2. Diagnostic tests to support requests. Current diagnostic tests, as applicable, and relevant medical history should be submitted. In most cases, an evaluation should have been conducted within the past three years. Specific tests should support the diagnosis and recommendation.

III. Academic/School or College Information

a. Pursuant to the student authorization and release, the school/college is required to provide documentation of accommodations provided in a testing environment, including the frequency of accommodations.

Important: Testing accommodation requests that are unreasonable, would fundamentally alter the nature or integrity of the examination, would jeopardize examination security, or that would impose an undue burden on NABP or other candidates will be subject to denial.

NABP will review the request and will notify the school/college regarding the coordination of the request. **Arrangements for accommodations can only be made if NABP is notified no less than 45 days prior to the start of your preferred testing window.** There are no exceptions to this policy.

Important: The school/college is responsible for securing the appropriate number of rooms to accommodate students requesting a separate testing space. This space should be in the same building where the rest of the cohort is testing. In some instances it may be appropriate for all students requiring a separate room to all test in one room.

Administering the PCOA

The school/college provides the PCOA test location and the physical facilities needed to assist NABP in securely administering the PCOA to the students.

NABP may contract with a testing vendor who will be responsible for overseeing the administration and proctoring of the PCOA. The Test Site Administrator (TSA) will arrange a meeting with the school/college contact approximately one week prior to the scheduled assessment day to confirm arrangements and test day schedule.

Each school/college contact must be present during the student check-in and at the conclusion of the assessment. It is imperative that a technical support person is on the premises during the assessment. The TSA will be responsible for overseeing the on-site student registration/check-in, as well as the proctoring of the assessment.

The school/college is expected to provide the following resources for all administrations, without charge to NABP:

- Assigned assessment room(s); rooms must be made available at least 30 minutes prior to student reporting time
- Registration area in each facility with table(s) and chairs
- Protocol for emergency situations
- A technical support person
- Continuous internet access and power for all students
- Additional laptops or computers in case of technical issues.
- Ensure that the FastTest WebLock software has been pre-installed on laptops/desktops in an on-campus computer lab.

The TSA and proctors will arrive at minimum one hour prior to the scheduled start of the PCOA to set up. Student check-in should begin 30 minutes prior to the assessment start time. However, those schools/colleges with a large number of participating students may need to allow additional time for check-in. As the student is checked in, they will be provided with a work paper that contains their unique computer login information for the assessment. The proctors will then seat each student in the designated room(s).

To ensure that assessment results for all students are earned under comparable conditions and represent fair and accurate measurement of each student's individual knowledge and skills, it is necessary to maintain a standardized and secure testing environment. All students must adhere to the following policies:

- No reference, study, or other materials or devices may be brought into the testing room.
- Prohibited items will not be allowed into the testing room. Prohibited items include, but are not limited to, the following:
  - Books, reference, or study materials
  - Book bags, backpacks, briefcases, handbags/purses, tote bags, computer bags
  - Calculators
  - Cell phones, pagers, Bluetooth ear pieces
  - Food
  - Glasses or any other device with a camera (such as Google Glass)
  - Other electronic or digital devices (watches, activity wristbands, PDAs)
  - Outerwear (coats, hats)
  - Photographic devices
  - Recording devices
  - Weapons

A place for students to place these items will be designated either inside or outside of the assessment room.

The PCOA is the property of NABP and is protected by copyright law, and other applicable state and federal laws and regulations. Students taking the PCOA are expressly prohibited from offering, disclosing, publishing, reproducing, transmitting, receiving, utilizing, or making available the PCOA including, but not limited to, examination question format, examination questions, profiles, and scenarios, in whole or in part, in any form or by any means, whether verbal, written, electronic, or mechanical for any purpose. Testing proctors will enforce security measures to ensure the integrity of the PCOA and the PCOA program. Students should be observed at all times while taking the PCOA.

If an individual engages in misconduct, NABP may terminate the assessment administration for the individual.

In the event of any serious breach of the security or integrity of the PCOA, regardless of who caused it or how, NABP may, in its sole discretion, suspend administration of the PCOA.

Technical Requirements

Each student sitting for the PCOA must have access to a personal or university-issued laptop or desktop computer. Computers must have continuous power and internet connectivity available (DSL or internet speed equivalent to 1.5 megabits per second or higher). Schools should ensure that adequate bandwidth is available for the number of students taking the examination.

For security purposes, NABP uses the FastTest WebLock browser, which prohibits access to other Internet browsers and other software until the assessment is completed and submitted. To ensure seamless delivery of the PCOA on testing day, this browser must be downloaded and installed before the examination. It is strongly recommended that it be installed at least one day prior to the testing day to avoid any issues on the day of the PCOA. Downloading the browser ahead of time will not impair the functionality of the computer for any other applications.

Taking the PCOA requires one of the following internet browsers:

- The current version of Mozilla Firefox
- The current version of Google Chrome
- The current version of Apple Safari
- The current version of Microsoft Edge

In addition, test takers should make sure their computers have the following:

- Adobe Flash Plug-in, version 9.0.115 or newer
- JavaScript enabled
- Cookies enabled
- Screen resolution set to 1024x768 or higher

Note: Virtual desktops, tablets, and other mobile devices cannot be used for the PCOA at this time.

For the most up-to-date technical requirements, please refer to the System Requirements section, which can be accessed through the Examinee Login page of the WebLock browser.

At least two weeks in advance of your scheduled administration date, NABP will send instructions for the WebLock browser to your students. We strongly recommend the student monitor the email address with which they registered for the PCOA for this communication, as well as monitor their spam folder.

So that each student can log in to take the PCOA on the testing day, during check-in the vendor gives each examinee a test code that is unique to them.

Installing FastTest WebLock

The following describes how to install the WebLock browser on a computer, deliver a test in WebLock, and remove WebLock afterward.

Install WebLock on Each Computer

1. Before you start, ensure that:
   - » You have administrative rights on the computer that will be used;
   - » The computer is connected to the internet;
   - » All other programs are closed on the computer; and
   - » For installation on a Mac, the latest version of Java must be installed on the computer.

   Note: The installation should be completed in advance to ensure that the computer is ready on testing day.

2. Visit *https://weblock.fasttestweb.com/testing/pr/20/9*.
3. Click on "Click here to install the *FastTest WebLock* secure browser" on the left side of the screen.

4. Run the program and click "Yes" or "Continue" for all prompts. The installation will check whether you have Microsoft Windows or an Apple Mac operating system and install appropriately.
5. If prompted, click the "Run" button or open WebLockSetup.exe when it has finished downloading. The setup installer will launch.
6. Your computer may ask you to confirm that you want to run the software. Click "Run" or "Yes" to continue.

