.4	12.3

Table 7 PCAT Score Statistics by Years of College Chemistry Completed

Subtest/Composite		Years completed			
		0	≤1	>1	Unknown
Biological Processes	<i>M</i>	398.4	402.4	408.7	409.3
	<i>SD</i>	19.9	18.0	20.7	21.9
Chemical Processes	<i>M</i>	396.4	402.2	409.3	411.2
	<i>SD</i>	25.8	20.5	24.1	25.4
Critical Reading	<i>M</i>	392.7	397.5	395.7	394.1
	<i>SD</i>	21.5	19.5	21.2	21.6
Quantitative Reasoning	<i>M</i>	400.9	403.2	401.8	405.0
	<i>SD</i>	23.3	18.6	19.5	21.0
Composite	<i>M</i>	397.2	401.5	404.0	405.0
	<i>SD</i>	18.7	15.0	16.9	17.9
Writing	<i>M</i>	3.24	3.48	3.33	3.29
	<i>SD</i>	0.82	0.68	0.73	0.73
<i>n</i>		318	5,138	51,289	7,907
% of normative sample		0.5	7.9	79.3	12.2

Table 8 shows score data by candidates' self-reported cumulative undergraduate grade point average (GPA) at the time of testing. These data show that candidates reporting the highest GPAs (3.50–4.00) earned the highest average scores for each subtest. This reflects the consistently positive correlations observed in research studies between PCAT scores and pre-pharmacy grade point averages (see the PCAT Reliability and Validity document).

Table 8 PCAT Score Statistics by Cumulative Undergraduate GPA

Subtest/Composite		Cumulative undergraduate GPA					
		≤1.99	2.00–2.49	2.50–2.99	3.00–3.49	3.50–4.00	Unknown
Biological Processes	<i>M</i>	391.6	397.0	400.7	406.4	412.8	409.3
	<i>SD</i>	14.7	17.7	18.9	19.9	20.6	21.8
Chemical Processes	<i>M</i>	395.4	394.2	398.4	405.8	415.5	410.9
	<i>SD</i>	18.1	19.8	20.7	22.3	24.4	25.4
Critical Reading	<i>M</i>	384.8	386.3	389.2	394.4	400.0	394.2
	<i>SD</i>	17.4	19.2	19.6	20.4	21.3	21.7
Quantitative Reasoning	<i>M</i>	392.9	391.2	394.2	399.7	407.3	404.9
	<i>SD</i>	14.9	16.6	17.6	18.4	19.6	21.2
Composite	<i>M</i>	391.3	392.3	395.8	401.7	409.0	404.9
	<i>SD</i>	12.0	14.3	14.9	15.8	16.6	18.0
Writing	<i>M</i>	3.20	3.22	3.22	3.32	3.42	3.29
	<i>SD</i>	0.68	0.74	0.75	0.73	0.70	0.73
<i>n</i>		38	883	8,282	23,256	23,551	8,642
% of normative sample		0.1	1.4	12.8	36.0	36.4	13.4

Tables 9 and 10 show average score results according to the type and level of college or university that candidates most recently attended. Table 9 shows data for candidates indicating most recent attendance at either a public or private institution. These data show that candidates most recently attending a private college or university averaged highest for Critical Reading and Writing, and those attending a public school averaged higher for the Biological Processes, Chemical Processes, Quantitative Reasoning, and Composite. Table 10 shows data for candidates indicating most recent attendance at several levels of institution: 2-year schools include community colleges, technical colleges, or other 2-year colleges awarding mostly associate's degrees; 4-year schools include all institutions awarding mostly bachelor's, master's, and/or doctoral degrees, with separate listings for bachelor's institutions (Bach.; those awarding mostly bachelor's degrees), master's institutions (those awarding bachelor's and master's degrees), doctoral institutions (those awarding bachelor's, master's, and doctoral degrees), and total (all types of 4-year institutions). Table 10 shows that among candidates indicating their most recent level of college attendance, candidates attending doctoral institutions averaged higher PCAT scores for all the subtests and Composite, equaled only by those attending bachelor's institutions for Quantitative Reasoning.

Table 9 PCAT Score Statistics by Most Recent Type of College or University Attended

Subtest/Composite		Type of institution		
		Private	Public	Unknown
Biological Processes	<i>M</i>	404.9	408.8	409.6
	<i>SD</i>	20.6	20.4	21.7
Chemical Processes	<i>M</i>	405.1	409.4	411.4
	<i>SD</i>	23.1	24.0	25.2
Critical Reading	<i>M</i>	396.0	395.8	394.7
	<i>SD</i>	21.2	21.0	21.7
Quantitative Reasoning	<i>M</i>	400.4	402.3	404.8
	<i>SD</i>	19.2	19.6	20.7
Composite	<i>M</i>	401.7	404.2	405.2
	<i>SD</i>	16.9	16.7	17.8
Writing	<i>M</i>	3.41	3.33	3.30
	<i>SD</i>	0.73	0.72	0.74
<i>n</i>		11,528	43,274	9,850
% of normative sample		17.8	66.9	15.2

Table 10 PCAT Score Statistics by Most Recent Level of College or University Attended

Subtest/Composite		Level of college or university						
		2-year	Type of 4-year institution				None/other	Unknown
			Bach.	Master's	Doctoral	Total		
Biological Processes	<i>M</i>	402.0	409.2	409.3	410.4	409.3	398.4	409.5
	<i>SD</i>	20.0	20.3	21.2	20.8	20.4	19.6	21.8
Chemical Processes	<i>M</i>	400.1	410.2	407.3	410.8	410.2	401.7	411.4
	<i>SD</i>	22.2	23.8	24.2	24.2	23.8	22.7	25.1
Critical Reading	<i>M</i>	387.1	397.5	394.3	399.3	397.6	385.0	394.8
	<i>SD</i>	21.5	20.5	21.8	20.2	20.5	20.2	21.6
Quantitative Reasoning	<i>M</i>	395.0	403.4	399.3	403.4	403.2	399.3	405.0
	<i>SD</i>	17.5	19.6	18.6	19.3	19.6	19.8	20.8
Composite	<i>M</i>	396.1	405.2	402.7	406.1	405.2	396.2	405.3
	<i>SD</i>	15.5	16.6	16.8	16.7	16.6	16.2	17.8
Writing	<i>M</i>	3.08	3.40	3.28	3.42	3.39	3.20	3.30
	<i>SD</i>	0.75	0.71	0.74	0.70	0.71	0.81	0.74
<i>n</i>		8,270	38,526	2,254	5,572	46,352	945	9,085
% of normative sample		12.8	59.6	3.5	8.6	71.7	1.5	14.1

Table 11 provides PCAT scaled score information by the candidates' age at the time of testing (calculated by reported date of birth). The data show that candidates age 19 and younger averaged highest for Critical Reading, Quantitative Reasoning, and Writing; and those 21 years of age averaged highest for Biological Processes, Chemical Processes, and Composite.

