



Australian and New Zealand College of Veterinary Scientists

Fellowship Examination

June 2012

Veterinary Clinical Pathology Paper 1

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

Time allowed: **Three (3)** hours after perusal

Answer your choice of any **FIVE (5)** questions from the **six** questions **ONLY**

All six questions are of equal value

Commence the answer to each question on a new page

Answer **FIVE** questions each worth 30 marks.....total 150 marks

Paper 1: Veterinary Clinical Pathology

Answer five (5) of six questions

1. Describe the mechanisms of leukaemogenesis. State techniques that may be used to classify acute leukaemia and discuss how these techniques may be applied to the classification system of Acute Myeloid Leukaemia (AML). Describe the characteristics of the cells of one category of AML. *(30 marks)*
2. Describe modern concepts of the mechanisms of coagulation. Illustrate how genetic disorders may disrupt these mechanisms and result in a haemorrhagic diathesis. Give examples of gene lesions that may result in such disorders. *(30 marks)*
3. Using a flow chart, outline how mammalian haematopoiesis is conceptualised. Describe how disorders of haematopoiesis may result in non-neoplastic disease and give examples of such disorders. *(30 marks)*
4. Discuss the role of cytokines in the regulation of inflammation and their effect on leukocytes and acute phase reactant proteins. *(30 marks)*
5. Describe your approach to the examination of a cytological preparation from the lymph node of a dog. What criteria would you use to determine whether the node is normal or a disease process is present? Under what circumstances can recognition of lymphoma be problematic using solely cytopathology? Discuss additional techniques which can be used to recognise and further characterise neoplastic lymphocytes to provide prognostic information. *(30 marks)*
6. The diagnosis of spontaneous hypercortisolism in dogs involves manipulation of the hypothalamic-pituitary-adrenal axis. Discuss the laboratory assays that are available to make this diagnosis. Include in your answer the physiology underlying the assays and the advantages and limitations of each assay. *(30 marks)*

End of paper



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Paper 2

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

Time allowed: **Three (3)** hours after perusal

Answer **both** part A and part B

Part A: Answer your choice of any **TWO (2)** questions from the **three** questions **ONLY**
Part B: Answer your choice of any **THREE (3)** questions from the **four** questions **ONLY**

All questions are of equal value
Subsections of questions are of equal value unless stated otherwise

Answer **FIVE** questions each worth 30 markstotal 150 marks

Paper 2: Veterinary Clinical Pathology

Part A

Cases with clinical pathology data for interpretation

Answer two (2) of the three questions from Part A.

1. History: A 9-year-old female spayed Labrador-cross dog presented to a veterinarian for lethargy and inappetance of 2 days duration. She had been vomiting but there was no diarrhoea. The most recent vomitus had fresh blood in it. The owner reports there is rat bait on the property. On examination the dog appeared depressed, in good body condition and clinically dehydrated (estimated at about 5%). The temperature was 38.5°C, heart rate was mildly increased and respiratory rate was normal. There was some pain elicited on palpation of the cranial abdomen

Discuss the blood and urinalysis results including the pathophysiological mechanisms which have brought about the changes. List the diagnosis/differential diagnoses which you consider most likely. Justify your answer. Outline any further laboratory assays (if any) which could be undertaken to support your conclusions. (30 marks)

Haematology (EDTA):

Analyte	Patient	Units	Reference Range
RBC	9.1	$\times 10^{12}/L$	5.5-8.5
Haemoglobin	209	g/L	120-180
HCT	0.60	L/L	0.37-0.55
MCV	66	fL	62-77
MCH	23	pg	20-25
MCHC	347	g/L	320-360
WBC	15.9	$\times 10^9/L$	6.0-17.0
Seg Neutrophils	12.72	$\times 10^9/L$	3.0-11.5
Lymphocytes	0.80	$\times 10^9/L$	1.0-4.8
Monocytes	2.34	$\times 10^9/L$	0.2-1.4
Eosinophils	0.0	$\times 10^9/L$	0.0-0.2
Basophils	0.0	$\times 10^9/L$	0.0-0.2
Platelets	191	$\times 10^9/L$	200-500

Blood film: RBC Morphology: Normocytic and normochromic
WBC Morphology: No significant abnormalities noted.
Platelets: Normal morphology.

