Australian and New Zealand College of Veterinary Scientists

Fellowship Examination

June 2018

Equine Medicine

Paper 1

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

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

Answer **ALL** **EIGHT (8)** questions

All eight (8) questions are of equal value

Answer **EIGHT (8)** questions, each worth 30 marks.................................total 240 marks

Paper 1: Equine Medicine

Answer all eight (8) questions

1. Current recommendations suggest that the existing term, 'equine gastric ulcer syndrome (EGUS)' in adult horses, should be further classified into the terms, 'equine squamous gastric disease (ESGD)' and 'equine glandular gastric disease (EGGD)'.

   Answer **all** parts of this question:

   a) Discuss in detail the pathophysiology of and risk factors for primary ESGD in adult horses.   *(15 marks)*

   b) Briefly discuss proposed theories regarding the pathophysiology of EGGD.
   (7 marks)

   c) Briefly discuss the scientific evidence for alternative acid-suppressive therapies other than oral omeprazole for the management of ESGD in adult horses.
   (8 marks)

2. Answer **all** parts of the question:

   a) Discuss the proposed pathophysiology and methods of definitive diagnosis for exercise-induced pulmonary haemorrhage (EIPH) in Thoroughbred racehorses.
   (10 marks)

   b) List the risk factors associated with EIPH in Thoroughbred racehorses, with reference to the recent literature.   *(8 marks)*

   c) Discuss how EIPH affects performance in Thoroughbred racehorses.   *(6 marks)*

   d) Discuss the proposed mechanism of action and effectiveness of furosemide for the prevention of EIPH in racehorses.   *(6 marks)*

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

    a) Discuss the pathophysiologic mechanisms of the following proposed causes of neonatal encephalopathy in foals:

        i.   hypoxic-ischaemic neuronal injury   *(10 marks)*

        ii.   altered neuroactive steroid concentrations.   *(10 marks)*

    b) List and discuss the principles of the supportive treatments that may be beneficial in the management of neuronal hypoxic-ischaemic damage in foals.
(10 marks)

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

    a) Briefly discuss the **five (5)** major physiological differences between neonatal foals and mature horses, with regard to pharmacokinetics and pharmacodynamics. Include examples of drugs, where appropriate.   *(10 marks)*

    b) For **each** of the statements below state the indications for administration of the drug, possible dose(s), routes of administration and appropriate monitoring for the side effects of the drug:

        i.   ceftiofur sodium for a critically ill neonatal foal   *(5 marks)*

        ii.   gentamicin for a seven-day-old foal with a septic joint   *(5 marks)*

        iii. lignocaine for a post-operative colic   *(5 marks)*

        iv.   dexamethasone for an adult horse with *purpura haemorrhagica.*
(5 marks)

Continued over page

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

   a) Draw a simple diagram or flow chart of the coagulation process. On this diagram, indicate the site of action of **four (4)** drugs used in clinical practice that have either fibrinolytic **or** anti-fibrinolytic action.   *(15 marks)*

   b) For **each** of the following tests of coagulation, describe what **each** test measures, its advantages and disadvantages, and an example of the clinical application of **each** test:

      i.   thromboelastography   *(5 marks)*

      ii. fibrinogen   *(5 marks)*

      iii. D-dimer and/or fibrin degradation products (FDP) assay.   *(5 marks)*

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

   a) Describe, in detail, the digestion and absorption of carbohydrates in the equine gastrointestinal tract.   *(7.5 marks)*

   b) Describe, in detail, the impact of excessive carbohydrate consumption (grain overload) on the gastrointestinal system in horses.   *(7.5 marks)*

   c) Following excessive carbohydrate consumption, describe the subsequent impact of the gastrointestinal changes described in your answer to question 6 b) on other body systems in the horse.   *(15 marks)*

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

   a) Provide brief notes on the incidence and epidemiology of lymphoma in the equine population. *(4 marks)*

   b) List the **four (4)** commonly recognised clinical syndromes of lymphoma in horses. *(2 marks)*

   c) List the reported paraneoplastic syndromes seen in association with lymphoma and briefly explain the proposed pathophysiologic mechanisms of **each** in horses. *(10 marks)*

   d) Discuss the methods for diagnosis and treatment of horses with mediastinal lymphoma. *(10 marks)*

   e) List the complications associated with the administration of chemotherapeutic drugs in horses. *(4 marks)*

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

   a) Describe the aetiology and pathogenesis of systemic inflammatory response syndrome (SIRS) in horses. Use an annotated diagram, if preferred. *(15 marks)*

   b) Discuss an evidence-based approach to the treatment of SIRS in horses.
   (15 marks)

End of paper

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Paper 2

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

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

Answer **ALL** **EIGHT (8)** questions

All eight (8) questions are of equal value.