Table 11 PCAT Score Statistics by Age Group

Subtest/Composite		Age group						Unknown
		≤19	20	21	22–23	24–28	≥29	
Biological Processes	<i>M</i>	403.6	406.8	410.9	410.3	409.9	409.6	400.5
	<i>SD</i>	18.4	19.8	20.6	21.6	21.8	21.6	21.5
Chemical Processes	<i>M</i>	406.3	410.4	412.9	409.8	407.2	405.2	405.2
	<i>SD</i>	21.1	23.7	24.8	25.0	24.9	24.7	27.7
Critical Reading	<i>M</i>	398.4	397.7	398.1	394.1	391.9	390.2	391.1
	<i>SD</i>	19.0	19.5	20.5	21.3	22.6	24.4	23.7
Quantitative Reasoning	<i>M</i>	406.3	404.2	404.5	401.2	398.1	394.6	404.6
	<i>SD</i>	18.6	18.9	19.6	20.0	19.8	19.2	23.2
Composite	<i>M</i>	403.8	404.9	406.7	404.0	401.9	400.0	400.5
	<i>SD</i>	15.1	16.3	17.1	17.6	17.7	17.6	19.6
Writing	<i>M</i>	3.50	3.45	3.43	3.29	3.16	2.98	3.34
	<i>SD</i>	0.67	0.68	0.70	0.72	0.76	0.77	0.76
<i>n</i>		13,474	11,057	11,822	12,322	10,046	5,787	144
% of normative sample		20.8	17.1	18.3	19.1	15.5	9.0	0.2

Tables 12 and 13 provide mean PCAT scaled scores according to sex and citizenship status. While the sample consists of over 55% females, male candidates averaged higher scores on each subtest and Composite, with females' Writing scores nearly equaling those of males. With regard to citizenship status, over 76% of the candidates who described themselves as U.S. citizens earned higher average scores only for Critical Reading and Writing. Though less than 6% of the normative sample, candidates describing themselves as an "other non-U.S. citizen" averaged higher for Biological Processes, Chemical Processes, Quantitative Reasoning, and Composite.

Table 12 PCAT Score Statistics by Sex

Subtest/Composite		Sex		
		Female	Male	Unknown
Biological Processes	<i>M</i>	406.3	410.9	410.0
	<i>SD</i>	20.3	20.6	22.1
Chemical Processes	<i>M</i>	405.9	412.9	411.4
	<i>SD</i>	23.3	24.3	25.6
Critical Reading	<i>M</i>	395.0	396.9	394.8
	<i>SD</i>	21.1	21.0	21.9
Quantitative Reasoning	<i>M</i>	400.3	405.0	404.3
	<i>SD</i>	19.2	19.8	21.1
Composite	<i>M</i>	402.0	406.6	405.3
	<i>SD</i>	16.6	16.8	18.2
Writing	<i>M</i>	3.34	3.35	3.28
	<i>SD</i>	0.73	0.72	0.74
<i>n</i>		35,787	23,238	5,627
% of normative sample		55.4	35.9	8.7

Table 13 PCAT Score Statistics by Citizenship Status

Subtest/Composite		Citizenship status			
		US citizen	US perm. resident	Other non-US citizen	Unknown
Biological Processes	<i>M</i>	407.7	404.3	415.8	410.4
	<i>SD</i>	20.2	21.9	21.3	22.1
Chemical Processes	<i>M</i>	407.3	408.9	424.5	412.3
	<i>SD</i>	23.1	25.0	26.8	25.5
Critical Reading	<i>M</i>	397.5	378.3	392.3	394.9
	<i>SD</i>	20.5	20.0	20.8	21.7
Quantitative Reasoning	<i>M</i>	401.2	400.6	413.9	405.4
	<i>SD</i>	18.9	21.1	21.6	21.0
Composite	<i>M</i>	403.5	398.2	411.7	405.9
	<i>SD</i>	16.4	17.3	17.8	18.1
Writing	<i>M</i>	3.38	2.93	3.34	3.30
	<i>SD</i>	0.72	0.75	0.71	0.73
<i>n</i>		49,588	4,184	3,699	7,181
% of normative sample		76.7	6.5	5.7	11.1

Table 14 shows average score data by candidates' linguistic background (defined as the candidate's native or first language). Among candidates indicating their linguistic background, nearly 71% identified themselves as having an English background and averaged highest for Biological Processes, Critical Reading, Composite, and Writing; and the 13.5% identifying themselves in the "Other" linguistic category averaged highest for Chemical Processes and Quantitative Reasoning. Over 65% of the candidates in the "Other" linguistic group also indicated an Asian racial background, which is consistent with mean score data shown in Table 16.

Table 14 PCAT Score Statistics by Linguistic Background

Subtest/Composite		Linguistic background			
		English	Spanish	Other	Unknown
Biological Processes	<i>M</i>	408.6	400.7	406.5	410.2
	<i>SD</i>	20.1	21.4	22.0	22.0
Chemical Processes	<i>M</i>	408.3	399.5	411.4	411.9
	<i>SD</i>	23.3	23.3	26.3	25.4
Critical Reading	<i>M</i>	399.0	379.7	382.6	394.5
	<i>SD</i>	19.9	20.6	20.4	21.8
Quantitative Reasoning	<i>M</i>	402.0	388.7	404.6	404.8
	<i>SD</i>	18.8	17.8	21.8	21.0
Composite	<i>M</i>	404.6	392.3	401.4	405.5
	<i>SD</i>	16.3	16.5	18.2	18.1
Writing	<i>M</i>	3.43	2.73	3.03	3.30
	<i>SD</i>	0.68	0.82	0.77	0.73
<i>n</i>		45,846	1,907	8,724	8,175
% of normative sample		70.9	2.9	13.5	12.6

Table 15 provides mean PCAT scaled scores according to candidates' self-reported ethnic identification and Table 16 shows data according to candidates' racial identity. During PCAT registration, the normative sample candidates were only able to indicate a single selection for ethnicity but were able to indicate multiple selections for race. Candidates indicating more than one racial category are grouped here as "Multi-racial." The majority of candidates identified themselves in Table 15 as non-Hispanic/Latino and in Table 16 as White. Table 15 shows that the nearly 71% of candidates identifying themselves as non-Hispanic/Latino averaged highest for each subtest. Data in Table 16 show that the 21.4% of candidates identifying themselves as Asian earned higher scores for Biological Processes, Chemical Processes, Quantitative Reasoning, and Composite; and those identifying themselves as White averaged highest for Critical Reading and Writing. The higher average scores earned by those who identified themselves as Asian is consistent with the data shown in Table 14 for the "Other" linguistic group.