Note: Steps 4-6 will differ depending on the browser and operating system you are using. For example, in step 4, older versions of Internet Explorer will display a pop-up box to confirm the download, while newer versions may ask for confirmation on a bar at the bottom of the browser window. If you are unable to download WebLock, you may need to consult your browser's help system.

7. The installer will then open. Click “Next.”
8. Click “Next” to install the program in the default folder.
9. Click “Install” to run the installer.
10. Click “Finish” to close the installer and return to the browser.

Verify Installation

To verify that the WebLock browser is properly installed on your computer, confirm the installation by clicking on this link using Google Chrome or Mozilla Firefox: *weblock.fasttestweb.com*.

Removing FastTest WebLock

You can remove WebLock if the individual computer is only being used for one test and no other test will be given via WebLock.

1. Click on Start > Control Panel > Uninstall a Program.
2. Select FastTest WebLock from the list of programs.
3. Click Uninstall.
4. Follow the on-screen prompts to remove the program.

PCOA Content Areas

The PCOA content areas and subtopics for the 2018-2019 administration are based upon the outcomes from the US College of Pharmacy Curricula Survey. The assessment is composed of four content areas that are broken down into 28 subtopic areas.

For a representative sample of the item types, see page 20 of this guide.

The 2018-2019 PCOA blueprint calls for each assessment form to meet the following distribution of questions:

Main Content Domain	% of Operational Items	# of Operational Items
Basic Biomedical Sciences	10%	20
Pharmaceutical Sciences	33%	66
Social/Behavioral/Administrative Sciences	22%	44
Clinical Sciences	35%	70
Totals ►	**100%**	**200**

Area 1.0 – Basic Biomedical Sciences 10%

1.1 Physiology
- 1.1.1 Function of the major body systems and homeostatic impact at organ and system level

1.2 Biochemistry
- 1.2.1 Chemistry and utilization of biomacromolecules including proteins, lipids, carbohydrates, nucleic acid, intermediary metabolism of energy and nutritional molecules
- 1.2.2 Enzymology and coenzymes and kinetics
- 1.2.3 Cell chemistry, signal transduction pathways
- 1.2.4 Transport and mobility
- 1.2.5 Recombinant DNA and molecular biotechnology
- 1.2.6 mRNA translation and protein synthesis

1.3 Microbiology Related to Human Disease
- 1.3.1 Structure, function, and characteristics of microorganisms: microbe classification, structure, metabolism, genetics
- 1.3.2 Pathogenic microorganisms of humans

1.4 Immunology
- 1.4.1 Innate and adaptive immunity
- 1.4.2 Principles of antibody actions
- 1.4.3 Hypersensitivity and types of reactions

Area 2.0 – Pharmaceutical Sciences 33%

2.1 Medicinal Chemistry
- 2.1.1 Physicochemical properties of drugs in relation to drug absorption, distribution, metabolism, and excretion (ADME)
- 2.1.2 Chemical basis for drug action
- 2.1.3 Fundamental pharmacophores for drugs used to treat diseases
- 2.1.4 Structure-activity relationships in relation to drug-target interactions
- 2.1.5 Chemical pathways of drug metabolism
- 2.1.6 Applicability to making drug therapy decisions

2.2 Pharmacology and Toxicology

- 2.2.1 Mechanisms of action of drugs of various categories including biologics
- 2.2.2 Pharmacodynamics of drug binding and response
- 2.2.3 Adverse effects and side effects of drugs
- 2.2.4 Mechanisms of drug-drug interactions
- 2.2.5 Drug discovery and development
- 2.2.6 Acute and chronic toxic effect of xenobiotics, including drug and chemical overdose and antidotes

2.3 Pharmacognosy and Dietary Supplements

- 2.3.1 Concepts of crude drugs, semi-purified, and purified natural products
- 2.3.2 Classes of pharmacologically active natural products
- 2.3.3 Science and regulation of dietary supplements (vitamins, minerals, and herbals)

2.4 Pharmaceutics/Biopharmaceutics

- 2.4.1 Biopharmaceutical principles of drug delivery to the body via dosage forms: liquid, solid, semisolid, controlled release, patches, implants
- 2.4.2 Materials and methods used in preparation of drug forms
- 2.4.3 Physicochemical properties relating to drug entities and dosage forms
- 2.4.4 Principles of drug and dosage form stability, including chemical degradation and physical instability

2.5 Pharmacokinetics

- 2.5.1 Basic principles of in-vivo drug kinetics (linear and nonlinear)
- 2.5.2 Principles of bioavailability and bioequivalence
- 2.5.3 Physiologic determinates of drug onset and duration, including disease and dietary influences on absorption, distribution, metabolism, and excretion

2.6 Pharmacogenomics and Genetics

- 2.6.1 Molecular genetics, genomic, proteomic, and metabolomic principles that serve as a foundation for pharmacogenomics and the genetic basis of disease
- 2.6.2 Genetic variants affecting drug action and metabolism, adverse drug reactions, and disease risk that influence the practice of personalized medicine

2.7 Sterile and Nonsterile Compounding

- 2.7.1 United States Pharmacopeia guidelines on sterile and nonsterile compounding, hazardous drugs, and FDA regulation of compounding
- 2.7.2 Techniques and principles used to prepare and dispense individual extemporaneous prescriptions, including dating of compounded dosage forms
- 2.7.3 Dosage form preparation calculations
- 2.7.4 Sterile admixture techniques, including stability, clean-room requirements, sterility testing, and dating

Area 3.0 – Social/Behavioral/Administrative Sciences 22%

3.1 Health Care Delivery Systems and Public Health

- 3.1.1 Organization of health care delivery systems at the national, state, and local levels: various settings where pharmacy is practiced and the structure of health care delivery systems such as managed care organizations, accountable care organizations, health departments
- 3.1.2 Health care delivery financing in the United States
- 3.1.3 Social, political, and economic factors that influence the delivery of health care in the United States
- 3.1.4 Public Health and Wellness: chronic disease prevention, health promotion, infectious disease control, demographics, physical, social, and environmental factors leading to disease, comparing and contrasting public health with individual medical care
- 3.1.5 The health care delivery system compared and contrasted with that of other industrialized nations

3.2 Population-based Care and Pharmacoepidemiology

- 3.2.1 Data sources and analytic tools that provide an estimate of the probability of beneficial or adverse effects of medication use in large populations
- 3.2.2 Application of epidemiological study designs to evaluate drug use and outcomes in large populations
- 3.2.3 Methods for continually monitoring unwanted effects and other safety-related aspects of medication use in large populations