Answer **EIGHT (8)** questions, each worth 30 marks.................................total 240 marks

Paper 2: Equine Medicine

Answer all eight (8) questions

1. An eight-year-old Arabian gelding endurance horse presents with signs of abdominal pain following veterinary elimination from an endurance ride held in hot, humid conditions. The horse had completed 120 km of a 160 km ride. Veterinary elimination from the ride was based on the following metabolic parameters obtained 30 minutes post-exercise: rectal temperature 38.9^{o}C; heart rate 66 beats per minute (bpm), respiratory rate 48 breath rate per minute (brpm); dark pink, tacky mucous membranes; capillary refill time, 2.5 seconds; prolonged skin recoil; markedly reduced intestinal borborygmi; and weak peripheral pulse. The horse is inappetent and adipsic.

    Answer **all** parts of this question:

    a) Provide an interpretation of the clinical findings and venous blood gas results obtained at the time of examination.   *(8 marks)*

Parameter	Result	Reference range
pH	7.45	7.35–7.45
$PvCO_2$	32.1	38–46 mmHg
HCO_3	34.6	26–32 mEq/L
Na^+	132	132–146 mmol/L
K^+	5.3	3.3–4.8 mmol/L
Cl^-	93	99–109 mmol/L
iCa^{2+}	1.1	1.4–1.6 mmol/L
Glucose	8.1	6.7–10 mmol/L
Lactate	4.2	<2.0 mmol/L
PCV	45	24–44%
TPP	80	52–79 g/L

Question 1 continued over page

b) Due to the severity of abdominal pain, the horse requires IV administration of xylazine (200 mg) to facilitate further diagnostic evaluation. Formulate and outline a brief, prioritised diagnostic approach and the emergency management of this case.   *(8marks)*

c) Palpation per rectum reveals distended loops of small intestine. Discuss the possible differential diagnoses and the methods used to distinguish between them.   *(6 marks)*

d) Discuss the pathophysiological principles of the management of colic due to ileus in endurance horses during competition, with reference to the literature.
(8 marks)

2. An 18-year-old Welsh mountain pony (weighing approximately 220 kg) presents with a history of polydipsia of at least three weeks duration. The owner reports that the pony drinks approximately 90 L of water per day. The urine appears grossly clear and has the appearance of water. Pertinent clinical examination findings include a body condition score of 7 out of 9, a cresty neck and abnormal adipose tissue distribution, typical of equine metabolic syndrome. There is no evidence of hirsutism, increased sweating, or laminitis. The pony is housed in a paddock at night and in a stable during the day for weight management. Mentation, appetite and all other clinical parameters are within normal limits. The pony is not receiving any supplements or medications.

Haematology

Parameter	Units	Patient value	Reference range
Red blood cell count	$\times 10^{12}$/L	7.7	6.0–10.5
Haemoglobin	g/L	136	95–155
Haematocrit	L/L	0.36	0.26–0.42
MCV	fL	47	36–52
MCH	pg	18	13–19
MCHC	g/L	378	340–380
White blood cell count	$\times 10^9$/L	8.9	5.8–11.8
Neutrophils	$\times 10^9$/L	5.5	2.5–7.3
Lymphocytes	$\times 10^9$/L	2.4	1.6–5.4
Monocytes	$\times 10^9$/L	0.4	0.1–0.7
Eosinophils	$\times 10^9$/L	0.4	0.1–0.5
Basophils	$\times 10^9$/L	0.0	0.0–0.07
Platelets	$\times 10^9$/L	207	100–350
Fibrinogen	g/L	2.2	2–4

Blood smear: Red cells, normal; white cells, normal; platelets, normal; no haemolysis