Table 15 PCAT Score Statistics by Ethnicity

Subtest/Composite		Hispanic/ Latino	Non-Hispanic/ Latino	Unknown
Biological Processes	<i>M</i>	404.1	408.8	407.8
	<i>SD</i>	21.0	20.4	21.6
Chemical Processes	<i>M</i>	402.0	409.9	408.1
	<i>SD</i>	23.0	23.9	24.7
Critical Reading	<i>M</i>	388.9	397.1	393.2
	<i>SD</i>	21.3	20.9	21.3
Quantitative Reasoning	<i>M</i>	393.4	403.5	401.4
	<i>SD</i>	18.2	19.4	20.4
Composite	<i>M</i>	397.2	405.0	402.7
	<i>SD</i>	16.7	16.6	17.6
Writing	<i>M</i>	3.08	3.39	3.27
	<i>SD</i>	0.81	0.71	0.74
<i>n</i>		4,644	45,757	14,251
% of normative sample		7.2	70.8	22.0

Table 16 PCAT Score Statistics by Race

Subtest/Composite		American Indian/ Alaskan Native	Asian	Black/ African- American	Multi-racial	Native Hawaiian/ other Pacific islander	White	Unknown
Biological Processes	<i>M</i>	403.3	410.5	399.0	409.9	400.8	408.7	409.1
	<i>SD</i>	18.7	21.8	19.7	20.0	21.4	19.5	22.2
Chemical Processes	<i>M</i>	401.6	414.6	398.4	408.9	400.5	408.3	409.8
	<i>SD</i>	21.0	26.1	22.6	24.1	23.2	22.4	25.2
Critical Reading	<i>M</i>	391.6	391.2	382.2	399.4	388.1	400.3	393.7
	<i>SD</i>	19.2	20.8	19.8	20.0	20.0	19.8	21.8
Quantitative Reasoning	<i>M</i>	395.6	408.6	390.6	402.3	395.3	401.9	402.3
	<i>SD</i>	16.6	21.6	17.3	19.7	18.5	17.8	20.8
Composite	<i>M</i>	398.2	406.3	392.7	405.3	396.3	404.9	403.8
	<i>SD</i>	14.7	18.1	15.2	16.7	17.3	15.6	18.1
Writing	<i>M</i>	3.22	3.28	3.01	3.39	3.17	3.44	3.25
	<i>SD</i>	0.74	0.73	0.75	0.71	0.76	0.69	0.76
<i>n</i>		305	13,855	5,859	1,919	133	32,929	9,652
% of normative sample		0.5	21.4	9.1	3.0	0.2	50.9	14.9

As an attempt to reflect socio-economic status, Table 17 shows subtest score data according to how candidates described their parents' or guardians' highest level of educational attainment. Candidates were asked for this information separately for mother/female guardian and father/male guardian. Table 17 combines the two responses into a single listing according to the parent/guardian with the highest level of education for each candidate. These data show that candidates with a parent/guardian earning at least a bachelor's degree averaged higher PCAT scores for each subtest, with average scores increasing with increased parent/guardians' graduate degree attainment.

Table 17 PCAT Score Statistics by Parent's or Guardian's Highest Educational Level Attained

Subtest/Composite		Less than HS diploma	HS diploma or equiv.	College less than bachelor's degree	Bachelor's degree	Graduate school through master's degree	Doctoral degree	Other/ unknown
Biological Processes	<i>M</i>	405.5	405.5	406.0	408.5	409.8	413.6	409.4
	<i>SD</i>	21.0	20.3	19.9	20.3	20.7	20.8	21.8
Chemical Processes	<i>M</i>	406.5	405.3	404.9	409.9	410.6	414.9	411.3
	<i>SD</i>	24.3	23.4	22.4	23.7	24.4	24.9	25.1
Critical Reading	<i>M</i>	385.0	391.1	394.8	397.0	400.0	401.1	394.0
	<i>SD</i>	20.0	20.4	20.0	20.9	21.2	20.9	21.8
Quantitative Reasoning	<i>M</i>	398.5	399.1	398.8	403.4	404.2	406.8	404.4
	<i>SD</i>	19.2	18.9	18.1	19.3	20.0	21.0	20.9
Composite	<i>M</i>	399.0	400.4	401.3	404.8	406.3	409.2	404.9
	<i>SD</i>	16.5	16.2	15.8	16.5	17.2	17.2	17.9
Writing	<i>M</i>	3.10	3.20	3.30	3.40	3.40	3.40	3.30
	<i>SD</i>	0.80	0.80	0.70	0.70	0.70	0.70	0.70
<i>n</i>		2,311	8,406	11,945	16,718	10,075	4,274	10,923
% of normative sample		3.6	13.0	18.5	25.9	15.6	6.6	16.9

Table 18 shows average scores according to candidates' residence at the time of testing listed by US state and territory, Canada, and country other than the US or Canada. These data show that Canadian residents averaged within the top 10 places of residence for Composite and four of the subtests, with the highest average scores for Chemical Processes, Quantitative Reasoning, and Composite. For the US states and territories, the following patterns are apparent: The residents of Wisconsin averaged within the top 10 for Composite and all five subtests; residents of Minnesota and Utah averaged within the top 10 for Composite and four of the subtests; residents of California, Indiana, Nebraska, and Washington averaged within the top 10 for Composite and three of the subtests; residents of Alaska, Colorado, Idaho, and Michigan averaged within the top 10 for either Composite and two subtests or three of the subtests, with Idaho residents averaging the highest for Biological Processes; Montana residents average the highest scores for Critical Reading, and candidates residing in Rhode Island averaged highest for Writing.