3.3 Economic and Humanistic Outcomes of Health Care Delivery

- 3.3.1 General microeconomic and general macroeconomic principles
- 3.3.2 Pharmacoeconomic analysis and its application to improve the allocation of limited health care resources
- 3.3.3 Humanistic outcomes and their application to improve the allocation of limited health care resources

3.4 Pharmacy Practice Management

- 3.4.1 Management principles (planning, organizing, directing, and controlling pharmacy resources) applied to various pharmacy practice setting and patient outcomes
- 3.4.2 Personnel management
- 3.4.3 Planning, including delineation between business and strategic planning
- 3.4.4 Marketing of goods and services: product versus service pricing, distribution, promotion
- 3.4.5 Accounting and financial management
- 3.4.6 Budgeting
- 3.4.7 Risk management

3.5 Pharmacy Law and Regulatory Affairs

- 3.5.1 Legal and regulatory principles applied to pharmacy practice: dispensing, professional services, drug use control
- 3.5.2 Administrative, civil, and criminal liability
- 3.5.3 Authority, responsibilities, and operation of agencies and entities that promulgate or administer laws, regulations, or guidances related to practice and prescription and nonprescription medications

3.6 Biostatistics and Research Design

- 3.6.1 Research study designs used in medical research
- 3.6.2 Application and interpretation of statistical tests and data collection instruments

3.7 Ethical Decision Making

- 3.7.1 Principles of biomedical ethics
- 3.7.2 Ethical dilemmas in the delivery of patient, centered care including, conflicts of interest, end-of-life decision making, use of codes of ethics, oaths of the pharmacist
- 3.7.3 Research ethics

3.8 Professional Communication

- 3.8.1 Communication abilities (appropriate verbal, nonverbal, visual, and written) with patient and caregivers, including empathetic communication
- 3.8.2 Communication abilities with other health care providers
- 3.8.3 Assertiveness and problem-solving techniques in relation to difficult social and professional conflicts and situations
- 3.8.4 Measurement and use of health literacy in pharmacy communications
- 3.8.5 Development of cultural competency in pharmacy personnel such that services are respectful of and responsive to the health beliefs, practices, and cultural and linguistic needs of diverse patient populations

3.9 Social and Behavioral Aspects of Pharmacy Practice

- 3.9.1 Health-, illness-, and sick-role behaviors of patients
- 3.9.2 Principles of behavior modification
- 3.9.3 Patient adherence to therapies and recommendations
- 3.9.4 Caregiving throughout the lifecycle
- 3.9.5 Death and dying

3.10 Medication Dispensing and Distribution Systems

- 3.10.1 Systems for safe and effective preparation and dispensing of medications in all types of practice settings
- 3.10.2 Role of automation and technology: pharmacy informatics, information management
- 3.10.3 Continuous quality improvement programs or protocols in the medication-use process, including identification and prevention of medication errors, and establishment of error reduction programs

Area 4.0 – Clinical Sciences 35%

4.1 Evidence-based Practice

- 4.1.1 Interpret and evaluate drug information
- 4.1.2 Apply drug-information skills for the delivery of medication therapy management
- 4.1.3 Evaluate the reliability of various sources of information
- 4.1.4 Interpret guidelines as they apply in a clinical setting
- 4.1.5 Utilize core scientific and systems-based knowledge in the patient care decision-making process
- 4.1.6 Utilize basic science principles in the development and/or implementation of drug treatment protocols and clinical practice guidelines
- 4.1.7 Evaluate clinical trials that validate clinical appropriateness

4.2 Clinical Pathophysiology

- 4.2.1 Apply concepts of pathophysiology to clinical decision making

4.3 Clinical Pharmacokinetics

- 4.3.1 Utilize pharmacokinetics to calculate, evaluate, and individualize drug therapy
- 4.3.2 Interpret clinical pharmacokinetics of commonly used and low-therapeutic-index drugs

4.4 Clinical Pharmacogenomics

- 4.4.1 Utilize pharmacogenomics to calculate, evaluate, and individualize drug therapy

4.5 Disease Prevention and Population Health

- 4.5.1 Recognize the proper use of nonpharmacologic therapies, including complementary and alternative medicines
- 4.5.2 Describe measures to promote wellness and disease prevention
- 4.5.3 Identify the role of immunizations in disease prevention and health promotion

4.6 Patient Assessment

- 4.6.1 Describe techniques for obtaining a comprehensive patient history
- 4.6.2 Describe how to perform patient physical assessments: inspection, palpation, percussion, auscultation
- 4.6.3 Differentiate between normal physical assessment findings and modifications caused by common disease states and drug therapy
- 4.6.4 Interpret common clinical laboratory values and diagnostic tests
- 4.6.5 Perform calculations related to patient assessment: BMI, CrCl, lab adjustments
- 4.6.6 Describe the use of OTC point-of-care testing devices: glucometers, pregnancy tests, home testing for HbA1c, drug screening

4.7 Clinical Pharmacology and Therapeutic Decision Making

- 4.7.1 Make therapy recommendations based on dosage calculations, specific uses and indications of drugs, and nutritional and support therapy
- 4.7.2 Interpret therapeutic drug concentrations
- 4.7.3 Assess pharmacotherapy considering contraindications, therapeutic duplications, dietary interactions, adverse drug reactions and interactions, and allergies
- 4.7.4 Triage and identify when to refer patients to other health professionals
- 4.7.5 Design patient-centered, culturally-relevant treatment plans
- 4.7.6 Apply evidence-based decision making to patient care
- 4.7.7 Recommend nonprescription and natural product therapies
- 4.7.8 Identify and manage drug toxicity, drug-induced diseases, and misuse or abuse
- 4.7.9 Monitor drug therapy for misuse, abuse, and non-adherence

PCOA Item Types

The following are examples of item formats that a student may encounter when taking the PCOA. These questions are presented as examples to familiarize students with their formats and are not intended to represent content areas of the PCOA.

Multiple-Choice Question Format

Which of the following vaccines is contraindicated in immunocompromised patients?

A. Pneumococcal polysaccharide

B. Varicella

C. Meningococcal conjugate

D. Subcutaneous influenza

Multiple-Response Question Format

What counseling information should a pharmacist provide to a patient taking oral tacrolimus?
(Select **ALL** that apply.)

