



Australian and New Zealand College of Veterinary Scientists

Fellowship Examination

June 2015

Veterinary Emergency Medicine and Critical Care

Paper 1

Perusal time: **Twenty (20)** minutes

Time allowed: **Four (4)** hours after perusal

Section A: Answer **ONE (1)** question

Section B: Answer **ALL FIVE (5)** questions

Section C: Answer **ALL TEN (10)** questions

Section A: Answer **ONE** essay-style question worth 60 markstotal 60 marks

Section B: Answer **FIVE** short-answer questions each worth 24 marks.....total 120 marks

Section C: Answer **TEN** short-answer questions each worth 6 markstotal 60 marks

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Paper 1: Veterinary Emergency Medicine and Critical Care

Section A: Answer ONE (1) essay-style question

1. Tick paralysis caused by *Ixodes holocyclus* is a condition that commonly leads to respiratory compromise.

Answer **all** parts of this question:

- a) Discuss in detail all of the pathophysiological processes that lead to hypoxaemia in a patient with tick paralysis. Include in your answer how to determine which of these processes are contributing to hypoxaemia in a patient with tick paralysis. Write in full any equations that you would use. (25 marks)
- b) ARDS (acute respiratory distress syndrome) may occur secondary to tick paralysis. Discuss and describe the diagnosis and pathophysiology of ARDS in a tick paralysis patient. (25 marks)
- c) Compare and contrast the use of the following **two (2)** tidal volume settings in a tick paralysis patient that has developed severe pneumonia: (10 marks)
 - i. 6 mL/kg
 - ii. 15 mL/kg

Section B starts over page

Section B: Answer ALL five (5) short-answer questions

1. Answer **all** parts of this question:

- a) Define central venous pressure (CVP). List the parameters that are estimated using CVP. (3 marks)
- b) Define venous return. Write an equation that shows the relationship between venous return, CVP and right atrial pressure. (2 marks)
- c) List the cardiovascular factors that have an effect on CVP (central venous pressure) **and** describe their relationship to CVP. (10 marks)
- d) Draw the pressure-volume loop for the left ventricle. Label the points where the mitral and aortic valves open and close. Indicate what represents the stroke volume on your curve. (6 marks)
- e) In a fluid-filled hemodynamic monitoring system for direct arterial blood pressure monitoring, abnormal waveforms may occur due to overdamping and under-damping. Define damping and list **three (3)** causes of over-damping in a fluid-filled hemodynamic monitoring system. (3 marks)

2. Answer **both** parts of this question:

- a) Describe how mast cell degranulation leads to the clinical signs of anaphylaxis. Include in your answer any key differences between dogs and cats. (14 marks)
- b) Corticosteroids and antihistamines are commonly administered to treat anaphylaxis. If a dog presents with signs of severe anaphylaxis after a bee sting describe the decision making process on whether or not to administer corticosteroids and/or antihistamines to the dog. Include in your answer recommendations for dosing. (10 marks)

Continued over page

3. Answer **all** parts of this question:

- a) Describe the immunological mechanisms of red cell destruction that occur in primary immune mediated haemolytic anaemia (IMHA). Include in your answer the role of complement proteins and mechanisms whereby intravascular and extravascular haemolysis occur. *(14 marks)*
- b) For **each** of the following drugs, outline the mode of action when used for treatment of IMHA: *(4 marks)*
 - i. azathioprine
 - ii. human immunoglobulin.
- c) State, with brief justification, why you would or would not use **each** of the drugs in 3 b) to treat a patient with IMHA. *(6 marks)*

4. Answer **both** parts of this question:

- a) Discuss in detail the **three (3)** mechanisms by which fluid and solutes are transported across the peritoneal membrane. In your answer explain how these mechanisms are used in the process of peritoneal dialysis. *(14 marks)*
- b) Explain the pathophysiology of dialysis disequilibrium. How can this condition be prevented in a patient receiving haemodialysis? *(10 marks)*

5. Answer **all** parts of this question:

- a) Discuss in detail the aetiology and pathophysiology of coagulopathy of trauma. *(20 marks)*
- b) Describe the mechanism of action of tranexamic acid. *(2 marks)*
- c) Briefly state the findings of the CRASH 2 trial as published in the Lancet 2010. *(2 marks)*

Section C starts over page

Section C: Answer ALL ten (10) short-answer questions

1. Answer **both** parts of this question:

a) Define the following terms as they pertain to microbiology results: *(3 marks)*

i. breakpoint

ii. intermediate susceptibility

b) Describe the circumstances in which it would be clinically appropriate to prescribe an antibiotic for use against an intermediately susceptible organism. *(3 marks)*

2. Answer **both** parts of this question:

a) Name **two (2)** factors that are considered as risk factors for gastrointestinal surgery breakdown. *(1 mark)*

b) Define the time frame in the post-operative period where dehiscence of the anastomosis of enterotomy sites is considered most likely **and** explain why this time frame is associated with a greater risk of breakdown. *(5 marks)*