Table 18 PCAT Score Statistics by Examinee Residence

Examinee residence	<i>n</i>	%	Biological Processes	Chemical Processes	Critical Reading	Quant. Reasoning	Composite	Writing
US states & territories	60,698	93.9	407.6	407.7	395.6	401.5	403.2	3.33
Alabama	1,128	1.7	406.0	403.0	398.2	398.0	401.4	3.33
Alaska	60	0.1	411.2	411.9	401.2	404.6	407.3	3.29
Arizona	1,340	2.1	409.3	409.0	395.6	401.7	404.0	3.32
Arkansas	737	1.1	407.3	407.2	400.8	400.5	404.1	3.42
California	3,456	5.3	416.7	417.6	395.1	410.4	410.1	3.33
Colorado	697	1.1	415.9	414.2	401.7	402.7	408.8	3.47
Connecticut	709	1.1	408.5	404.8	396.7	400.8	402.8	3.54
Delaware	119	0.2	409.6	407.9	394.4	400.8	403.3	3.32
District of Columbia	46	0.1	401.8	402.0	383.8	393.9	395.5	2.91
Florida	4,136	6.4	410.2	409.2	394.4	400.8	403.7	3.30
Georgia	2,481	3.8	403.0	403.4	393.5	398.5	399.7	3.27
Hawaii	311	0.5	411.1	406.0	394.4	401.3	403.3	3.35
Idaho	86	0.1	420.7	414.8	402.1	402.1	410.0	3.26
Illinois	2,965	4.6	406.4	408.2	395.5	402.3	403.2	3.43
Indiana	798	1.2	407.6	409.7	402.3	406.3	406.6	3.53
Iowa	644	1.0	411.4	410.3	399.9	403.5	406.4	3.34
Kansas	885	1.4	404.2	406.4	398.3	400.6	402.5	3.35
Kentucky	1,162	1.8	407.1	406.8	400.6	401.4	404.1	3.41
Louisiana	1,266	2.0	396.7	397.7	390.8	394.1	395.0	3.14
Maine	307	0.5	403.5	400.5	397.2	398.4	400.1	3.56
Maryland	1,582	2.4	408.8	408.0	388.7	401.1	401.8	3.22
Massachusetts	585	0.9	405.5	402.1	393.7	398.3	400.0	3.39
Michigan	2,287	3.5	411.8	414.1	396.2	404.9	406.9	3.42
Minnesota	1,206	1.9	413.8	414.7	401.8	408.1	409.7	3.43
Mississippi	709	1.1	403.1	399.3	396.2	394.3	398.4	3.27
Missouri	1,080	1.7	408.6	405.3	399.2	401.1	403.7	3.39
Montana	260	0.4	408.3	414.4	405.1	401.9	407.6	3.42
Nebraska	345	0.5	412.4	413.1	401.4	405.1	408.1	3.55
Nevada	430	0.7	414.8	411.8	391.2	400.4	404.7	3.24
New Hampshire	110	0.2	404.3	402.2	395.5	401.9	401.1	3.56
New Jersey	1,270	2.0	403.9	404.4	388.9	398.3	399.0	3.35
New Mexico	414	0.6	403.7	403.7	396.6	395.4	400.0	3.31
New York	3,934	6.1	404.8	405.2	393.4	400.0	401.0	3.41
North Carolina	1,971	3.0	407.3	406.7	398.4	402.4	403.8	3.39
North Dakota	225	0.3	404.0	405.0	399.1	401.4	402.5	3.28
Ohio	2,091	3.2	408.1	412.2	400.0	404.6	406.4	3.45
Oklahoma	1,001	1.5	403.0	405.9	397.4	398.8	401.4	3.26
Oregon	203	0.3	415.4	412.1	398.6	402.6	407.3	3.31
Pennsylvania	2,956	4.6	405.2	407.0	397.4	403.5	403.4	3.44
Puerto Rico	1,086	1.7	395.0	395.1	372.5	383.4	386.6	2.43

Table 18 PCAT Score Statistics by Examinee Residence *continued*

Examinee residence	<i>n</i>	%	Biological Processes	Chemical Processes	Critical Reading	Quant. Reasoning	Composite	Writing
US states & territories	60,698	93.9	407.6	407.7	395.6	401.5	403.2	3.33
Rhode Island	79	0.1	404.3	401.7	396.6	395.2	399.5	3.63
South Carolina	1,324	2.0	403.2	398.8	396.6	396.9	399.0	3.31
South Dakota	60	0.1	409.5	410.1	400.2	402.5	405.7	3.38
Tennessee	1,554	2.4	405.9	405.1	397.8	398.2	401.8	3.35
Texas	5,598	8.7	407.0	406.6	392.9	401.5	402.1	3.23
Utah	609	0.9	413.7	413.4	403.3	405.3	409.0	3.37
Vermont	79	0.1	410.7	405.0	398.1	402.5	404.2	3.49
Virginia	1,561	2.4	407.1	405.3	393.5	398.6	401.3	3.23
Washington	947	1.5	414.9	419.9	399.1	407.0	410.4	3.39
West Virginia	570	0.9	400.3	400.5	398.0	399.0	399.6	3.40
Wisconsin	1,084	1.7	414.0	417.6	402.8	408.8	411.0	3.48
Wyoming	150	0.2	411.3	405.6	402.4	400.4	405.1	3.50
Other U.S. territory or military base	5	0.0	394.8	381.0	379.0	386.2	385.4	3.25
International	3,954	6.1	418.3	427.0	396.2	415.6	414.4	3.42
Canada	3,647	5.6	420.5	429.3	398.4	417.1	416.4	3.49
Country other than U.S. or Canada	307	0.5	392.6	400.2	369.4	397.4	390.0	2.60
Total	64,652	100.0	408.3	408.9	395.6	402.3	403.9	3.34

The 2015 Norms

PCAT Scaled Scores and Percentile Ranks for the 2015 Norms

Though the scaled score means have not been readjusted for the new norms, the percentile ranks that correspond to the scaled scores have been recalculated. Table 19 lists all scaled scores and corresponding percentile ranks for the four multiple-choice subtests and Composite for the 2015 norms.

The data in Table 19 indicate that around the means (see Table 1), slight changes in scaled scores result in somewhat greater differences in percentile rank. This is because the large size of the normative sample used to determine the percentile ranks (over 64,000) has resulted in the data forming a classically shaped bell curve, with the majority of scores bunched around the mean. The result of this bunching is that, near the mean, slight changes in a candidate's scaled score result in greater changes in his or her percentile rank than scores at either extreme.

Please note that not all percentile ranks have a corresponding scaled score. Also note that at the higher and lower percentile ranks, some of the corresponding scaled scores are listed as ranges, indicating that more than one scaled score corresponds to a given percentile rank.

