



The Canadian Society | La Société Canadienne
of Clinical Perfusion | de Perfusion Clinique

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National Certification Exam Candidate Manual



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Examination registration information

Application deadline	July 1 NO EXCEPTIONS
Registration fees *Must be an Associate member in good standing to apply for exam	Please see the Examination Application
Proof of graduation deadline For students graduating between July 1 and September 30	September 30 (in year exam is to be written)
Cancellation deadline See 4. below	September 17 (in year exam is to be written)

1. The candidate is responsible for accurate completion of the CSCP application form. The candidate must notify CSCP of any address and/or telephone number changes.
2. Applications will only be accepted for the current exam year.
3. Applications submitted to the National Office later than July 1, will **not** be processed for that year.
4. A \$50.00 administration fee (subject to change) will be charged for a cancellation request if received not less than thirty (30) days prior to the examination.
5. All requests must be sent in writing to the CSCP National Office at info@cscp.ca
6. All information can be accessed at this link on the CSCP website:
<http://www.cscp.ca/Professionals/Careers/Certifying-Exam/Exam-Documentation>

General Information

The Goal of the CSCP National Certification Exam

The CSCP has a role in educating and certifying clinical perfusionists to protect the public interest. Part of this role includes assuring the public that clinical perfusionists are competent at the time of entry to practice.

The ACE Committee

The Accreditation, Certification and Examination committee (ACE) consist of six CSCP certified members representing both pediatric and adult clinical perfusion practice from all regions across Canada.

Setting up the Examination

All exam questions are based on the 2009 National Competency Profile (see <http://www.cscp.ca/Professionals/Careers/Certifying-Exam/Exam-Documentation> for information on obtaining a copy). Prior to inclusion in the question bank, all exam questions had to be unanimously accepted by the ACE committee and reviewed in English and in French. Each year, with the help of the 2009 Blueprint document (see under blueprint document), the CSCP National Exam is computer generated and randomly selects the appropriate quantity of questions from each of the **six competency profiles**.

Pilot Test Items

Pilot test items are questions included on the CSCP National Exam for the purpose of gathering statistical information, but are NOT used in calculating candidate's scores.

Examination Information

The CSCP National Exam is held each year in conjunction with the Annual General Meeting and Scientific Sessions of the CSCP. The ACE Committee Chair will notify candidates as to whether their application for the examination has been approved by the Board of Directors and at the same time indicate the exam location.

Candidate Preparation

All exam questions are "A" type multiple choice. The multiple choice items are presented as independent items (the text provided is used to answer only one item) and case-based items (more than one question is linked to a case text). The examination will be presented and responded to in a pencil and paper format.

Writing the Examination

The CSCP National Exam is presented in one booklet. To ensure reliable results for the total score, the CSCP National Exam contains between 180 and 220 items. The allotted time for the exam is 4.5 hours. There will be no break permitted.

Schedule:

Exam candidates MUST arrive 20 minutes early with government issued I.D.

Time and date of the exam will be stated in your acceptance letter and on the CSCP website.

Types of questions:

A-Type: Multiple choices with one correct answer and three distracters. Select the MOST correct answer

eg. Which of the following effects on the heart are seen with the use of Milrinone (Primacor)?

- a. stroke volume decreases, cardiac output decreases
- b. cardiac output decreases, coronary circulation increases
- c. heart rate decreases, blood pressure increases

d. blood pressure decreases, stroke volume increases

Which of the following best describes the Bentall procedure?

- a. replacement of the aortic cusps and aortic sinus with reimplantation of the coronary arteries
- b. reimplantation of the pulmonary valve in the aortic position with an allograft in the pulmonary position
- c. replacement of the aortic valve and the Valsalva sinus
- d. replacement of the ascending aorta using a tube graft and reimplanted of the head vessels

What is the most common cause of morbidity and mortality in patients on ECLS?