A. Avoid live virus vaccinations

B. Avoid grapefruit and grapefruit juice

C. If a dose is missed, double up on the next dose

D. Do not drink alcohol while taking this medication

E. Medication levels need to be monitored

Constructed-Response Question Format

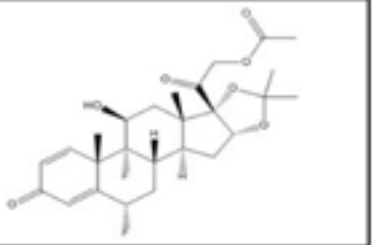
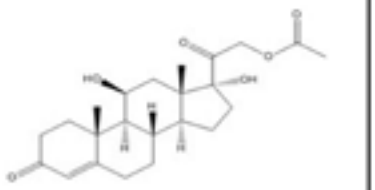
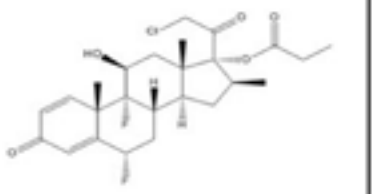
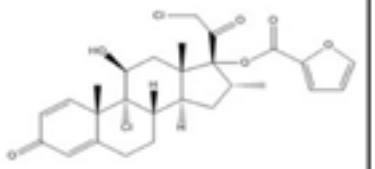
Griseofulvin oral suspension contains 125 mg/5 mL. A physician prescribed 250 mg bid for 2 weeks for a patient. How many milliliters of griseofulvin should be dispensed in order to fill this prescription?

(Answer must be numeric; round the final answer to the nearest **WHOLE** number.)

Ordered-Response Question Format

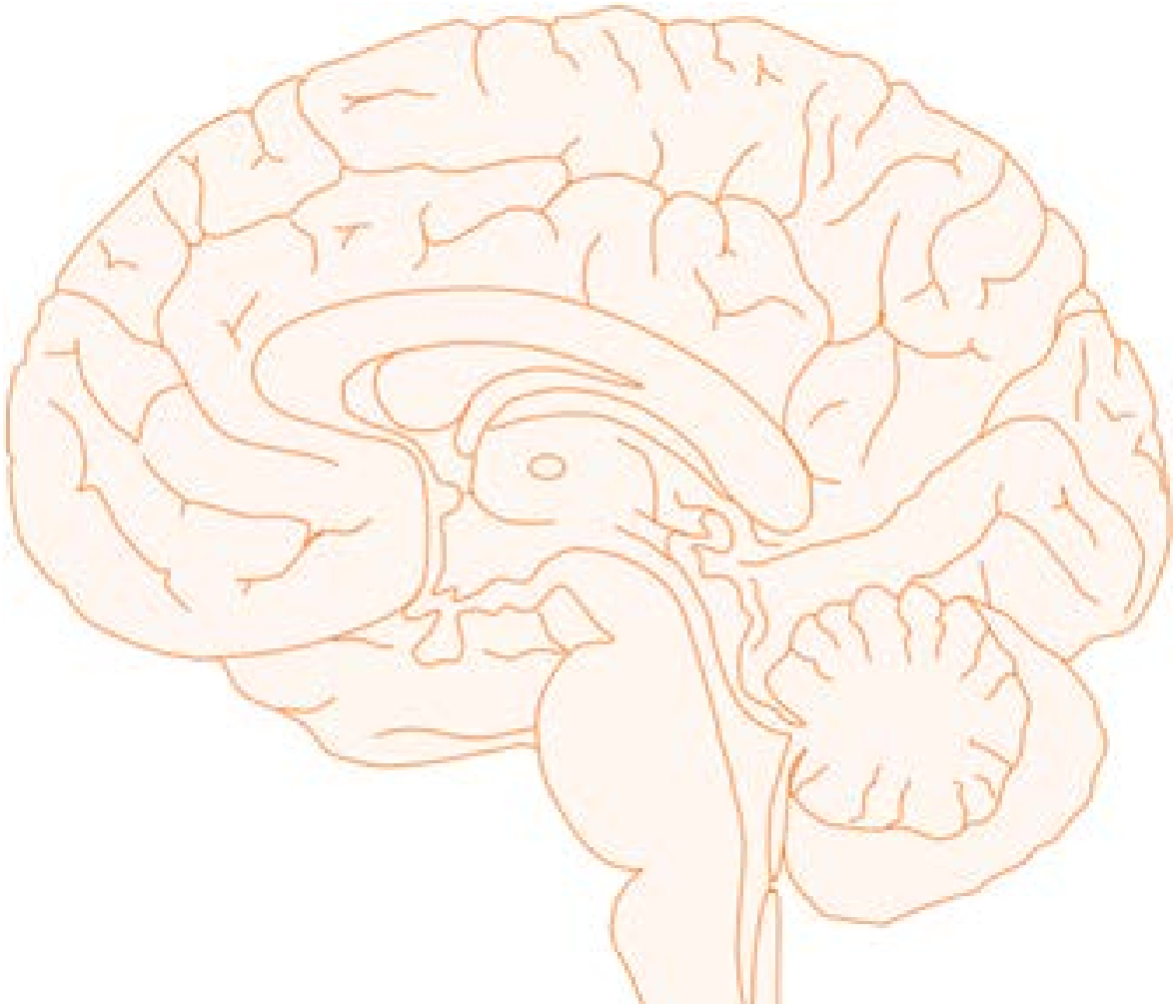
The following corticosteroids are formulated as topical ointments. Rank their potency from highest to lowest starting with the highest on top.

(**ALL** options must be used.)

Unordered Options	Ordered Response
	
	
	
	

Hot Spot Question Format

Which area is predominantly responsible for coordination of movement using skeletal muscles? (Place the cursor on the area to select, then click the left mouse button. To change your answer, move the cursor to another area and click.)



PCOA Practice Test

To help familiarize students with the types of questions and the format of the PCOA, as well as the FastTest WebLock software, NABP offers a 50-item PCOA Practice Test at no charge. Students who have registered for the PCOA will receive a practice test code and instructions for downloading FastTest WebLock in an email (to the address provided by the student at registration) approximately two weeks before the PCOA administration. The practice test may be taken only once.

Students who do not receive the email with the practice test code should be directed to check their spam filters. If no email has been received, please email the student's name and email address to NABP at PCOA@nabp.pharmacy. A new practice code will be sent to the student. A spreadsheet will be sent to the school contact containing all students' practice codes upon request. **Please note that the PCOA email address is for use by schools/colleges only.**

Responses will not be sent to students who request information through this email address.

Accessing and Understanding PCOA Scores

Accessing Score Reports

Individual student and school score reports are made available only to the school/college of pharmacy within two to three weeks after the assessment administration. Both student and school/college score reports may be accessed by the school via NABP e-Profile Connect. A roster of participating students and their respective scores will also be available. NABP will also provide a summary report to ACPE that will contain mean overall and domain-level scores for each participating school/college of pharmacy. Schools/colleges of pharmacy may use individual scores, overall and domain-level scores, percentile ranks, scaled and national scores, and "normed" scores provided by NABP for analysis, research, education, and other lawful purposes.