Table 19 PCAT Percentile Ranks and Scaled Scores

Percentile rank	Scaled scores				
	Biological Processes	Chemical Processes	Critical Reading	Quantitative Reasoning	Composite
1	200–366	200–363	200–349	200–363	200–369
2	367–369	364–366	350–353	364–366	370–372
3	370–371	367–369	354–356	367–368	373–374
4	372–373	370–371	357–359	369–370	375
5	374–375	372–373	360–361	371–372	376
6	376	374	362–363	373	377
7	377–378	375–376	364–365	374–375	378
8	379	377	366	376	379
9	380	378	367	377	380
10	381	379	368	378	381
11	382	380	369	379	382
12	383	381	370	380	383
13	384	382	371	381	384
14	385	383	372	382	—
15	386	384	373	—	385
16	387	385	374	383	386
17	388	386	375	384	—
18	389	—	376	—	387
19	390	387	377	385	388
20	—	388	378	—	—
21	391	—	379	386	389
22	392	389	—	—	—
23	—	390	380	387	390
24	393	—	381	—	—
25	394	391	—	388	391
26	—	392	382	—	—
27	395	—	383	389	392
28	—	393	—	—	—
29	396	394	384	390	393
30	—	—	385	—	—
31	397	395	—	391	394
32	—	396	386	—	—
33	398	—	—	392	395
34	—	397	387	—	—
35	399	398	388	393	396
36	—	—	—	—	—
37	400	399	389	394	397
38	—	—	390	—	—
39	401	400	—	395	398
40	—	—	391	—	—
41	402	401	—	396	399

Table 19 PCAT Percentile Ranks and Scaled Scores *continued*

Percentile rank	Scaled scores				
	Biological Processes	Chemical Processes	Critical Reading	Quantitative Reasoning	Composite
42	—	—	392	—	—
43	403	402	—	397	400
44	404	—	393	—	—
45	—	403	—	398	401
46	405	—	394	—	—
47	—	404	—	399	402
48	406	—	395	—	—
49	—	405	—	400	403
50	407	—	396	—	—
51	—	406	—	401	404
52	408	—	397	—	—
53	—	407	—	402	405
54	409	—	398	—	—
55	—	408	—	403	—
56	410	—	399	—	406
57	—	409	—	404	—
58	411	410	400	—	407
59	—	—	401	405	—
60	412	411	—	406	408
61	413	412	402	—	—
62	—	—	—	407	409
63	414	413	403	—	—
64	415	414	—	408	410
65	—	—	404	—	—
66	416	415	—	409	411
67	417	416	405	410	—
68	—	—	—	—	412
69	418	417	406	411	—
70	419	418	—	—	413
71	—	—	407	412	—
72	420	419	408	413	414
73	421	420	—	—	—
74	—	—	409	414	415
75	422	421	—	415	416
76	423	422	410	—	—
77	—	—	411	416	417
78	424	423	412	417	418
79	425	424	—	—	—
80	—	—	413	418	419
81	426	425	414	419	420
82	427	426	415	420	—

Table 19 PCAT Percentile Ranks and Scaled Scores *continued*

Percentile rank	Scaled scores				
	Biological Processes	Chemical Processes	Critical Reading	Quantitative Reasoning	Composite
83	428	427	—	421	421
84	429	428	416	422	422
85	430	429	417	423	—
86	431	430	418	424	423
87	432	431–432	419	425	424
88	433	433	420	426	425
89	434	434–435	421	427	426
90	435	436	422	428	427
91	436	437–438	423	429	428
92	437–438	439–440	424–425	430–431	429
93	439	441–442	426	432	430
94	440–441	443–444	427–428	433–434	431
95	442–444	445–447	429–430	435–437	432–433
96	445–447	448–450	431–433	438–441	434–436
97	448–451	451–454	434–437	442–446	437–439
98	452–456	455–459	438–442	447–452	440–443
99	457–600	460–600	443–600	453–600	444–600

Comparing Scaled Scores and Percentile Ranks for the 2011 and 2015 Norms

All multiple-choice scores are currently reported on Official Transcripts as scaled scores and 2015 percentile ranks, with all percentile ranks obtained before July 2016 converted to 2015 equivalents (see the Score Reporting section of the PCAT Basics document). However, a school may still have on file older Official Transcripts that list candidates' scores based only on the 2011 norms.

Compendium Tables 20–24 may be used to determine a candidate's 2015 percentile ranks and previously obtained 2011 percentile ranks for specific scaled scores. Each table lists percentile-rank-to-scaled-score correspondences separately for Biological Processes (Table 20), Chemical Processes (Table 21), Critical Reading (Table 22), Quantitative Reasoning (Table 23), and Composite (Table 24).

Please note that for instances in Tables 20–24 where more than one scaled score corresponds to the same percentile rank, these scaled scores are shown as ranges, and that for some subtest percentile ranks, there are no corresponding scaled scores. It is also important to note that for the Composite 2011 and 2015 percentile ranks, the subtests included in the Composite average has changed. The 2011 Composite scaled scores and percentile ranks included the Verbal Ability subtest in the calculation, which weighted the Composite scores more toward the language skills than the 2015 Composite scores, which did not include the Verbal Ability subtest. As a result, the Composite scores earned from July 2016 on are more weighted toward the sciences than previously earned Composite scores.

When using these tables, it will be apparent that many of the 2011 percentile ranks differ from the 2015 percentile ranks. These differences suggest that candidates in the more recent sample tended to score either higher or lower than those in the previous sample, depending on the scaled score equivalent and the subtest.

For instance, as shown in Table 20, a Biological Processes scaled score of 410 corresponds to a 2011 percentile rank of 61 but to a 2015 percentile rank of 56. This difference indicates that while 61% of the 2011 normative sample scored lower than 410, only 56% of the 2015 sample scored lower than 410, suggesting the recent sample generally scored higher for this content area than the previous normative sample. A similar phenomenon is apparent with the Chemical Processes and Composite score comparisons.

Conversely, as shown in Table 22, a Critical Reading scaled score of 396 corresponds to a 2011 percentile rank of 43 but to a 2015 percentile rank of 50. This difference indicates that while 43% of the 2011 normative sample scored lower than 396, 50% of the 2015 sample scored lower than 396, suggesting the recent sample generally scored lower for this content area than the previous normative sample. A similar but a much less pronounced phenomenon is apparent with the Quantitative Reasoning subtest comparisons.

These sorts of percentile rank differences are due to differences in the two normative samples—the candidates who took the PCAT between 2007 and 2011 and the candidates who took the test between 2011 and 2015. A lower percentile rank in the 2015 norms indicates that more recent candidates averaged a higher scaled score on the PCAT than their peers did during the 2007–11 period, and a higher percentile rank in the 2015 norms indicates that more recent candidates averaged a lower scaled score than their peers did during the 2007–11 period.