- a. infection
- b. thromboembolism
- c. bleeding
- d. equipment malfunction

Results

Candidates will receive their results (pass or fail) and their performance profile by registered mail within 40 days of the examination date. Results will not be given by telephone or by e-mail. Unsuccessful candidates will also receive a letter describing the appeal process.

Cut Score Study

The CSCP will utilize a Cut Score Study to establish the minimum passing level for the CSCP National Certification Exam. In determining a passing grade, a minimum standard is applied which candidates must achieve in order to pass the examination. In the case of the CSCP National Exam, the cut score represents the standard of knowledge expected of a "minimally competent entry-level clinical perfusionist".

The procedure used to determine the passing score is generally known as the modified Angoff procedure; a criterion-referenced technique that is commonly used for certification and licensure examinations. The steps in the Angoff procedure are as follows:

1. Each member of the ACE committee will review the exam question and make their best judgement about the probability that the “minimally competent entry-level clinical perfusionist” will answer the question correctly. Therefore the members are estimating how many of the “entry-level clinical perfusionist” will correctly answer the question.
2. The estimates of each ACE member are averaged out for each exam question. These averages are used to calculate the cut score for the whole examination.

CSCP National Certification Examination Appeal Process

Consistent with other health professions the appeal process is designed to verify examination scores. It is not intended to allow a challenge or review of the content of the examination.

The ACE Committee ensures the validity of the CSCP National Examination before beginning to mark the answer sheets. The sheets are manually scored multiple times by multiple members of the Accreditation, Competency and Examination Committee, prior to the results being finalized.

All candidates challenging the CSCP National Certification Examination are entitled due process through the following appeal process approved by the CSCP Board of Directors in September 2005.

Appeals will be accepted only in relation to a request for review of a failing grade.

The candidate will have 30 days from the date of receipt of the examination results to appeal. Appeals must be addressed to the ACE Committee and received through the CSCP National Office postmarked no later than the date mentioned on the candidate’s notification letter. All examination booklets will be destroyed after this date.

The appeal application must describe the reason for the appeal in writing and must include a \$300.00 examination appeal fee payable to The Canadian Society of Clinical Perfusion. The CSCP will reimburse the appeal costs if the candidate’s appeal is successful.

On appeal the ACE Committee Chair, or their delegate, will:

- a) ensure that all questions were marked
- b) re-mark the answer sheet and confirm the marks were awarded and the final tally
- c) ensure that the candidate received the mark assigned to their answer sheet
- d) advise the candidate of a pass or fail grade

The decision of the Appeals Review is final.

Instructions for Examination

Instructions to Candidates

1. Candidates must arrive at the examination room 15 minutes before commencement of the exam. The exam room will be locked at the hour set for the examination. Late arrivals up to 30 minutes will receive instructions outside the examination room but will be restricted to writing within the remaining time. Candidates who arrive more than 30 minutes late will not be permitted to challenge the exam.
2. Candidates must present government - issued photo ID (driver's license, passport). This will be verified with the list of candidates for the examination.
3. All personal belongings (handbags, backpacks, briefcases) will be placed at the front of the room. Cell phones contained in personal belongings stored in the examination room must be turned off.
4. Eating is not permitted in the examination room.
5. Cell phones and other personal devices with storage capabilities are not permitted.
6. Candidates may use basic function calculators (devices which do not perform logarithm calculations and do not have information storage capabilities).

7. Candidates should bring 2 pencils (HB) and an eraser.
8. Candidates leaving the room to use the washroom may not take books/papers or purses etc. out of the exam room nor bring books/papers etc. back into the exam room.
9. Candidates are requested to fill in the examination evaluation at the back of the exam booklet. Candidates will be given an additional 10 minutes for this evaluation following conclusion of the examination.

