Candidate I.D.	Affix sticker here

ROYAL COLLEGE
OF PHYSICIANS AND SURGEONS OF CANADA
COLLÈGE ROYAL
DES MÉDECINS ET CHIRURGIENS DU CANADA

Medical Biochemistry

The following are examples of items that you would find in a short-answer question (SAQ) exam. Model answers are included for your information.

[Date]

SAMPLE

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COLLÈGE DES MÉDECINS
DU QUÉBEC

Booklet 1 of 1

https://exams.freshersnow.com/category/entrance-exam-question-papers/

Instructions – Please Read Carefully

1. The time allowed for this examination is THREE hours.

2. Please use a ballpoint or fountain pen only. Do not use a felt-tip pen. It produces a script that spreads or is too thick, and is therefore difficult or impossible to read.

3. Please write or print as legibly as possible. The examiners cannot assign marks for answers they cannot read.

4. Be as brief and direct as possible, making use of the space provided after each question.

5. Examination booklets must be returned intact to the invigilator. You may not copy and/or remove the questions in any way.

6. If a specific number of answers is requested (e.g. list FOUR), do not list more than requested as they will not be marked (i.e. if four are requested, only the first four will be marked).

7. Certain questions might contain more than one page. Please make sure that you have completed all pages of each booklet.

8. Please affix your candidate number sticker in the space provided on the COVER PAGE of each examination booklet.

NOTE:
After test administration, statistical analyses are conducted and a small number of questions may be deleted if they do not meet standards for psychometric validity. Question weighting may vary because of the importance of the question or the number of answers required. Deleted questions are not included when calculating candidates' final scores. Unanswered questions are scored as incorrect; therefore, you should answer every question.

There is a standard process for evaluating changes in medicine that occur too late in the test administration schedule to replace or modify any affected examination questions. We advise candidates to answer all questions according to their understanding of current clinical principles and practice. If it is determined that any question has been compromised by new information (newly published findings), that question will be reviewed to ensure that test-taker results are not adversely affected.

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	Marks
1. a) Describe how prostate-specific antigen (PSA) is distributed in plasma ?	2
b) List the cut-off values used clinically for PSA levels. List and briefly describe how PSA cut-off values are applied to clinical practice.	2
c) How is the free PSA to total PSA ratio used to differentiate between malignant prostate cancer and benign prostathyperplasia?	2

Model Answer

(a=2, b=2, c=2)

a) 89% is bound to a2-macroglobulin and a1-antichymotrypsin. Rest of PSA is in a free form.

b) Normal < 4 ug/L ;
- between 4 and 10 ug/L (or between 2 and 10 ug/L according to centre) : to investigate benign prostate hyperplasia (BPH) etc;
> 10 ug/L is suggestive of cancer

c) While most of the PSA is protein-bound in the plasma of a healthy adult male , the protein-bound proportion is higher in the presence of prostatecancer. Therefore, the ratio of free PSA to total PSA (f/t) is decreased in the presence of a malignant prostate tumour and normal in the presence of benign conditions such as prostat hypertrophy. (f/t > 25 ug/L in benign conditions)

	Marks
2. Hypercalcemia is a frequent clinical finding	
a) In an apparently healthy, asymptomatic individual, what would be the MOST likely cause of hypercalcemia?	1
b) In the following diseases, briefly describe the pathophysiologic mechanism(s) involved in the development of hypercalcemia: i) oat cell tumour of the lung ii) sarcoidosis iii) multiple myeloma	6

Model Answer

(a:1, b:6, total of 7 points)

a) Primary hyperparathyroidism
b)
- i) secretion of a "PTH-like" factor
- ii) endogenous extra-renal production of 1,25 dihydroxyvitamin D (1 hydroxylase activity in the granulomatous tissue)
- iii) local bone destruction, local production of cytokines

a) L'hyperparathyroïde primaire
b)
i) Sécrétion d'un facteur relié à la PTH
ii) Production endogène extra rénale de 1,25 dihydroxyvitamine D (activité 1-hydroxylase dans le tissue granulomateux)
iii) Destruction osseuse locale, production locale de cytokines

	Marks
3. a) Briefly explain the principle of immunoturbidimetric assay of a protein.	2
b) Can a monoclonal antibody be used in immunoturbidimetry? Justify your answer.	2
c) Briefly explain the hook effect in immunoturbidimetry.	2

Model Answer

(2 points each) (Total 6 points)
a) A polyclonal antibody is added with a buffer usually containing polyethylene glycol as precipitant. The antigen forms complexes with the antibody which absorb or scatter the light of the spectrophotometer. The angle of measurement relative to the incident light is 0 degrees.
b) In principle, no (unless the protein contains a repeated antigenic epitope), since it will at best form small complexes between one or two antigens and a single antibody molecule. There will be no formation of the large multimolecular complexes that cause the measured signal. In practice, the signal emitted by a monoclonal antibody is too

weak to be of any use.
c) A large excess of antigen can consume the antibody and limit formation of large immune complexes. Eventually, only free antigens and antigens bound to a single antibody will be found. Past a certain concentration threshold, the increase in antigen causes dissolution of the complexes and a decrease in the observed signal.

	Marks
4. List **FOUR** biochemical tests whose results could be potentially affected by EACH of the following factors:	
a) exercise	**2**
b) recent food ingestion	**2**
c) pregnancy	**2**

Model Answer

2 marks each, total 6 marks

a) CK, lactate, LD, AST, pH, urea...
b) ALT, ALP, TG, LDL-C, glucose, uric acid...
c) ALP, cholesterol, glucose, CK, albumin, Hb/Ht, creatinine...

	Marks
5. a) Briefly describe the recommended method to determine the reference interval for an analyte.	4
b) Give **ONE** example of an analyte for which a personal or subject-based reference interval may be more appropriate than a population-based reference interval. Explain your answer.	2

Model Answer

a:4 marks, b:2 marks, total 6 marks

a) 2 marks for preanalytical:

- Define selection criteria for reference population
- Partitioning criteria for sub-group analysis if applicable (age, gender, criteria for health/disease, pregnancy, obesity, etc).
- Select random sample (or non-random representative sample) of individuals (minimum 40; recommended 120 for each group).
- Standardize preanalytical conditions (collection time, method, etc)

2 marks for analytical / post-analytical:

- standardize analytical conditions, analyze samples
- Statistical analysis: test need for partitioning, inspect distribution, remove outliers

Non-parametric - select central 95% interval

Parametric - test for Gaussian distribution, transform data if required, 2 SD limits

b) Creatinine, serum proteins, enzymes or other analytes not under tight hormonal control.

Comparison to population reference interval lacks sensitivity for changes in biochemical status if intraindividual variation is less than 60% of interindividual variation. For such analytes, previous values in the individual make the best comparison.

End	Before you leave the room, please return your examination booklet(s) to the invigilator.