The school/college of pharmacy is responsible for the distribution of individual reports to the students. NABP will maintain the data collected through the administration of the PCOA for Association use and will not disclose any identifiable data except as stated in this guide, as required by law, or as permitted by the student.

Individual (Student) Score Reports

Student score reports are produced for each participating student and include the student's name, program year, sponsoring institution, test window of administration, and scores. Scaled scores and corresponding percentile rank scores are produced as an overall measure of proficiency as well as proficiency measures for each of the four major content areas. Scaled scores range from a minimum of 0 to a maximum of 700.

In addition to overall and domain-level scores and percentile ranks, percent-correct scores (and the respective number of questions per subtopic) are produced at the subtopic level. These scores are reported only as a general indicator of subtopic performance. Because the level of item difficulty and the number of items vary across subtopics, strict score comparisons should not be made across subtopics, nor should subtopic scores be used to make inferences about specific performance outcomes.

A sample individual report is included in Appendix C of this guide.

Roster Reports

The roster report is a Microsoft Excel file that contains score results for each of a school's students who tested in a given testing window. The roster contains the following information: student name, school code, program year, time taken to complete the exam, overall and domain-level scaled score (SS), scaled score standard error of measurement (error), and percentile rank (%tile). The roster also contains percent-correct scores for each subtopic.

School/College of Pharmacy Reports

School/college-level reports include summary information at the cohort level. Mean scaled scores and their corresponding percentile rank scores (based on the norm reference group) are reported at the overall- and four domain-levels. Subtopic mean percent-correct scores and respective number of questions are also reported at the cohort level.

A sample school report is included in Appendix D of this guide.

Understanding PCOA Results

PCOA score results provide measures of foundational knowledge in the didactic PharmD curriculum. Student-level score reports provide personalized, comparative information for participating students. School/college score reports provide aggregated results at the institutional level. The PCOA is designed to yield data that can be used to compare performance within a student cohort and across cohorts, such as to make dual pathway comparisons or comparisons to peer programs. PCOA results can be used to document change in student performance after an intervention and can serve as an independent measure for student portfolios.

Comparisons in outcomes between students, schools, and across time should only be made based on scaled scores. Percent-correct scores should not be used in any score comparisons because these scores are not equated, meaning that they do not take into account differences in item difficulty across test forms. NABP makes full effort to create PCOA test forms comparable in difficulty overall and at the domain level, but because each test form is unique, there may still be some variation. The scaled score is adjusted for any difference in difficulty across forms and therefore "levels the field" so that scores can be compared across different test forms without any confounds. Because of the limited utility of percent-correct scores, they are not reported for the overall exam or the four primary content domains.

Currently, subtopic scores are not placed on a common scaled score metric. To provide schools and students with some general indication of performance at the subtopic level, subtopic percent-correct scores are reported. However, these percent-correct scores should be interpreted with caution.

Information regarding the norm reference group is included with PCOA school/college of pharmacy reports.

Question and Exam Development

Questions (items) for the PCOA are written, reviewed, and approved by large, diverse committees of subject matter experts (SMEs) that serve as faculty at accredited US schools/colleges of pharmacy. Prior to being accepted as an item writer, SMEs are selected based upon academic and professional credentials. Committees of SMEs are routinely evaluated for representativeness and qualifications regarding geographic location, school/college of pharmacy affiliation, academic specialization and training, and demographics such as gender and ethnicity. Prior to writing items, SMEs receive thorough training on item development as outlined in professional guidelines for test development.

Committee item reviewers are experienced item writers whose role is to review and edit items developed for the PCOA. In accordance with professional standards, there is intentional, minimal overlap between item writers and item reviewers. This policy serves to protect tests from unintended bias.

PCOA forms are assembled to meet numerous pre-specified psychometric and statistical targets. These include, but are not limited to, item count, form-level difficulty, form-level reliability, and test information and test characteristic curves. Each test form aligns to the PCOA blueprint and therefore meets all content requirements.

Technical aspects of the PCOA are aligned with standards for professional test development. Prior to being selected to appear on an operational exam form, all questions are subjected to review by a committee of SMEs for the purpose of screening for enemy items (unintended cluing between items and/or content overlap) and to verify the item keys (answers). Forms are subject to various reviews prior to being approved for administration: psychometric review, editorial review, SME review, and overall committee review.

Validity Framework

The usefulness and interpretation of outcome measures (scores) are embedded in the assessment's psychometric framework, which includes test design, item development, form assembly, data analyses, scoring, and reporting. An integral component of the PCOA's content validity argument is the triangulation between outcomes from the content (curriculum) survey, the PCOA blueprint's domains and weights, and the adherence to those weights in the assembly of operational test forms. All questions are written and reviewed by a wide range of SMEs who are faculty at accredited US schools/colleges of pharmacy, and all exam forms are reviewed and approved by committees of SMEs prior to being administered. Thus, the PCOA is tightly linked to the content and culture of pharmacy education.

NABP Analyses

At the conclusion of each test window, NABP routinely performs a key validation, which includes an option/distractor analysis of every operational item, computation of item difficulty and discrimination indices, fit analyses, computation of item- and form-level reliability indices, a time analysis, and data forensics. Data forensics are used to review response data for inconsistent or unusual responses, over-endorsement of an option, unusual response times, and/or significant difference in performance on operational versus pretest items. NABP archives all assessment data in the event that a test record may need to be retrieved or rescored.

In addition to analyses on operational items, NABP also performs a comprehensive item analysis on all pretest items. Pretest items are non-scored items that are included in the examination form for the purpose of evaluating measures of item performance. Pretest status is not detectable by the examinee. In other words, an examinee cannot differentiate between which items will contribute to their score and those that will not. Items that meet or exceed certain psychometric and statistical targets are promoted to operational status and become available for inclusion on future operational test forms. Items that fail to meet such targets are either sent for revision or are deleted. All revised items (if selected) are pretested on a future PCOA form.

Appendices

Appendix A: Glossary of Important Terms for the PCOA Scores

Scaled Scores: A scaled score is the result of applying a mathematical transformation to a raw (eg, number correct) score. Placing scores on an established scale removes extraneous effects due to differences in exam form difficulty and thus allows end users to easily interpret scores from different test forms and/or different administrations. PCOA scaled scores range from 0 to 700, inclusively, and can be compared across administrations as well as between major content areas. For example, a student scoring 200 on Pharmaceutical Sciences and 250 on Basic Biomedical Sciences demonstrates greater proficiency in Basic Biomedical Sciences than Pharmaceutical Sciences.