Examination Instructions

1. Candidates are expected to adhere to the principles of intellectual and academic honesty during the examination.
2. Candidates must check that their name is on the exam booklet and the answer sheet. Contact information should be corrected if necessary: name, address, phone number, email address.
3. The exam contains 180-200 questions. The maximum allotted time is 4.5 hours.
4. Answers will be scored based on the **answer sheet only**. Information written in the examination booklet will NOT be considered.
5. Candidates should read each question carefully.
6. The candidate should fill in the **MOST CORRECT ANSWER** on the answer sheet. If they wish to change an answer, they may either erase or place an "X" over the incorrect answer and indicate their correct answer by filling in the appropriate circle on the answer sheet. **Only** the answer sheet is scored.

7. Candidates are reminded to periodically check to make sure their answer on the answer sheet coincides with the questions in the examination booklet.
8. **All copies of the examination answer sheet and booklet must be returned to the invigilator prior to the candidates exiting the examination room.**
9. Candidates will be contacted in 6-8 weeks with the results of the examination. Successful candidates will receive a **SUCCESSFUL (PASS)** notification. Unsuccessful candidates will receive an **UNSUCCESSFUL (FAIL)** notification. A letter describing the appeal process will be included with the **UNSUCCESSFUL** notification.

CSCP Policy and Procedures

Academic Dishonesty

1. Copying another candidate's answers.
2. Using unauthorized sources.
3. Bringing unauthorized materials into the examination room.

Procedure:

1. Should academic dishonesty be suspected, the invigilators will confidentially communicate the incident to each other.
2. The suspected candidate(s) will be allowed to complete the exam.
3. The suspected candidate(s) will be notified once the examination is complete.
4. Unauthorized materials will be confiscated.
5. The invigilators will fill out a Notification of Academic Dishonesty Form which will then be submit to the Board of Directors the day following the examination.
6. The Board of Directors will notify the candidate(s) of repercussions in writing no later than fourteen (14) days after the infraction was reported.
7. The candidate(s) may appeal this decision to the Board of Directors.

Accommodation of Special Needs

Candidates with special needs may request special accommodations and arrangements to write the examination on the scheduled exam date.

If the candidate requires accommodation for a physical, cognitive or other special need, they must complete the special accommodation application form found at the end of this document when applying for the exam.

All requests for special accommodations must be supported with written verification of the nature and extent of the candidate's special needs from a licensed professional.

In some cases, documentation from the educational institution where candidates received their education may be required.

The CSCP exam is provided in English and French

To arrange for accommodation of special needs during the exam, candidates must:

- complete and submit a special accommodations application form found at the end of this document
- include appropriate documentation supporting the request(s)
- return the completed special accommodations application form with documentation to the ACE Committee via the CSCP National Office along with their examination application form
- submit all forms by the exam application deadline, no exceptions

All special accommodation requests are subject to approval by the CSCP Board of Directors on a case by case basis.

Candidates will be notified as to the board decision by telephone or email. A formal letter will follow.

Subject to review by the CSCP Board of Directors, candidates with approved special accommodations may incur additional charges depending on the nature of the accommodation.



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Criteria taken into account by the CSCP Board of Directors when requests for accommodation are considered include:

- the needs of the candidate
- preservation of the integrity of the examination
- the ability of CSCP to provide resources

No accommodation request will be granted which jeopardizes the integrity or validity of the examination.



Nomenclature and Normal Values

Blood gases

Accepted adult ranges for blood gas interpretation			Mixed Venous		
Arterial					
pH	7.35 - 7.45		pH	7.30 - 7.40	
PCO ₂	35 - 45	mm Hg	PCO ₂	40 - 50	mm Hg
PO ₂	80 - 100	mm Hg	PO ₂	35 - 40	mm Hg
HCO ₃ ⁻	22 - 26	mmol/L plasma	HCO ₃ ⁻	22 - 26	mmol/L plasma
Base Excess	-2 to + 2		Base Excess	-2 to + 2	
SO ₂	93 - 97	%	SO ₂	70 - 75	%