A demographic change observed in the two samples may suggest an explanation for some of these percentile rank differences. The average number of PCAT candidates taking the test annually decreased from 17,060 for the 2007–11 sample (68,241 over 4 years) to 16,133 for the 2011–15 sample (64,652 over 4 years). This decrease was partly due to the decrease in the number of candidates included in the 2011–15 sample who subsequently took the PCAT a second time. The number and proportion of subsequent repeaters thereby decreased from 28,614 (41.9%) for the 2007–11 sample to 21,655 (33.5%) for the 2011–15 sample. At the same time, the number and proportion of candidates taking the PCAT only once increased from 39,627 (58.1%) for the 2007–11 sample to 42,997 (66.5%) for the 2011–15 sample. Although candidates' first attempt was the only one included in the normative sample data, the first attempt for candidates' subsequently taking the test again tended to be lower than for candidates taking the test once and only once (see Table 4). Thus, the higher proportion of candidates taking the PCAT only once may account for the increase in mean scores from the 2007–11 to the 2011–15 normative samples for the Biological Processes and Chemical Processes subtests.

Concerning the decreases in mean scores and changes in scaled-score-to-percentile-rank relationships seen between the 2007–11 and 2011–15 samples for the Critical Reading subtest, a changing PCAT candidate pool may account for these changes. The Critical Reading subtest is the most reading intensive subtest and requires candidates to comprehend, analyze, and evaluate extended passages to a much greater degree than the other subtests. Decreases in candidates indicating an English linguistic background and slight increases in candidates indicating Spanish or Other linguistic backgrounds may account for the decreases seen in mean scores and in the changes in percentile ranks for the Critical Reading subtest. As for the Quantitative Reasoning subtest, the relatively slight changes in the mean score and percentile ranks are so minor that it may be reasonable to suggest that changes in the normative sample have not been significant enough to have a significant effect on scores for this subtest.

Compendium Tables

Table 20 Biological Processes Percentile Ranks and Scaled Scores for the 2011 and 2015 Norms

Percentile rank	Scaled scores		Percentile rank	Scaled scores		Percentile rank	Scaled scores	
	2011	2015		2011	2015		2011	2015
1	200–361	200–366	34	—	—	67	413	417
2	362–366	367–369	35	396	399	68	—	—
3	367–368	370–371	36	397	—	69	414	418
4	369–370	372–373	37	—	400	70	—	419
5	371–372	374–375	38	398	—	71	415	—
6	373–374	376	39	—	401	72	416	420
7	375	377–378	40	399	—	73	417	421
8	376	379	41	—	402	74	418	—
9	377–378	380	42	400	—	75	—	422
10	379	381	43	—	403	76	419	423
11	380	382	44	401	404	77	420	—
12	381	383	45	—	—	78	—	424
13	382	384	46	402	405	79	421	425
14	383	385	47	—	—	80	422	—
15	384	386	48	403	406	81	423	426
16	—	387	49	404	—	82	424	427
17	385	388	50	—	407	83	—	428
18	386	389	51	405	—	84	425	429
19	—	390	52	—	408	85	426	430
20	387	—	53	406	—	86	427	431
21	388	391	54	—	409	87	428	432
22	389	392	55	407	—	88	429	433
23	—	—	56	—	410	89	430–431	434
24	390	393	57	408	—	90	432–433	435
25	—	394	58	—	411	91	434	436
26	391	—	59	409	—	92	435	437–438
27	392	395	60	—	412	93	436–437	439
28	—	—	61	410	413	94	438–439	440–441
29	393	396	62	—	—	95	440–441	442–444
30	—	—	63	411	414	96	442–445	445–447
31	394	397	64	—	415	97	446–448	448–451
32	—	—	65	412	—	98	449–454	452–456
33	395	398	66	—	416	99	455–600	457–600

Table 21 Chemical Processes Percentile Ranks and Scaled Scores for the 2011 and 2015 Norms

Percentile rank	Scaled scores		Percentile rank	Scaled scores		Percentile rank	Scaled scores	
	2011	2015		2011	2015		2011	2015
1	200–357	200–363	34	392	397	67	—	416
2	358–361	364–366	35	—	398	68	412	—
3	362–364	367–369	36	393	—	69	—	417
4	365–366	370–371	37	394	399	70	413	418
5	367–368	372–373	38	—	—	71	414	—
6	369–370	374	39	395	400	72	415	419
7	371	375–376	40	—	—	73	416	420
8	372	377	41	396	401	74	417	—
9	373–374	378	42	397	—	75	—	421
10	375	379	43	398	402	76	418	422
11	376	380	44	—	—	77	—	—
12	377	381	45	399	403	78	419	423
13	378	382	46	—	—	79	420	424
14	379	383	47	400	404	80	421	—
15	380	384	48	—	—	81	422	425
16	381	385	49	401	405	82	423	426
17	382	386	50	—	—	83	424	427
18	—	—	51	402	406	84	425	428
19	383	387	52	—	—	85	426	429
20	384	388	53	403	407	86	427–428	430
21	385	—	54	—	—	87	429	431–432
22	—	389	55	404	408	88	430	433
23	386	390	56	405	—	89	431–432	434–435
24	—	—	57	406	409	90	433	436
25	387	391	58	—	410	91	434	437–438
26	388	392	59	407	—	92	435–437	439–440
27	—	—	60	—	411	93	438–439	441–442
28	389	393	61	408	412	94	440–442	443–444
29	—	394	62	—	—	95	443–444	445–447
30	390	—	63	409	413	96	445–448	448–450
31	—	395	64	410	414	97	449–453	451–454
32	391	396	65	411	—	98	454–460	455–459
33	—	—	66	—	415	99	461–600	460–600

Table 22 Critical Reading Percentile Ranks and Scaled Scores for the 2011 and 2015 Norms

Percentile rank	Scaled scores		Percentile rank	Scaled scores		Percentile rank	Scaled scores	
	2011	2015		2011	2015		2011	2015
1	200–352	200–349	34	391	387	67	—	405
2	353–356	350–353	35	—	388	68	409	—
3	357–360	354–356	36	392	—	69	410	406
4	361–362	357–359	37	393	389	70	—	—
5	363–364	360–361	38	—	390	71	411	407
6	365–366	362–363	39	394	—	72	—	408
7	367–368	364–365	40	—	391	73	412	—
8	369	366	41	395	—	74	—	409
9	370–371	367	42	—	392	75	413	—
10	372	368	43	396	—	76	414	410
11	373	369	44	—	393	77	—	411
12	374	370	45	397	—	78	415	412
13	375	371	46	—	394	79	416	—
14	376	372	47	398	—	80	—	413
15	377	373	48	—	395	81	417	414
16	378	374	49	399	—	82	418	415
17	379	375	50	—	396	83	—	—
18	380	376	51	400	—	84	419	416
19	381	377	52	—	397	85	420	417
20	382	378	53	401	—	86	421	418
21	383	379	54	402	398	87	422	419
22	—	—	55	—	—	88	423	420
23	384	380	56	403	399	89	424	421
24	—	381	57	—	—	90	425	422
25	385	—	58	404	400	91	426–427	423
26	386	382	59	—	401	92	428	424–425
27	387	383	60	405	—	93	429	426
28	—	—	61	—	402	94	430–431	427–428
29	388	384	62	406	—	95	432–433	429–430
30	389	385	63	—	403	96	434–435	431–433
31	—	—	64	407	—	97	436–439	434–437
32	390	386	65	—	404	98	440–443	438–442
33	—	—	66	408	—	99	444–600	443–600