3. Explain how low serum calcium levels lead to muscle tetany. *(6 marks)*

4. Answer **both** parts of this question:

a) Describe how peripheral blood carbon dioxide leads to changes in cerebral blood flow. *(3 marks)*

b) Draw a labelled graph that describes the relationship between arterial carbon dioxide and cerebral blood flow. *(3 marks)*

Continued over page

5. Briefly describe the pathophysiological mechanisms that lead to reduced cardiac output after severe burn injury. (6 marks)
6. Answer **both** parts of this question:
- a) Intraocular pressure is the result of a balance between **three (3)** physiological factors. Name these **three (3)** factors. (2 marks)
 - b) Name **two (2)** drugs that may be used to reduce intraocular pressure. For **each** drug state the mechanism of action as it pertains to glaucoma **and** state which physiological factor is altered in order to reduce intraocular pressure. (4 marks)
7. Renal tubular acidosis is a differential diagnosis for a metabolic acidosis with normal anion gap.
- Answer **both** parts of this question:
- a) Describe the physiological mechanisms that lead to renal tubular acidosis. (4 marks)
 - b) Explain how proximal renal tubular acidosis may be differentiated from distal renal tubular acidosis. (2 marks)
8. Fresh frozen plasma (FFP) is commonly used in critically ill patients with coagulopathies. Defend an argument against the use of FFP in a patient with disseminated intravascular coagulopathy (DIC). (6 marks)
9. Explain how gastric outflow obstruction can lead to metabolic alkalosis despite significant hypovolaemia. (6 marks)
10. In 2013, the American Animal Hospital Association changed their guidelines for fluid therapy for anaesthetised patients. Discuss why the fluid therapy rate of 10 mL/kg/hr ('surgical rates') is no longer recommended for all patients under anaesthesia. (6 marks)

End of paper



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Paper 2

Perusal time: **Twenty (20)** minutes

Time allowed: **Four (4)** hours after perusal

Answer **ALL FIVE (5)** questions

All five questions are of equal value.

Question 2 a) requires completion of the table located in the answer booklet you have been provided.

Answer **FIVE** questions each worth 48 markstotal 240 marks

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Paper 2: Veterinary Emergency Medicine and Critical Care

Answer all five (5) questions

1. Answer **all** parts of this question:

- a) A normovolaemic canine patient has a heart rate of 220 bpm. Explain what effect this heart rate has on the patient's cardiac output. *(4 marks)*
- b) Describe the Singh Vaughan Williams classification scheme for anti-arrhythmic drugs. Give an example of **one (1)** drug from **each** class. For **each** drug describe in detail the mechanisms by which it can alter heart rhythm. *(12 marks)*
- c) A patient presents with lethargy, weakness, pale mucous membranes, weak femoral pulses and pulsus paradoxus:
 - i. Outline the pathophysiology behind the phenomenon of pulsus paradoxus. *(8 marks)*
 - ii. A colleague wishes to treat this patient's shock with intravenous fluids (20 mL/kg boluses of lactated Ringer's solution (LRS) over 15 minutes until pulse quality improves). Describe how you expect the patient to respond to this treatment **and** why? *(8 marks)*
 - iii. Describe the benefits and limitations of pericardial fluid analysis. *(5 marks)*
- d) Define coronary perfusion pressure. How is it determined? Briefly explain how the administration of intravenous fluids during cardiopulmonary resuscitation (CPR) may be detrimental to the patient. *(5 marks)*

Question 1 continued over page

e) Provide formulas to show how the following are calculated: (6 marks)

- i. oxygen delivery
- ii. oxygen consumption
- iii. oxygen extraction %
- iv. systemic vascular resistance
- v. pulmonary vascular resistance
- vi. pulse pressure.

2. Answer **all** parts of this question: (answer 2 a, in the answer booklet provided)

- a) Complete the table provided in the answer booklet with the correct information in regards to localisation of the visual pathway lesions based on vision and pupillary light reflexes. (10 marks)

Question 2 continued over page

- b) A 25 kg Australian cattle dog presents collapsed 8 hours after having been found with a chewed up packet of amlodipine tablets. The dose ingested is calculated to be a toxic dose. The dog is obtunded and hypotensive.

Answer **all** of the following questions in regards to this patient:

- i. List **four (4)** medical therapies for amlodipine toxicity that can be used in this patient. *(2 marks)*
- ii. For **each** of the listed therapies state the mechanism of action as it pertains to amlodipine overdose. *(12 marks)*
- iii. Based on your knowledge of the current literature outline and justify your treatment plan for this patient. *(15 marks)*
- iv. You direct your nurses to obtain a blood pressure measurement in this dog. Compare and contrast oscillometry and invasive blood pressure measurement using an electronic pressure transducer. Your answer will need to take into consideration the equipment setup, principles behind the operation, advantages or disadvantages of **each** technique in addition to recommendations to improve the accuracy. *(8 marks)*
- v. Continuous electrocardiogram (ECG) monitoring is being used to monitor this patient. The nurse caring for the patient signals for your attention after noting that despite undergoing your medical recommendations the dog's heart rate has been steadily falling. The dog also appears to be conscious but minimally-responsive.
What other treatment options would you consider for this patient?
(1 mark)

Continued over page

3. A four-year-old female Labrador retriever presents with collapse and vomiting. It was reported to have ingested a box of Multiguard Slug and Snail Killer containing iron EDTA as the active ingredient 24 hours prior.