Scaled Score Standard Error of Measurement: Standard error of measurement (SEM) for overall and domain-level scaled scores (SS) can assist with meaningful score interpretation. SEM is a measure that can be used to establish confidence bands around an examinee's scaled score. A confidence band is an interval that is expected to contain the examinee's true ability score with a certain degree of confidence. Estimates for confidence bands can be established by calculating SS ± 2×SEM (95% confidence) and SS ± 1xSEM (68% confidence). In these examples, one may infer (with 95% or 68% confidence, respectively) that a student's true ability score is located within the respective score ranges. SEM is especially useful when evaluating the magnitude or significance of score differences. When comparing two test scores, the presence or absence of overlap between the confidence bands should be evaluated. If the confidence bands for two test scores do not overlap, there is evidence for a meaningful difference in test scores (ie, the test score difference is not primarily attributable to measurement error). Measurement error is not constant across the test score range; very high and very low scores will have more measurement error (and hence higher SEM) than scores near the middle of the score range.

% Correct Scores: The percent-correct score indicates the percentage of items answered correctly. It is not adjusted for differences in item difficulty across forms and, as such, should be interpreted with caution. NABP reports percent-correct scores for the subtopic section of both the individual (student) and school/college reports.

Percentile Rank Scores: Percentile rank scores indicate a relative rank of proficiency with respect to a well-defined, representative reference group. For example, if a first-year student's Percentile for Program Year score is 68, then this implies that the student performed equally or better than 68% of all other first-year students in the norm reference group.

PCOA Form Assembly: The PCOA is assembled to meet very specific content and psychometric targets. Content targets include the number of items per main content domain and subdomain. Item counts align with the PCOA blueprint.

Prior to scoring, a **key validation** is performed. All operational data (scored items) are analyzed for performance and model fit. If an item is flagged for aberrant performance, it is sent to a SME for review and key verification. All exam data are screened for anomalous records, and when appropriate, schools are notified when anomalies are detected. Data are also subjected to extensive data forensic analyses.

Appendix B: Important Dates for the 2019 PCOA

First Testing Window:	January 14, 2019 – February 15, 2019
Registration Closes for All Schools/Colleges:	October 16, 2018
Student Registration Closes:	November 15, 2018
Student Rosters Completed by:	November 30, 2018
ADA Requests Submitted by School to NABP by:	November 30, 2018

Second Testing Window:	April 8, 2019 – May 17, 2019
Registration Closes for All Schools/Colleges:	January 8, 2019
Student Registration Closes:	February 7, 2019
Student Rosters Completed by:	February 22, 2019
ADA Requests Submitted by School to NABP by:	February 22, 2019

Third Testing Window:	June 17, 2019 – June 28, 2019
Registration Closes for All Schools/Colleges:	March 19, 2019
Student Registration Closes:	April 18, 2019
Student Rosters Completed by:	May 3, 2019
ADA Requests Submitted by School to NABP by:	May 3, 2019

Fourth Testing Window:	August 19, 2019 – September 13, 2019
Registration Closes for All Schools/Colleges:	May 21, 2019
Student Registration Closes:	June 20, 2019
Student Rosters Completed by:	July 5, 2019
ADA Requests Submitted by School to NABP by:	July 5, 2019

Fifth Testing Window:	November 11, 2019 – December 13, 2019
Registration Closes for All Schools/Colleges:	August 13, 2019
Student Registration Closes:	September 12, 2019
Student Rosters Completed by:	September 27, 2019
ADA Requests Submitted by School to NABP by:	September 27, 2019

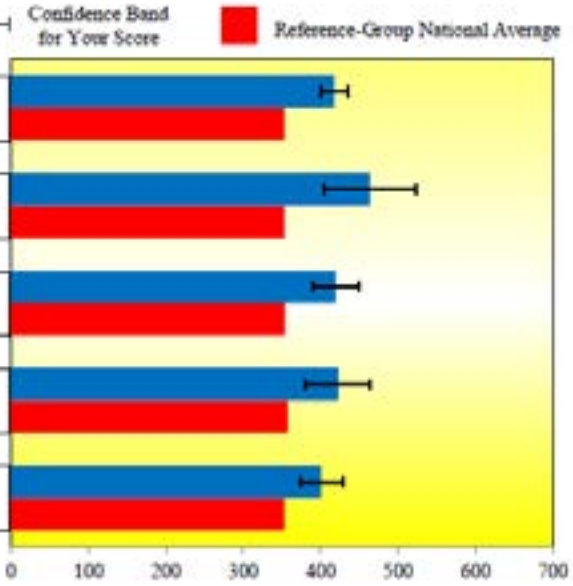
Appendix C: Student Score Report Sample

Pharmacy Curriculum Outcomes Assessment® (PCOA®) Individual Score Report

[STUDENT NAME]
[School]

Program Year
Test Window:

Your Scaled Score	Percentile Rank for Program Year	
418	89	Total Score
464	94	Basic Biomedical Sciences
420	87	Pharmaceutical Sciences
423	85	Social/Behavioral /Administrative Sciences
401	80	Clinical Sciences



Your PCOA® scaled scores for the overall examination and each of the four main content areas are included in the figure and table above. Examination scaled scores range from 0 to 700. The score report includes confidence bands, which indicate the degree of measurement precision in each of your test scores. When a confidence band overlaps two test scores, then by comparison, the performance in those areas should be considered similar.

Also included in the report are average scores for a large, diverse, national group of students who have taken the PCOA (reference group). If you are designated as a student in their first, second, or third program year, your reference group is the national group of students who took the PCOA in the same program year as you. If you are a fourth-year student, your scores will be referenced against scores from the national group of third-year students. Third-year students test at or near the end of the didactic curriculum. The number of students testing after completion of the didactic portion of the curriculum is not large enough to create an independent reference group. Your scores and associated confidence bands can be used to gauge your performance relative to the reference group. If there is no overlap between the confidence band for one of your scores and its corresponding reference-group national average, then you may conclude that you performed differently than your peers. However, if the reference group national average falls largely within your score's confidence band, then your performance should be considered similar to the reference group.

The percentile ranks for your overall score and content area scores are also included in the score report above. Percentile ranks are reported in relation to the reference group. For example, a percentile rank of 68 indicates that you scored as well as or better than 68% of your national peer group.

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Percent-correct scores are reported below for each subtopic along with the number of items in each subtopic. These scores are reported only as a general indicator of subtopic performance. Because the level of item difficulty and the number of items vary across subtopics, strict score comparisons should not be made across subtopics, nor should subtopic scores be used to make inferences about specific performance outcomes.