Table 23 Quantitative Reasoning Percentile Ranks and Scaled Scores for the 2011 and 2015 Norms

Percentile rank	Scaled scores		Percentile rank	Scaled scores		Percentile rank	Scaled scores	
	2011	2015		2011	2015		2011	2015
1	200–363	200–363	34	—	—	67	410	410
2	364–367	364–366	35	394	393	68	—	—
3	368–369	367–368	36	—	—	69	411	411
4	370–371	369–370	37	395	394	70	412	—
5	372–373	371–372	38	—	—	71	—	412
6	374	373	39	396	395	72	413	413
7	375	374–375	40	—	—	73	—	—
8	376–377	376	41	397	396	74	414	414
9	378	377	42	—	—	75	415	415
10	379	378	43	398	397	76	—	—
11	380	379	44	—	—	77	416	416
12	—	380	45	399	398	78	417	417
13	381	381	46	—	—	79	—	—
14	382	382	47	400	399	80	418	418
15	383	—	48	—	—	81	419	419
16	384	383	49	401	400	82	420	420
17	—	384	50	—	—	83	421	421
18	385	—	51	402	401	84	422	422
19	386	385	52	—	—	85	423	423
20	—	—	53	403	402	86	424	424
21	387	386	54	—	—	87	425	425
22	—	—	55	404	403	88	426	426
23	388	387	56	—	—	89	427–428	427
24	389	—	57	—	404	90	429	428
25	—	388	58	405	—	91	430	429
26	—	—	59	—	405	92	431–432	430–431
27	390	389	60	406	406	93	433–434	432
28	—	—	61	407	—	94	435–437	433–434
29	391	390	62	—	407	95	438–439	435–437
30	—	—	63	408	—	96	440–442	438–441
31	392	391	64	—	408	97	443–447	442–446
32	—	—	65	409	—	98	448–453	447–452
33	393	392	66	—	409	99	454–600	453–600

Table 24 Composite Percentile Ranks and Scaled Scores for the 2011 and 2015 Norms

Percentile rank	Scaled scores		Percentile rank	Scaled scores		Percentile rank	Scaled scores	
	2011	2015		2011	2015		2011	2015
1	200–367	200–369	34	—	—	67	—	—
2	368–370	370–372	35	—	396	68	410	412
3	371–372	373–374	36	396	—	69	—	—
4	373–374	375	37	—	397	70	411	413
5	375–376	376	38	397	—	71	—	—
6	377	377	39	—	398	72	412	414
7	378	378	40	398	—	73	—	—
8	379	379	41	—	399	74	413	415
9	380	380	42	—	—	75	—	416
10	381	381	43	399	400	76	414	—
11	382	382	44	—	—	77	—	417
12	383	383	45	400	401	78	415	418
13	—	384	46	—	—	79	416	—
14	384	—	47	401	402	80	—	419
15	385	385	48	—	—	81	417	420
16	386	386	49	—	403	82	418	—
17	—	—	50	402	—	83	—	421
18	387	387	51	—	404	84	419	422
19	—	388	52	403	—	85	420	—
20	388	—	53	—	405	86	—	423
21	389	389	54	404	—	87	421	424
22	—	—	55	—	—	88	422	425
23	390	390	56	—	406	89	423	426
24	—	—	57	405	—	90	424	427
25	391	391	58	—	407	91	425	428
26	—	—	59	406	—	92	426–427	429
27	392	392	60	—	408	93	428	430
28	—	—	61	407	—	94	429–430	431
29	393	393	62	—	409	95	431–432	432–433
30	—	—	63	—	—	96	433–434	434–436
31	394	394	64	408	410	97	435–437	437–439
32	—	—	65	—	—	98	438–441	440–443
33	395	395	66	409	411	99	442–600	444–600

Comparing Current and Older Composite Scores

Beginning with the July 2016 PCAT administration, all test forms consist of four multiple-choice subtests—Biological Processes, Chemical Processes, Critical Reading, and Quantitative Reasoning. Prior to that date, the PCAT had consisted of these four multiple-choice subtests plus a Verbal Ability subtest, and all candidates who took the PCAT during the current normative sample period (July 2011 through January 2015) earned a Verbal Ability scaled score.

When determining the 2015 Composite percentile ranks, the Verbal Ability scaled scores were excluded from the Composite scaled score calculations. This was done so that all the Composite percentile ranks reported after July 2016 would be consistent with the current test form structure. For the same reason, Composite percentile ranks listed on Official Transcripts for scores earned prior to July 2016 are based on recalculated scaled scores that exclude the Verbal Ability subtest. Thus, all candidates' older scaled scores and percentile ranks reported on their Official Transcripts are comparable to current Composite scores.

Using normative sample data, several analyses were conducted to examine the impact of excluding Verbal Ability scores from the 2015 Composite score calculations for candidates whose historical Composite scores were recalculated for reporting on Official Transcripts. These analyses involved comparisons between the 2015 Composite percentile ranks and hypothetical Composite percentile ranks that were created solely for research purposes, which included the four current subtests plus Verbal Ability. One analysis found a correlation of 0.98 between the Composite percentile ranks based only on the four current multiple-choice subtests and Composite percentile ranks that included Verbal Ability. This very high correlation suggests that the Composite percentile ranks derived from either four or five subtests are not significantly different when the entire normative sample is considered.

However, because excluding the Verbal Ability subtest from the PCAT changes the structure of the Composite scaled scores, there is bound to be some impact on some individual candidates at some scaled score ranges. This is important to consider because candidates' Composite scores that have been recalculated without Verbal Ability for reporting on current Official Transcripts had originally been reported to them and to schools with the Verbal Ability score included. For this reason, analyses were done to compare how differences between Composite scores computed with and without Verbal Ability would affect candidates' Composite percentile ranks. Such comparisons may be especially important since the current percentile ranks without Verbal Ability are more weighted toward the science and quantitative content than the older percentile ranks that included the Verbal Ability subtest in the Composite score calculation.