Coagulation profile (Citrated plasma):

Analyte	Patient	Units	Reference Range
PT	13.5	seconds	7-14
APTT	18.2	seconds	14-20
Thrombin time	5.2	seconds	4-6
Platelets	210	$\times 10^9/L$	200 -500

Case 1 continued over page

Case 1 continued.

Biochemistry (serum):

Analyte	Patient	Units	Reference Range
CK	996	IU/L	0-609
AST	84	IU/L	0-79
ALP	239	IU/L	0-185
ALT	65	IU/L	0-75
Bilirubin	4	µmol/L	0-6
Total Protein	83	g/L	52-75
Albumin	48	g/L	26-44
Globulin	35	g/L	17-39
Urea	29.3	mmol/L	2.6-10.2
Creatinine	181	µmol/L	45-135
Phosphate	2.55	mmol/L	1.0-3.0
Calcium	3.05	mmol/L	2.2-3.0
Cholesterol	10.9	mmol/L	3.0-9.0
Amylase	2009	IU/L	30-1020
Lipase	442	IU/L	13-200
Spec cPL (IDEXX)	<30	µg/L	<200
Sodium	140	mmol/L	139-153
Potassium	4.1	mmol/L	3.5-5.6
Chloride	72	mmol/L	105-121
Na:K	34		23-38

Blood gas (jugular venous sample):

Analyte	Patient	Units	Reference Range
pH	7.547		7.35-7.45
pCO ₂	43.6	mm Hg	35-38
BE	15	mmol/L	-5 -0
HCO ₃	37.4	mmol/L	15-23
TCO ₂	39.0	mmol/L	17-25
Lactate	2.35	mmol/L	0.6-2.9

Urinalysis:

Analyte	Patient
Collection Method	Free flow
Colour	Yellow
Turbidity	Clear
SG	1.048
pH	6.9
Glucose	Neg
Ketones	Neg
Bilirubin	Neg
Protein	1+
Blood	Neg
RBC (per hpf)	None seen
WBC (per hpf)	None seen
Crystals	1+ struvites
Epithelial cells	1+
Casts	None seen
Bacteria	None seen

2. History: A veterinarian is called to a dairy farm in the autumn in Waikato NZ to see two cows. Another cow in the herd had recently died. Both cows had calved in spring. The farmer has noticed “redwater” in one (Cow #52). The second cow (Cow #78) appears slow and her milk production is down. He is concerned it is the same problem.

Physical exam of Cow #52: Temperature normal, anaemic/icteric, respiratory rate and heart rate are increased, urine is red.

Physical exam of Cow #78: Temperature normal, possibly slightly pale mucous membranes, respiratory rate and heart rate normal. Body condition score is low. “Dirty” tail.

Discuss the blood and urinalysis results from both cows; including the pathophysiological mechanism(s) which may have brought about the changes. List the diagnosis and differential diagnoses which you consider most likely, briefly justifying your selection. Outline any further laboratory assays (if any) which could be undertaken to support your conclusions. (30 marks)

Results for Cow #52:

Haematology (EDTA):

Analyte	Patient	Units	Ref Range
RBC	1.21	$\times 10^{12}/L$	5.0-7.7
Haemoglobin	31	g/L	85-130
HCT	0.07	L/L	0.24-0.40
MCV	55	fL	38-56
MCH	26	pg	14-20
MCHC	443	g/L	320-400
Absolute reticulocyte	61	$\times 10^9/L$	<1.0
Heinz Bodies	<1	%	0-1
Nucleated RBC	0	/100 WBC	0
WBC	34.4	$\times 10^9/L$	3.8-11.0
Seg Neutrophils	29.2	$\times 10^9/L$	0.7-4.9
Lymphocytes	3.4	$\times 10^9/L$	1.0-5.8
Monocytes	1.4	$\times 10^9/L$	0.0-0.9
Eosinophils	0.0	$\times 10^9/L$	0.0-1.9
Basophils	0.3	$\times 10^9/L$	0.0-0.2
Platelets	1016	$\times 10^9/L$	220-640
Fibrinogen	5.8	g/L	2.0-7.0

Blood film: RBC morphology: Anisocytosis ++, macrocytosis +, polychromasia ++, stippled cells +
WBC morphology: no significant abnormalities were recognised
Platelet morphology: no significant abnormalities were recognised

Case 2 continued over page

Case 2 continued...