Question 2 continued over page

Serum biochemistry

Parameter	Units	Patient value	Reference range
Sodium	mmol/L	120	132–146
Potassium	mmol/L	4.4	3.1–4.9
Chloride	mmol/L	84	94–105
Total CO_2	mEq/L	26	24–32
Calcium	mmol/L	2.80	2.50–3.30
Phosphate	mmol/L	1.06	0.8–1.4
Magnesium	mmol/L	0.53	0.70–1.15
Triglyceride	mmol/L	0.70	<0.80
Glucose	mmol/L	4.2	3.5–7.1
Urea	mmol/L	3.5	4.4–7.8
Creatinine	μmol/L	55	80–180
Total bilirubin	μmol/L	11	<25
Alkaline phosphatase	U/L	152	<280
Aspartate aminotransferase	U/L	218	<400
Gamma glutamyl transferase	U/L	26	<40
Creatine kinase	U/L	715	<220
Total protein	g/L	66	58–72
Albumin	g/L	33	27–35
Globulin	g/L	33	25–38
Plasma ACTH	pg/ml	29	<35

Answer **all** parts of question 2:

a) Interpret the clinical and laboratory results and outline a prioritised list of the most likely differential diagnoses.   *(15 marks)*

b) Discuss the diagnostic methods used to distinguish between the possible differential diagnoses.   *(10 marks)*

c) Explain the term 'medullary washout' and its potential causes.   *(5 marks)*

Continued over page

3. A three-day-old Thoroughbred foal is presented to your referral hospital with generalised seizure activity. The foal had not been nursing well for the last day and there is no history or evidence of diarrhoea.

Answer **all** parts of this question:

a) List **four (4)** differential diagnoses for this case.   *(2 marks)*

b) Interpret the following haematology and biochemistry results.   *(6 marks)*

Haematology

Parameter	Units	Patient value	Reference range (foal)
Red blood cell count	x10^{12}/L	7.4	5.2–12.0
Haemoglobin	g/L	112	107–168
Haematocrit	L/L	0.31	0.28–0.46
MCV	fL	42	35–44
MCH	pg	15	13–19
MCHC	g/L	367	320–400
White blood cell count	x10^9/L	21.0	5.2–12.0
Neutrophils	x10^9/L	17.6 (84%)	3.21–10.60
Lymphocytes	x10^9/L	3.15 (15%)	0.67–3.12
Monocytes	x10^9/L	0.21 (1%)	0.03–0.58
Eosinophils	x10^9/L	0.0	0.0–0.5
Basophils	x10^9/L	0.0	0.0–0.07
Platelets	x10^9/L	207	100–350
Plasma protein	g/L	62	52–79
Fibrinogen	g/L	4.0	2–4
IgG	g/L	8	>8

Question 3 continued over page

Biochemistry panel

Parameter	Units	Patient value	Reference range (foal)
Glucose	mmol/L	5.8	5.6–12.9
Urea	mmol/L	7.5	2.5–9.3
Creatinine	μmol/L	277	70–200
Total bilirubin	μmol/L	73	46–72
Serum protein	g/L	51	50–70
Albumin	g/L	24	28–34
Globulin	g/L	27	20–38
Sodium	mmol/L	104	131–140
Potassium	mmol/L	3.9	3.3–4.4
Chloride	mmol/L	70	86–95
Total CO_2	mEq/L	29	27–32
Calcium	mmol/L	2.62	2.77–3.07
Phosphate	mmol/L	1.78	1.47–1.83
Magnesium	mmol/L	0.91	0.70–1.15
Triglyceride	mmol/L	0.46	<0.80

c) List and briefly describe any additional diagnostic tests relevant to this case.

(2 marks)

d) Describe the clinicopathogenesis of hyponatraemic encephalopathy and outline the specific management of this case.   *(15 marks)*

e) Discuss the prognosis of foals with acute kidney injury and hyponatraemic encephalopathy. Include factors that will influence your opinion and refer to the relevant literature.   *(5 marks)*

Continued over page

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

   a) Define the statistical term, 'heteroskedasticity'. The following graph represents heteroskedasticity.   *(5 marks)*