"Egan's Fundamentals of Respiratory Care, 9th Ed." Wilkins, Stoller, Kacmarek 2009

Blood Chemistry

Calcium (serum)

Total 2.18 - 2.58 mmol/L

Ionized 1.05 - 1.30 mmol/L

Chloride 98 - 106 mmol/L

Cholesterol < 5.2 mmol/L

LDL < 3.37 mmol/L

HDL > 0.9 mmol/L

Creatinine Female 50 - 90 µmol/L

Male 70 - 120 µmol

Glucose fasting 3.3 - 5.8 mmol

Magnesium 0.75 - 0.95 mmol/L

Osmolarity 280 - 300 mmol/kg

Potassium 3.5 - 5.0 mmol/L

Sodium 135 - 145 mmol/L

Urea nitrogen (BUN) 2.5 - 8.0 mmol/L

Lactate 0.5 - 2.2 mmol/L

Ref: Medical Council of Canada website:

http://apps.mcc.ca/Objectives_Online/objectives.pl?lang=english&loc=values

Enzymes

ALT 3 - 36 U/L

AST 0 - 35 U/L

Troponin (TnT) < 0.01µg/L

Ref: Medical Council of Canada website:

http://apps.mcc.ca/Objectives_Online/objectives.pl?lang=english&loc=values

Coagulation Profile

International Normalized Ratio (INR) 0.9 - 1.2

Partial thromboplastin time (PTT) 28 - 38 sec

Prothrombin time (PT) 10 - 13 sec

Fibrinogen 1.8 - 4.0 g/L

Ref: Medical Council of Canada website:

http://apps.mcc.ca/Objectives_Online/objectives.pl?lang=english&loc=values

Hematology

Hemoglobin (Hb)

Female 123 - 157 g/L



Male 140 - 174 g/L

Hematocrit (HCT)

Female 0.37 - 0.46

Male 0.42 - 0.52

Red Blood Cells (RBC)

Female 4.0 - 5.2 x 10¹²/L

Male 4.4 - 5.7 x 10¹²/L

White Blood Cell Count (WBC) 4 - 10 x 10⁹/L

Platelet Count (Plt) 130 - 400 x 10⁹/L

Ref: Medical Council of Canada website:

http://apps.mcc.ca/Objectives_Online/objectives.pl?lang=english&loc=values

Hemodynamics

Systolic arterial pressure (SBP)	100 - 140 mmHg
Diastolic arterial pressure (DBP)	60 - 90 mmHg
Mean arterial pressure (MAP)	65 - 100 mmHg
Pulmonary artery systolic pressure (PAS)	15 - 30 mmHg
Pulmonary artery diastolic pressure (PAD)	4 - 12 mmHg
Mean pulmonary artery pressure (MPAP)	9 - 16 mmHg
Pulmonary capillary wedge pressure (PCWP)	2 - 12 mmHg
Central venous pressure (CVP)	0 - 8 mmHg
Systemic vascular resistance (SVR)	900 - 1400 dynes/sec/cm ⁻⁵
Pulmonary vascular resistance (PVR)	150 - 250 dynes/sec/cm ⁻⁵
Stroke volume (SV)	60 - 130 mL/beat
Heart rate (HR)	60 - 100 bpm



Cardiac output (CO) or (Q)	4 - 8 LPM
Cardiac index (CI)	2.5 - 4 L/min/m ²
O ₂ consumption (VO ₂)	200 - 300 mL/min