Results for Cow #52:

Biochemistry (serum):

Analyte	Patient	Units	Ref Range
CK	366	IU/L	0-578
AST	325	IU/L	0-179
GGT	312	IU/L	0-36
GLDH	175	IU/L	8-41
Bilirubin	10	µmol/L	0-13
Total Protein	75	g/L	60-86
Albumin	32	g/L	25-40
Globulin	43	g/L	28-53
Haptoglobin	1.63	g/L	0-0.6
Urea	12.8	mmol/L	2.7-12.3
Creatinine	322	umol/L	55-130
Phosphate	1.6	mmol/L	1.1-2.8
Calcium	2.14	mmol/L	2.0-2.6
Magnesium	1.01	mmol/L	0.49-1.15
BOH	0.2	mmol/L	0.2-1.0
Sodium	135	mmol/L	132-152
Potassium	4.2	mmol/L	3.9-5.8
Chloride	98	mmol/L	96-104

Results for Cow #52:

Urinalysis:

Analyte	Patient
Collection Method	Free flow
Colour	Dark brown
Supernatant colour	Dark brown
SG	1.028
pH	8.0
Glucose	Neg
Ketones	Neg
Bilirubin	Neg
Protein	3+
Blood	4+
RBC (per hpf)	1
WBC (per hpf)	1
Crystals	None seen
Epithelial cells	None seen
Casts	None seen
Bacteria	3+

Case 2 continued over page

Case 2 continued.**Results for Cow #78:**

Haematology (EDTA):

Analyte	Patient	Units	Ref Range
RBC	7.7	$\times 10^{12}/L$	5.0-7.7
Haemoglobin	121	g/L	85-130
HCT	0.35	L/L	0.24-0.40
MCV	45	fL	38-56
MCH	16	pg	14-20
MCHC	347	g/L	320-400
Absolute reticulocyte	0	$\times 10^9/L$	<1.0
Heinz Bodies	<1	%	0-1
Nucleated RBC	0	/100 WBC	0
WBC	5.6	$\times 10^9/L$	3.8-11.0
Seg Neutrophils	0.73	$\times 10^9/L$	0.7-4.9
Lymphocytes	4.14	$\times 10^9/L$	1.0-5.8
Monocytes	0.50	$\times 10^9/L$	0.0-0.9
Eosinophils	0.17	$\times 10^9/L$	0.0-1.9
Basophils	0.06	$\times 10^9/L$	0.0-0.2
Platelets	424	$\times 10^9/L$	220-640
Fibrinogen	7.5	g/L	2.0-7.0

Blood film: RBC morphology: Poikilocytosis 1+
WBC morphology: no significant abnormalities were recognised
Platelet morphology: no significant abnormalities were recognised

Results for Cow #78:

Biochemistry (serum):

Analyte	Patient	Units	Ref Range
CK	1017	IU/L	0-578
AST	149	IU/L	0-179
GGT	<2	IU/L	0-36
GLDH	8	IU/L	8-41
Bilirubin	3	$\mu\text{mol}/L$	0-13
Total Protein	46	g/L	60-86
Albumin	21	g/L	25-40
Globulin	25	g/L	28-53
Haptoglobin	0.4	g/L	0-0.6
Urea	7.5	mmol/L	2.7-12.3
Creatinine	57	$\mu\text{mol}/L$	55-130
Phosphate	3.85	mmol/L	1.1-2.8
Calcium	1.73	mmol/L	2.0-2.6
Magnesium	0.92	mmol/L	0.49-1.15
BOH	1.3	mmol/L	0.2-1.0
Sodium	131	mmol/L	132-152
Potassium	6.0	mmol/L	3.9-5.8
Chloride	89	mmol/L	96-104

3. History: A two-year old Warmblood mare presented with anorexia, depression, weight loss and weakness. She was also polyuric and polydipsic.

On physical exam she was depressed but all vital signs were within normal limits.