Answer **all** of the following questions in regards to this patient:

- a) Describe in detail the mechanism of iron toxicity. (12 marks)
- b) Describe the expected progression of clinical effects associated with iron toxicity (8 marks)
- c) Discuss confirmatory tests for the presence of iron toxicity and their use in clinical cases of iron toxicity in Australia. Justify your opinion in regards to testing for iron toxicity and its utility in guiding chelation therapy. (8 marks)
- d) Outline your treatment and monitoring plans for this dog. (12 marks)
- e) The red cell distribution width (RDW) is a common result on automated haematological evaluation of patients. Recently RDW has been used as a prognostic indicator in critically ill patients. Describe the RDW and give **three (3)** possible explanations as to why it may have an association with mortality. (8 marks)

4. Answer **all** parts of this question:

- a) Compare and contrast the use of adrenalin and vasopressin during CPR. (13 marks)
- b) The difference between PaCO₂ and end-tidal CO₂ (ETCO₂) has been associated with outcome in human CPR patients. What is the physiological relationship between these two CO₂ levels **and** why is their difference likely to impact upon the outcome of patients undergoing CPR? (5 marks)

Question 4 continued over page

- c) A 10-year-old dog is accidentally given 10 times the recommended dose of acepromazine and morphine. A nurse finds the dog unresponsive and apnoeic.

Answer **all** the following questions in regards to this patient:

- i. Outline your approach to cardiopulmonary cerebral resuscitation in this patient. (15 marks)
- ii. The patient returns to spontaneous circulation. Outline your approach for post-cardiac arrest care for this patient. Include in your answer explanations as to why interventions such as rapid warming and oxygen supplementation can be detrimental in post cardiac arrest care. (15 marks)

5. A 14-year-old male neutered domestic shorthair cat is referred to your hospital for evaluation. The cat has a history over recent days to weeks of decreased appetite, lethargy and weight loss.

On physical examination at the time of presentation the cat was mentally dull. He remained recumbent during examination and did not attempt to move. His physical examination was as follows:

Body weight 4.14 kg

Body count score 5/9

Temperature 36.3°C

Heart rate / pulse rate 140 beats per minute

His femoral pulses were weak

Respiratory rate 28 breaths/min

Heart and lung auscultation was normal

His oral mm were pale pink, and tacky

He had moderately increased skin turgor

His abdomen was soft and non-painful and no significant abnormalities were palpable

Peripheral lymph nodes were normal

Ears, eyes and nose were normal

Moderate dental calculus was noted

Question 5 continued over page

The cat's biochemistry profile is displayed below. Concurrently his urine specific gravity is 1.015.

Parameter	Patient value	Reference interval	Units
Glucose	30.3	3.89–6.67	mmol/L
Urea	27.5	5.36–11.78	mmol/L
Creatinine	212	80–186	µmol/L
Phosphorous	14.5	9.3–19.5	mmol/L
Calcium	2.4	2.2–2.9	mmol/L
Magnesium 2+	3.9	2.0–3.1	mEq/L
Total Protein	95	60–84	g/L
Albumin	36	22–40	g/L
Globulins	59	25–58	g/L
Sodium	151	146–158	mmol/L
Chloride	102	110–125	mmol/L
Potassium	2.3	3.4–5.2	mmol/L
TCO ₂ (Bicarb)	6	13–22	mmol/L
Anion Gap	43	9.0–21.0	
Na/K	66	28–43	
Total Bilirubin	82.1	1.71–5.13	µmol/L
Alkaline phosphatase	110	10–79	U/L
GGT	21	0–5	U/L
ALT	236	24–145	U/L
AST	67	5–42	U/L
Creatine kinase	203	14–528	U/L
Cholesterol	11.7	2–64.5	mmol/L
Triglycerides	1.23	0.28–2.1	mmol/L
Amylase	791	496–1940	U/L

With the addition of the chemistry panel it is now possible to interpret the cat's acid-base status in light of the simplified quantitative approach to acid-base analysis proposed by Hopper and Haskins.

- c) Without doing any calculations, list additional influences on acid-base balance that the simplified quantitative approach makes us consider, and how they may be involved in this case. (10 marks)
- d) Estimate this patient's effective osmolality. (1 mark)
- e) The cat is diagnosed with diabetic ketoacidosis (DKA). List the counter-regulatory hormones that are important in the pathogenesis of DKA. (2 marks)

Question 5 continued over page

- f) Given the information on the previous page derive a fluid therapy plan for the cat for the next 24 hours. (9 marks)
- g) Discuss the options for insulin administration in this patient. (8 marks)
- h) Due to prolonged anorexia, weight loss and concern for hepatic lipidosis a nutrition plan is required.
Formulate a nutrition plan for this patient. Include in your answer the route of nutrition administration and calculations for kilocalories and protein requirements. (9 marks)

End of paper