Physiologic Calculations and Formulas

Cardiac output	$CO = HR \times SV$
Cardiac index	$CI = CO / BSA$
Mean arterial pressure	$MAP = DBP + 1/3 (SBP - DBP)$
Systemic vascular resistance	$SVR = ((MAP - CVP) / CO) \times 80$
Pulmonary vascular resistance	$PVR = ((MPAP) - PCWP) / CO) \times 80$
O ₂ consumption (modified fick equation) (mL/min)	$VO_2 = (CaO_2 - CvO_2) \times Q \text{ (flow)}$
Stroke volume (mL)	$SV = CO / HR$
Oxygen delivery (mL/min)	$DO_2 = CaO_2 \times CO$
Arterial oxygen content (CaO ₂) (mL/dL)	$(Hgb \times 1.34 \times SaO_2) + (PaO_2 \times .003)$
Mixed venous oxygen content (CvO ₂) (mL/dL)	$(Hgb \times 1.34 \times SvO_2) + (PvO_2 \times .003)$
Cerebral perfusion pressure CPP	$CPP = MAP - \text{Intracranial pressure or } CPP = MAP - CVP$
Total blood volume for an adult female TBV	$\text{TBV} = \text{weight (kg)} \times 70 \text{ ml/kg}$
Total blood volume for an adult male TBV	$\text{TBV} = \text{weight (kg)} \times 75 \text{ ml/kg}$
Total blood volume for a child TBV	$\text{TBV} = \text{weight (kg)} \times 80 \text{ ml/kg}$
BSA	$BSA = \sqrt{(\text{height (cm)} \times \text{weight (kg)}) / 3600}$
Hct	$Hct = RBC / TBV$



CPB Hct = (Hct pt X TBV pt) / total priming volume

Predicted Hct during CPB = Pt RBC before CPB / (Pt estimated TBV + CPB prime volume + Pre-CPB IV fluid)

RBC volume required = (TBV pt + total priming volume) (Hct desired) – (TBV pt) (Hct pt)

Volume per Tubing length calculation

3/16 inch tubing 5.4 ml/ft

1/4 inch tubing 9.65 ml/ft

3/8 inch tubing 21.71 ml/ft

1/2 inch tubing 38.61 ml/ft

Ref: Brodie, **The Manual of Clinical Perfusion**, 2nd ed., 1997, Glendale Medical Gravlee, **CPB Principles and Practice**, 2nd and 3rd ed., Lippincott, Williams & Wilkins



Abbreviations and Symbols

“A”

a arterial

A alveolar

ABG arterial blood gas

ACLS advanced cardiac life support

ACT activated clotting time

ACS acute coronary syndrome

ADH antidiuretic hormone

AG anion gap

AI aortic insufficiency

AICD Automated Implantable Cardioverter Device

AIDS acquired immunodeficiency syndrome

AP anterior posterior

AR aortic regurgitation

ARDS adult respiratory distress syndrome

AS aortic stenosis

ASD atrial septal defect

ATP adenosine triphosphate

AV atrioventricular

A-V arterial venous



"B"

BCLS basic cardiac life support

BE base excess

BMI body mass index

BP blood pressure

BSA body surface area

BUN blood urea nitrogen

"C"

Ca⁺⁺ ionized calcium

CABG coronary arterial bypass graft

CaO₂ oxygen content of arterial blood

C(a-v)O₂ arterial to venous oxygen content difference

CHF congestive heart failure

CI cardiac index

Cl⁻ chloride

cm H₂O centimetres of water pressure

CNS central nervous system

CO cardiac output

CO₂ carbon dioxide



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COHb carboxyhemoglobin

COPD chronic obstructive pulmonary disease

CPAP continuous positive airway pressure

CPB cardiopulmonary bypass

CPP cerebral perfusion pressure

CPR cardiopulmonary resuscitation

CSCP Canadian Society of Clinical Perfusion

CSF cerebrospinal fluid

CT computerized tomography

CVA cerebrovascular accident

$Cv\bar{O}_2$ oxygen content of mixed venous blood

CVP central venous pressure

CXR chest x-ray

“D”

DHCA deep hypothermic circulatory arrest

DIC disseminated intravascular coagulation

DO_2 oxygen delivery

“E”