Discuss the blood and urinalysis results including the pathophysiological mechanisms which have brought about the changes. List the diagnosis/differential diagnoses which you consider most likely, briefly justifying your selection. Outline any further laboratory assays (if any) which could be undertaken to support your conclusions.

(30 marks).

Haematology (EDTA):

Analyte	Patient	Units	Ref Range
RBC	6.7	$\times 10^{12}/L$	7.0-11.8
Haemoglobin	113	g/L	112-180
HCT	0.33	L/L	0.31-0.52
MCV	51	fL	38-52
MCH	17	pg	13-18
MCHC	342	g/L	340-380
WBC	14.4	$\times 10^9/L$	5.7-12.0
Seg Neutrophils	11.7	$\times 10^9/L$	2.9-6.9
Lymphocytes	2.4	$\times 10^9/L$	1.5-6.3
Monocytes	0.3	$\times 10^9/L$	0.2-0.7
Eosinophils	0.0	$\times 10^9/L$	0.1-0.3
Basophils	0.0	$\times 10^9/L$	0.0-0.1
Platelets	175	$\times 10^9/L$	100-350
Fibrinogen	3.4	g/L	1.5-5.0

Blood film: RBC morphology: no significant abnormalities were recognised
 WBC morphology: no significant abnormalities were recognised
 Platelet morphology: no significant abnormalities were recognised

Case 3 continued over page

Case 3 continued.

Biochemistry (serum):

Analyte	Patient	Units	Ref Range
CK	688	IU/L	63-469
AST	282	IU/L	0-700
GGT	11	IU/L	7-45
GLDH	89	IU/L	1-8
Bilirubin	34	µmol/L	10-42
Total Protein	67	g/L	57-76
Albumin	32	g/L	32-40
Globulin	35	g/L	20-41
Serum amyloid A	4	mg/L	<8
Urea	7.0	mmol/L	3.0-9.2
Creatinine	164	umol/L	97-144
Phosphate	1.15	mmol/L	0.9-1.7
Calcium	2.67	mmol/L	2.8-3.3
Magnesium	0.69	mmol/L	0.68-0.90
Sodium	137	mmol/L	131-141
Potassium	2.6	mmol/L	3.0-4.6
Chloride	110	mmol/L	94-104
Bicarbonate	11	mmol/L	26-35

Fractional excretion:

Analyte	Patient	Units	Ref Range
Sodium	0.04	%	<1
Potassium	52.5	%	15-40
Chloride	0.08	%	<1
Calcium	10.2	%	<7.0

Urinalysis :

Analyte	Patient
Collection Method	Free flow
Colour	Yellow
Turbidity	Cloudy
SG	1.019
pH	7.8
Glucose	1+
Ketones	Neg
Bilirubin	Neg
Protein	1+
Blood	Neg
RBC (per hpf)	None seen
WBC (per hpf)	1-2
Crystals	Many calcium carbonate
Epithelial cells	Low numbers
Casts	None seen
Bacteria	Rare cocci

Part B

Applied aspects of veterinary clinical pathology

Answer three (3) of the four questions below.

1. Construct a quality assurance program suitable for a commercial clinical pathology laboratory and describe how each of the components contributes to the fidelity of results. *(30 marks)*

2. From a clinical pathologists' perspective practically categorise haemoparasites that may be encountered in the blood of vertebrates in Australia and New Zealand; give examples from each general category and briefly describe their general morphological features as observed with Romanowsky stained thin blood films and light microscopy; and state methods that can be used to further characterise and classify these organisms. *(30 marks)*

3. Describe the general haematological and biochemical characteristics of birds in response to disease. Illustrate your answer with appropriate clinical examples and describe any limitations inherent in the analysis of samples or interpretation of the results from these species. *(30 marks)*

4. Briefly discuss **four (4)** of the following:
 - a) clinical application of the fructosamine assay. *(7½ marks)*

 - b) the differentiation between primary hyperparathyroidism and humoral hypercalcaemia of malignancy in the laboratory. *(7½ marks)*

 - c) the use of PCR as a diagnostic assay. *(7½ marks)*

 - d) the laboratory investigation of granulosa cell tumours in the mare. *(7½ marks)*

 - e) the causes, mechanisms and distinguishing laboratory features of erythrocytosis (polycythaemia). *(7½ marks)*

End of paper