Sub Topics	# of Items	% Correct
Basic Biomedical Sciences		
Physiology	6	44
Biochemistry	8	75
Microbiology Related to Human Disease	2	60
Immunology	4	25
Pharmaceutical Sciences		
Medicinal Chemistry	15	42
Pharmacology and Toxicology	17	33
Pharmacognosy and Dietary Supplements	2	100
Pharmaceutics/Biopharmaceutics	12	54
Pharmacokinetics	8	20
Pharmacogenomics and Genetics	6	0
Sterile and Nonsterile Compounding	6	43
Social/Behavioral/Administrative Sciences		
Health Care Delivery Systems and Public Health	6	71
Population-Based Care and Pharmacoepidemiology	3	67
Economic and Humanistic Outcomes of Health Care Delivery	2	33
Pharmacy Practice Management	6	0
Pharmacy Law and Regulatory Affairs	5	80
Biostatistics and Research Design	3	80
Ethical Decision Making	3	50
Professional Communication	7	67
Social and Behavioral Aspects of Pharmacy Practice	3	100
Medication Dispensing and Distribution Systems	6	71
Clinical Sciences		
Evidence-based Practice	10	71
Clinical Pathophysiology	8	67
Clinical Pharmacokinetics	5	58
Clinical Pharmacogenomics	2	67
Disease Prevention and Population Health	4	100
Patient Assessment	9	71
Clinical Pharmacology and Therapeutic Decision Making	32	50

Appendix D: School/College Score Report Sample

Pharmacy Curriculum Outcomes Assessment® (PCOA®) School/College of Pharmacy Report

2017 Window 2 (April/May)

School Name: Sample University

The following tables and graphs summarize your students' performance on the PCOA®. To date in 2017, a total of 16,709 students have taken the PCOA, with 1,624 students reporting as first year, 1,933 students as second year, 12,964 students as third year and 188 students as fourth year.

The School/College Score Means section on Page 2 includes your school's mean scaled scores for the total examination as well as the mean scaled scores for each of the four major content areas. The score report charts include confidence intervals, which indicate the degree of sampling error in each of your mean test scores. When a confidence interval overlaps two test score means, then by comparison, performance in those areas should be considered similar.

Scaled scores take into account the difficulty of the items in the major content areas. These scores range from 0 to 700 and can be compared across administrations. Scaled scores can also be compared between the major content areas, such that a student scoring 200 on Pharmaceutical Sciences and 250 on Basic Sciences demonstrated greater proficiency in Basic Biomedical Sciences than Pharmaceutical Sciences.

Also included in the report (on Page 2) are mean scaled scores for all students in a normed reference group. The normed reference group consists of a large, national, diverse group of students from United States colleges/schools of pharmacy. Based on data from 2016 through 2017, the norm group consists of approximately 18,070 students that collectively generalize to the population of pharmacy students. The use of reference groups in score reporting permits meaningful comparisons between the performances of current examinees to the performance of a national representative group.

Your school's mean scores and associated confidence intervals can be used to gauge your school's performance relative to national performance. If there is very little or no overlap between your school's confidence interval and the corresponding reference group mean, then you may conclude that your school performed differently in that area than the normed reference group. However, if the normed reference group mean falls largely within your school's confidence interval, then your school's performance in that area should be considered similar to the national average.

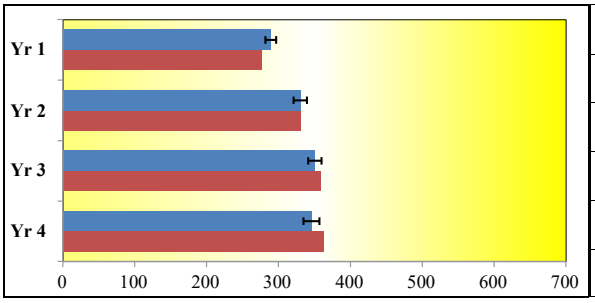
The percentile ranks of your school's mean scaled scores (overall and at the major domain level) in the normed reference group are reported on Page 2. Individual percentile ranks (supplied in the student report) provide performance information in relation to other students within the normed reference group. The percentile rank for your school's average scaled score indicates the standing of your school's average student in the normed reference group. For example, if your school's percentile rank for third-year students is 60, this implies that your average third-year student performed equally or better than 60% of all other third-year students in the normed reference group.

The School/College Subtopic Mean Percent Correct Scores section on Page 3 reports your students' performance (broken out by program year) at the subtopic level. These scores are reported only as a general indicator of subtopic performance. Because the level of item difficulty and the number of items vary across subtopics, strict score comparisons should not be made using subtopic scores, nor should subtopic scores be used to make inferences about specific performance outcomes.

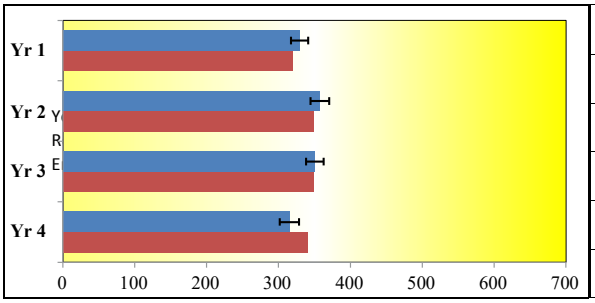
School/College Score Means

Your School | Reference Group | Confidence Interval

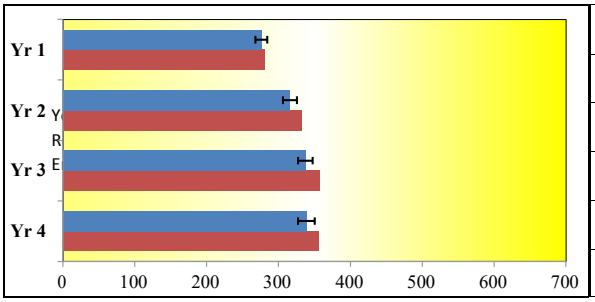
Year 1 N:	Year 2 N:	Year 3 N:	Year 4 N:
15	15	15	15



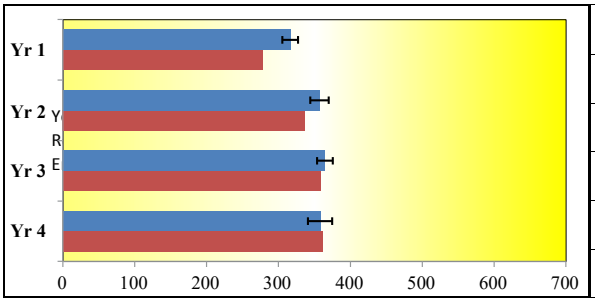
Total Score			
P Year	Your School	Reference Grp	Percentile Rank
Yr 1	289	277	50
Yr 2	330	331	50
Yr 3	351	358	50
Yr 4	346	362	50