ECC extracorporeal circuit

ECG electrocardiogram

ECLS extracorporeal life support

ECMO extra corporeal membrane oxygenation

EEG electroencephalogram

EF ejection fraction

ER emergency room/department

“F”

FFP Fresh frozen plasma

FiO₂ fraction of inspired oxygen

Fr French (sizes)

“G”

g or gm gram

GI gastrointestinal

GME gaseous microemboli

GFR glomerular filtration rate

“H”

Hgb or Hb hemoglobin

HbCO carboxyhemoglobin

HbF fetal hemoglobin

Hbmet methemoglobin

HCO₃⁻ bicarbonate

Hct hematocrit



HIT heparin induced thrombocytopenia

HIV human immunodeficiency virus

HLHS hypoplastic left heart syndrome

HR heart rate

"I"

IAB intraaortic balloon

IABP intraaortic balloon pump

IBW ideal body weight

ICD Implantable cardioverter defibrillator

ICP intracranial pressure

ICU intensive care unit

INR international normalized ratio of prothrombin time

IVC inferior vena cava

"K"

kg kilogram

k⁺ potassium

"L"

L litre

LAD left anterior descending artery

LAP left atrial pressure



LA left atrium

LAFA left atrial/femoral artery (bypass)

LHB left heart bypass

LPM liters per minute

LSPV left superior pulmonary vein

LSVC left superior vena cava

LV left ventricle

LVAD left ventricular assist device

LVEDP left ventricular end - diastolic pressure

LVSV left ventricular stroke volume

LVSW left ventricular stroke work

“M”

MAC minimum alveolar concentration

MAP mean arterial pressure

Mg⁺⁺ magnesium

MV mitral valve

MI myocardial infraction

mm Hg millimetres of mercury pressure (torr)

MR mitral regurgitation

MUF modified ultrafiltration

mmol millimole



mL milliliter

mg milligram

mcg or μg microgram

“N”

Na^+ sodium

NaHCO_3 sodium bicarbonate

NO nitric oxide

NO_2 nitrogen dioxide

N_2O nitrous oxide

“O”

O_2 oxygen

OR operating room

“P”

P pressure

P50 partial pressure of oxygen at 50% HbO_2

PA pulmonary artery

P(A-a)O_2 alveolar to arterial oxygen gradient

PAC Pulmonary artery catheter

PAP pulmonary artery pressure

PAWP pulmonary artery wedge pressure



PCWP pulmonary capillary wedge pressure

PDA patent ductus arteriosus

PEEP positive end - expiratory pressure

PFO patent foramen ovale

PG prostaglandin

pH standardized hydrogen ion activity

pRBC (packed) red blood cells

PT prothrombin time

PTT partial thromboplastin time

PV pulmonary valve

PR pulmonary regurgitation

PVC premature ventricular contraction

PVR pulmonary vascular resistance

PVRI pulmonary vascular resistance index

“Q”

Qs / Qt shunted cardiac output ratio

Qt total cardiac output

“R”

RA right atrium

RAP retrograde autologous priming



RBC red blood cell

RCA right coronary artery

RDS respiratory distress syndrome

RPM revolutions per minute

RV right ventricle

RVAD right ventricular assist device

“S”

SaO₂ arterial oxygen saturation

STEMI ST elevation myocardial infarction

SvO₂ mixed venous oxygen saturation

SVC superior vena cava

SVR systemic vascular resistance

SVRI systemic vascular resistance index

“T”

T temperature

TGA transposition of the great arteries

TEG thromboelastography

TMP Transmembrane pressure

TOF tetralogy of fallot

TR tricuspid regurgitation



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cscp.ca

TV tricuspid valve

TT thrombin time

“U”

“V”

V/A veno-arterial

VAVD vacuum assisted venous drainage

VO₂ oxygen consumption per minute

Vol% concentration (percent per volume)

VSD ventricular septal defect

V/V veno-venous

“W”

WBC white blood cell

ALL EXAM CANDIDATES ARE WELCOME TO