Table 25 shows comparisons between the 2015 Composite percentile ranks calculated with the current four multiple-choice subtests (CPR4) and the hypothetical Composite percentile ranks computed with the current four subtests plus Verbal Ability (CPR5). The values listed in each Composite scaled score range column represent percentages and totals for all candidates from the normative sample ($n = 64,652$) who earned scores within each score range listed. Please note that the Total column to the right and the Total row at the bottom indicate the total percentages of candidates for each percentile rank point discrepancy and for each Composite scaled score range, respectively; and the middle CPR4=CPR5 row indicates the percentages of candidates with no discrepancy.

Table 25 Comparisons of the 2015 Composite Percentile Ranks (CPR) Computed Without the Verbal Ability Subtest (CPR4) to Composite Percentile Ranks Computed With the Verbal Ability Subtest (CPR5) for Selected Composite Scaled Score (SS) Ranges

CPR point discrepancy	Composite Scaled Score									Total	
	<370	370–379	380–389	390–399	400–409	410–419	420–429	430–439	≥440		
CPR4 < CPR5	≥10	—	0.1	1.5	4.8	10.0	8.9	0.8	—	—	5.3
	9	—	0.1	0.5	2.2	1.8	1.2	0.8	—	—	1.2
	8	—	0.1	0.8	1.4	4.1	5.9	1.0	—	—	2.6
	7	—	0.4	0.9	2.1	2.6	1.7	2.5	—	—	1.8
	6	—	0.7	2.2	2.7	5.3	6.9	4.2	—	—	3.8
	5	0.1	1.2	2.0	2.3	2.7	3.6	5.4	0.0	—	2.7
	4	0.1	2.2	3.6	4.9	6.5	8.5	8.5	0.9	—	5.6
	3	0.2	4.4	4.8	3.3	3.7	3.7	8.6	3.0	—	4.1
	2	2.4	7.3	6.2	7.0	6.5	9.3	11.8	8.3	—	7.6
	1	14.5	16.1	5.6	4.6	6.1	2.0	11.4	17.0	7.6	6.7
Total	17.3	32.5	28.0	35.4	49.3	51.7	55.1	29.2	7.6	41.4	
CPR4=CPR5	82.7	24.5	13.2	7.2	5.8	10.4	8.8	22.3	64.5	12.5	
CPR4 > CPR5	1	—	20.6	9.7	4.4	6.7	2.5	10.7	18.7	19.8	7.8
	2	—	12.1	11.5	9.2	3.6	9.5	5.8	11.7	5.6	7.9
	3	—	6.6	12.8	2.8	6.0	1.8	6.3	8.3	1.5	5.4
	4	—	3.0	7.4	10.6	3.2	7.4	3.1	4.0	0.5	6.0
	5	—	0.6	6.5	1.9	5.1	1.1	2.6	2.6	0.4	3.1
	6	—	0.1	5.5	8.7	3.8	4.2	1.9	1.5	—	4.5
	7	—	—	2.2	1.7	3.1	1.7	1.6	0.7	—	1.9
	8	—	—	1.5	7.2	3.0	2.6	0.7	0.5	—	3.0
	9	—	—	0.9	1.0	1.5	1.8	1.2	0.2	—	1.1
	≥10	—	—	0.7	10.0	8.8	5.2	2.1	0.2	—	5.5
Total	—	42.9	58.8	57.4	44.8	37.9	36.1	48.5	27.8	46.1	
Total	1.5	5.3	12.8	21.2	23.6	18.2	10.4	4.6	2.4	100.0	

Table 25 shows that 63.0% of the discrepancies were for Composite scaled scores in the 390–399 (21.2%), 400–409 (23.6%), and 410–419 (18.2%) ranges. These data also show that for most scaled score ranges and for the Total column, the highest proportions of discrepancies tended to be 1–4 percentile rank points. The table also shows that for scaled scores <370 and ≥440, relatively few candidates had Composite percentile rank differences (17.3% and 35.4%, respectively). For the other scaled score ranges, greater proportions of candidates in the 400–429 scaled score range had Composite percentile ranks that were lower without Verbal Ability (CPR4 < CPR5), and greater proportions of candidates in the 370–399 and 430–439 scaled scores ranges had Composite percentile ranks that were higher without Verbal Ability (CPR4 < CPR5).

Based on information in this table, excluding the Verbal Ability subtest from the PCAT had the least impact on the lowest (<370) and highest (≥440) scoring candidates. However, for candidates nearest the middle of the scaled score point distribution (400–409), the structural change had the greatest effect, with about equal proportions of individuals seeing Composite percentile rank increases (CPR4 > CPR5 = 44.8%) or decreases (CPR4 < CPR5 = 49.3%) when the Verbal Ability scores are excluded.

Item Response Theory (IRT)—A mathematical model that relates the characteristics of test items and estimates of candidates' ability or proficiency to the probability of a positive response, such as the correct answer to an item.

Longitudinal Tracking—The tracking of particular data (e.g., mean entering PCAT scores) over a long period of time (e.g., 5 years) to establish trends.

Mean (*M*)—The average of a set of scores computed by adding all of the scores together and then dividing by the total number of scores.

Median—The middle value in a distribution of scores with 50% of the scores lying below it (i.e., the 50th percentile).

N-count (*n*)—The total number of individuals who make up a sample (e.g., the number of candidates that took a test).

Normative Sample/Norm Group—The group of individuals (sample) earning scores on a test whose score data are used to determine scaled scores and/or percentile ranks.

Norm-Referenced Standardized Test—A measurement in which an individual's scores are interpreted by comparing them to scores obtained by a defined group of individuals (a norm group or normative sample) that have been used to determine scaled scores and/or percentile ranks.

Norms—Data that summarize the performance of a normative sample (or norm group) by showing how earned scores compare to one another, such as by listing scaled scores and corresponding percentile ranks.

Operational Items—Items on a test that are used to determine candidates' scores.

Percentile Rank (PR)—A whole number between 1 and 99 that represents the proportion of individuals from the normative sample who earned lower than a given score on a test.

Raw Score (RS)—The number of items answered correctly by a candidate on a test.

Reliability—An estimate of the dependability of test scores in terms of the degree of consistency between measures of the test (e.g., comparisons of administrations of a test over time, or comparisons of items within a test).

Scoring Rubric—A list of detailed descriptions of the criteria that must be met for specific scores to be assigned to an assessment performance, such as essay results.

Standard Deviation (SD)—A measure of the variability of test scores in terms of how spread out scores are from one another in a normative sample distribution.

Validity—The extent to which a test measures what it is intended to measure. Validity refers to the extent to which test scores (or other measures) support appropriate interpretations and inferences regarding measured characteristics (e.g., knowledge or ability) of a person or performances other than those measured (e.g., subsequent performance or achievement).