Blood glucose (mmol/L) versus Time (minutes)
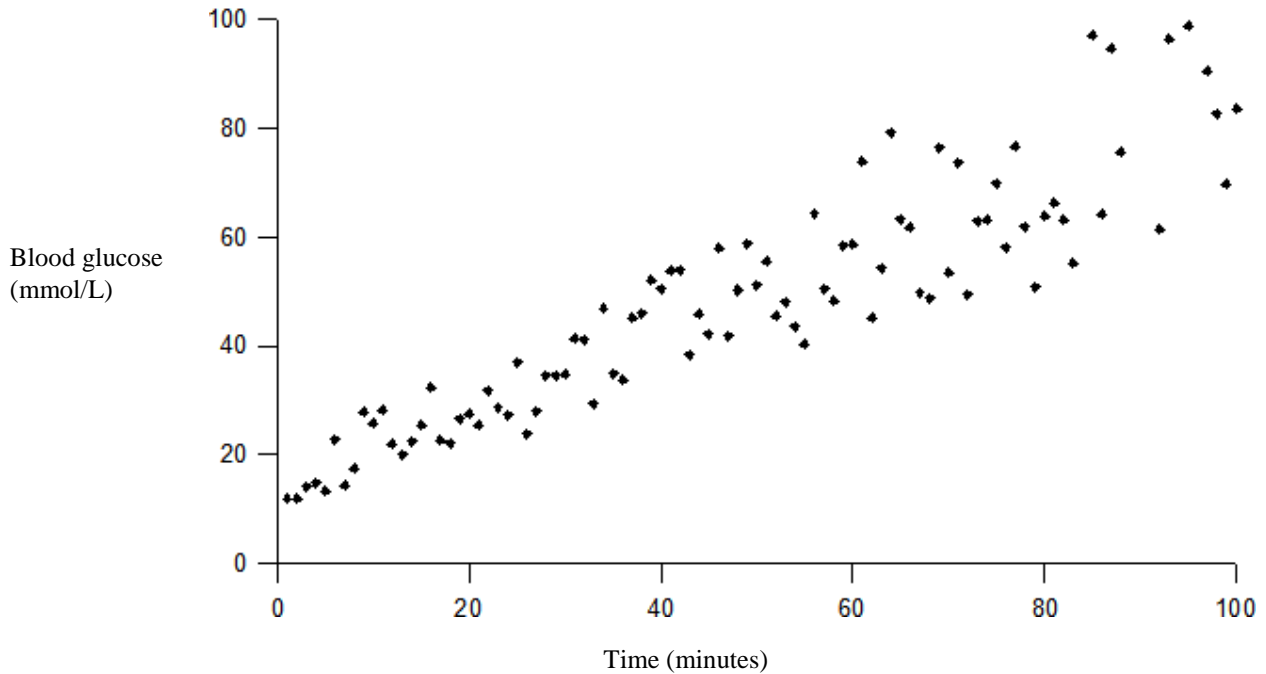
   b) Explain the consequences of heteroskedasticity on study results and how this variation in data can be detected.   *(5 marks)*

   c) Discuss **one (1)** method to correct the statistical data and avoid heteroskedasticity.   *(5 marks)*

   d) Suggest a prospective clinical study design to compare the efficacy of the nasogastric administration of psyllium, magnesium sulphate, and their combination, for the removal of sand accumulation from the large colon of horses. Include in your answer the meaning of a p-value **and** which statistical tests could be chosen for:

      i.   normally distributed, independent numerical data, **and**

      ii.   independent numerical data that is not normally distributed.   *(15 marks)*

Continued over page

5. A seven-year-old Thoroughbred gelding is presented to you for pre-purchase examination. The gelding is currently performing well over a distance of 2000–2400 metres. The only abnormality is a grade 3/6 holosystolic band-shaped murmur with a point of maximal intensity over the left cardiac apex. A grade 2/6 right-sided holosystolic murmur was also audible.

An echocardiographic examination was performed and the results are provided below:

Doppler	Regurgitation
Mitral	moderate
Tricuspid	mild
Aortic	trivial
Pulmonic	none

Two-dimensional	View	Normal TB	Case
LAd	left long axis	12.82 ± 0.782	14.1 cm

M mode	View	Normal TB	Case
IVSd	short axis LV	2.79 ± 0.01	3.0 cm
IVSs	short axis LV	4.19 ± 0.03	5.1 cm
LVIDd	short axis LV	13.96 ± 0.06	16.1 cm
LVIDs	short axis LV	9.0 ± 0.06	10.2 cm
LVFWd	short axis LV	2.26 ± 0.01	2.7 cm
LVFWs	short axis LV	3.85 ± 0.41	4.4 cm