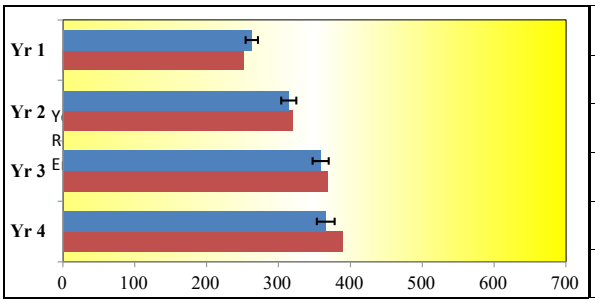
Area 1: Basic Biomedical Sciences			
P Year	Your School	Reference Grp	Percentile Rank
Yr 1	329	320	50
Yr 2	358	349	50
Yr 3	351	348	50
Yr 4	315	340	50



Area 2: Pharmaceutical Sciences			
P Year	Your School	Reference Grp	Percentile Rank
Yr 1	276	281	50
Yr 2	316	332	50
Yr 3	337	357	50
Yr 4	339	356	50



Area 3: Social/Behavioral/Administrative Sciences			
P Year	Your School	Reference Grp	Percentile Rank
Yr 1	316	278	50
Yr 2	357	337	50
Yr 3	365	358	50
Yr 4	358	361	50



Area 4: Clinical Sciences			
P Year	Your School	Reference Grp	Percentile Rank
Yr 1	263	252	50
Yr 2	314	320	50
Yr 3	359	368	50
Yr 4	366	389	50

School/College Subtopic Mean Percent Correct Scores

Sub Topics	# of Items	School			
		Yr 1	Yr 2	Yr 3	Yr 4
Basic Biomedical Sciences	**20**				
Physiology	6	58	58	58	58
Biochemistry	8	44	44	44	44
Microbiology Related to Human Disease	2	55	55	55	55
Immunology	4	52	52	52	52
Pharmaceutical Sciences	**66**				
Medicinal Chemistry	15	32	32	32	32
Pharmacology and Toxicology	17	56	56	56	56
Pharmacognosy and Dietary Supplements	2	58	58	58	58
Pharmaceutics/Biopharmaceutics	12	74	74	74	74
Pharmacokinetics	8	69	69	69	69
Pharmacogenomics and Genetics	6	47	47	47	47
Sterile and Nonsterile Compounding	6	31	31	31	31
Social/Behavioral/Administrative Sciences	**44**				
Health Care Delivery Systems and Public Health	6	51	51	51	51
Population-Based Care and Pharmacoepidemiology	3	67	67	67	67
Economic and Humanistic Outcomes of Health Care Delivery	2	65	65	65	65
Pharmacy Practice Management	6	63	63	63	63
Pharmacy Law and Regulatory Affairs	5	56	56	56	56
Biostatistics and Research Design	3	83	83	83	83
Ethical Decision Making	3	67	67	67	67
Professional Communication	7	68	68	68	68
Social and Behavioral Aspects of Pharmacy Practice	3	78	78	78	78
Medication Dispensing and Distribution Systems	6	92	92	92	92
Clinical Sciences	**70**				
Evidence-based Practice	10	62	62	62	62
Clinical Pathophysiology	8	61	61	61	61
Clinical Pharmacokinetics	5	80	80	80	80
Clinical Pharmacogenomics	2	58	58	58	58
Disease Prevention and Population Health	4	58	58	58	58
Patient Assessment	9	83	83	83	83
Clinical Pharmacology and Therapeutic Decision Making	32	73	73	73	73

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Pharmacy Curriculum Outcomes Assessment® (PCOA®) Registration Form

*This form must be submitted **prior** to the close of registration for each window as noted below. Late registrations will not be processed.*

School/College of Pharmacy _____

Please select a date(s) within the following five 2019 administration windows:

- January 14 – February 15 (register by October 16, 2018)
- April 8 – May 17 (register by January 8, 2019)
- June 17 – June 28 (register by March 19, 2019)
- August 19 – September 13 (register by May 21, 2019)
- November 11 – December 13 (register by August 13, 2019)

Date and Time for Your Assessment Administration
"Time" is when you would like your assessment to begin. The testing location, including the registration area, should be available one hour prior to your scheduled assessment start time.

_____ _____ (_____)
Date Time Time Zone

On-site Assessment Location(s):

_____
Building Name and Room(s) – minimum of a four-hour time slot

_____
Building Physical Street Address

School/College of Pharmacy On-site Contact

Name: _____

Title: _____

Address: _____

Address 2: _____

City, State, Zip: _____

Phone: _____ Email: _____

On-site technical representative: _____

Phone: _____

Email: _____

Estimated Number of Students Participating by Program Year:

Note: To ensure appropriate reporting of scores and assessment-related invoicing, please indicate any students nearing the end of their didactic curriculum as P3.

P1: _____ + P2: _____ + P4: _____ x $75 = $ _____

P3: _____ (No fee for first-time P3 test takers.)

Report scores to the Accreditation Council for Pharmacy Education? Yes ☐ No ☐

Will any candidates need Americans with Disabilities Act (ADA) testing accommodations?

☐ Yes ☐ No

If yes, approximately how many? _____

Note: Please refer to the *PCOA Registration and Administration Guide for Schools and Colleges of Pharmacy* for details about ADA accommodations for students. It is the responsibility of the student to submit the ADA request form to the school. Schools must complete the academic/college statement section of the ADA request forms and **completed forms (all three sections, including Individual's Statement, Practitioner's Statement and Diagnostic Results, and Academic/College Information) must be received by NABP from the school/college 45 days prior to the start of the testing window**. Failure to submit the appropriate documentation will result in unavailability of testing accommodations.

Payment Information

If applicable, NABP will invoice you after the completion of your PCOA. If you would like to send a purchase order prior to your administration, NABP will invoice against your purchase order.

☐ Invoice on-site assessment contact

☐ Please send invoice to the following:

Name: _____

Title: _____

Address: _____

Address 2: _____

City, State, Zip: _____

Email: _____

Instructions for Submitting the PCOA Registration Form

- Please download, complete, save, and send the form via email to PCOA@nabp.pharmacy.
- Attn: Nancy Rutter, FPGEC/PCOA Program Analyst

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1600 Feehanville Drive
Mount Prospect, IL 60056
847/391-4406

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