Calculations	Method	Normal TB	Case
FS (fractional shortening)	LVIDd-LVIDs/ LVIDd	37.42 ± 3.86	37%
MWT (mean wall thickness)	LVFWd+IVSd/ 2	2.51 ± 0.01	2.85cm
LVM (left ventricular mass)	1.04 x [(LVIDd +LVFWd+IVSd)^3- LVIDd^3]-13.6	4.223 ± 0.036	6.421

Question 5 continued over page

Answer **all** parts of question 5:

a) Identify the abnormalities present in the echocardiographic report **and** discuss how these abnormalities relate to the clinical presentation.   *(10 marks)*

An exercising ECG was performed on this horse on a treadmill. The peak heart rate was 224 beats per minute. The peak exercise duration was 60 seconds. An example of the rhythm during peak exercise is shown in Figure 1. An example of the rhythm in the immediate post-exercise period (within two minutes of finishing exercise) is shown in Figure 2.

Figure 1:   Rhythm during peak exercise period. Lead II. Paper speed 25mm/s
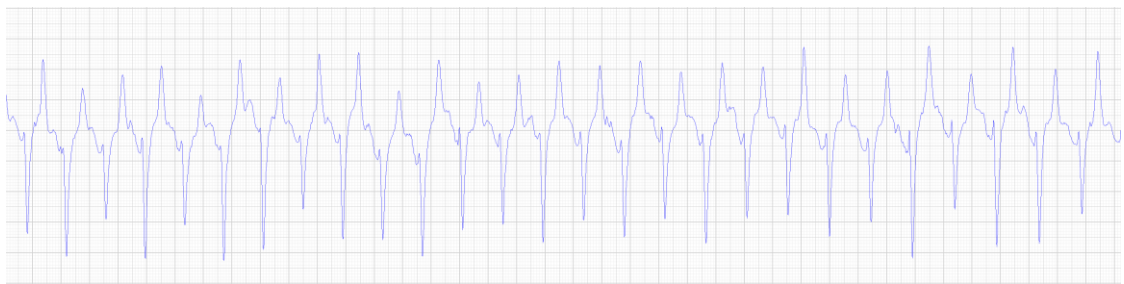

Figure 2:   Rhythm during immediate post-exercise period. Lead II. Paper speed 25mm/s

b) Describe **and** categorise the rhythm abnormalities present and include your reasoning. You may label the figure(s) if you wish.   *(8 marks)*

c) Discuss the significance of the above ECG **and** echocardiographic findings in the clinical setting of a pre-purchase examination for Thoroughbred racing.
(8 marks)

d) Describe any further testing that would be warranted in the investigation of cardiac disease in this case.   *(4 marks)*

Continued over page

6. A 20-day-old Thoroughbred foal presents with acute septic arthritis of the hock. Culture and susceptibility from an aseptically obtained arthrocentesis of the hock joint revealed a heavy growth of *Klebsiella pneumoniae* with the following susceptibility profile:

Penicillin	resistant
Gentamicin	resistant
Doxycyline	resistant
Tetracycline	resistant
Trimethoprim-sulphonamide	sensitive
Ceftiofur	resistant
Ceftriaxone	resistant
Enrofloxacin	sensitive
Neomycin	resistant
Chloramphenicol	resistant
Amikacin	resistant

Answer **all** parts of question 6:

a) State the most likely source of exposure to *Klebsiella pneumoniae* in this foal.
(2 marks)

b) Of the antimicrobials listed above, which antimicrobial agent would be most appropriate for an intravenous regional limb perfusion in this foal? Provide **two (2)** reasons for your answer. *(6 marks)*

c) Of the antimicrobials listed above, which antimicrobial agent would be most appropriate for systemic antimicrobial therapy in this foal? Provide **two (2)** reasons for your answer. *(6 marks)*

d) The minimum inhibitory concentration (MIC) of amikacin for this *Klebsiella pneumoniae* isolate returns as 6 µg/ml (the MIC used for susceptibility testing is 4 µg/ml). Discuss the methods required to establish an effective systemic dosing regime. *(8 marks)*

e) Discuss the biosecurity measures required while managing this case and following hospital discharge. *(8 marks)*

Continued over page

7. A twelve-year-old, late-term, pregnant Thoroughbred broodmare presents with markedly obtunded mentation, ataxia, head-pressing and drooling. The mare's mucous membranes are jaundiced and she intermittently shows signs of abdominal discomfort. The following haematology and biochemistry results were obtained:

Haematology

Parameter	Units	Patient value	Reference range
Red blood cell count	x10^{12}/L	11.2	6.0–12.0
Haemoglobin	g/L	185	130–174
Haematocrit	L/L	0.52	0.35–0.47
MCV	fL	47	38–49
MCH	pg	17	13–16
MCHC	g/L	355	300–390
White blood cell count	x10^9/L	15.1	6.0–12.0
Band neutrophils	x10^9/L	0.15 (1%)	0–0.20
Neutrophils	x10^9/L	11.3 (75%)	2.47–7.00
Lymphocytes	x10^9/L	3.62 (24%)	1.63–4.40
Monocytes	x10^9/L	0.0 (1%)	0.03–0.58
Eosinophils	x10^9/L	0.0	0.0–0.5
Basophils	x10^9/L	0.0	0.0–0.07
Platelets	x10^9/L	250	100–350
Plasma protein	g/L	80	55–70
Fibrinogen	g/L	2.0	2–4

Question 7 continued over page

Biochemistry panel

Parameter	Units	Patient value	Reference range
AST	U/L	5300	<350
ALP	U/L	573	<200
Gamma GT	U/L	176	<22
Creatine kinase	U/L	198	<350
Glucose	U/L	3.2	4.5–6.3
Urea	mmol/L	2.4	3.7–7.0
Creatinine	μmol/L	132	87–160
Total bilirubin	μmol/L	215	17–48
Serum protein	g/L	71	55–65
Albumin	g/L	28	29–37
Globulin	g/L	43	13–37
Sodium	mmol/L	134	136–142
Potassium	mmol/L	4.2	3.1–4.4
Chloride	mmol/L	93	95–106
Total CO_2	mEq/L	28	27–32
Calcium	mmol/L	2.62	2.77–3.07
Phosphate	mmol/L	1.71	0.92–1.38
Magnesium	mmol/L	0.79	0.73–0.91
Triglyceride	mmol/L	5	<0.80

Answer **all** parts of question 7:

a) Interpret the haematology and biochemistry panel results for this mare.

(5 marks)

b) List **four (4)** potential differential diagnoses.   *(2 marks)*

c) Briefly discuss the proposed pathophysiology of hepatic encephalopathy.

(10 marks)

d) List the additional diagnostic tests that should be performed to investigate this case and discuss how the results obtained would influence the prognosis.

(5 marks)

e) Describe management of this case with the goal of keeping the foetus alive.

(8 marks)

Continued over page

8. A Thoroughbred yearling has been treated for six days with an oral trimethoprim/sulphonamide antimicrobial prior to transport to a sale. Within 24 hours of arriving at the sales complex, the horse was found to be obtunded and inappetent. The following haematology results were obtained:

Haematology

Parameter	Units	Patient value	Reference range
Red blood cell count	$x10^{12}$/L	7.7	6.0–12.0
Haemoglobin	g/L	100	130–174
Haematocrit	L/L	0.30	0.35–0.47
MCV	fL	39	38–49
MCH	pg	13	13–16
MCHC	g/L	334	300–390
White blood cell count	$x10^9$/L	7.3	6.0–12.0
Band neutrophils	$x10^9$/L	0.07 (1%)	0–0.20
Neutrophils	$x10^9$/L	4.31 (59%)	2.47–7.00
Lymphocytes	$x10^9$/L	2.70 (37%)	1.63–4.40
Monocytes	$x10^9$/L	0.22 (3%)	0–0.72
Eosinophils	$x10^9$/L	0.0	0.0–0.96
Basophils	$x10^9$/L	0.0	0.0–0.36
Platelets	$x10^9$/L	28	100–600
Plasma protein	g/L	57	55–70
Fibrinogen	g/L	3	2–4

Note: platelets appear reduced on blood smear

Answer **all** parts of question 8:

a) Interpret the clinicopathological abnormalities present.   *(2 marks)*

b) List the possible clinical signs of thrombocytopaenia in the horse.   *(4 marks)*

c) Describe the physiological role of platelets.   *(4 marks)*

Question 8 continued over page

d) List **three (3)** causes of thrombocytopaenia in horses and briefly outline the pathophysiology of **each**. *(10 marks)*

e) List and justify any additional diagnostic tests that could be useful in the management of this case. Assume you have a well-equipped hospital and laboratory. *(5 marks)*

f) Outline the most appropriate management strategy for this case. *(5 marks)*

End of paper