



Australian and New Zealand College of Veterinary Scientists

Membership Examination

June 2022

Veterinary Public Health

Paper 1

Perusal time: **Fifteen (15)** minutes

Time allowed: **Two (2)** hours after perusal

Answer **ALL FOUR (4)** questions

Answer **FOUR** questions, each worth 30 markstotal 120 marks

Paper 1: Veterinary Public Health

Answer all four (4) questions

1. Bovine tuberculosis (bTB) is a globally significant zoonosis and an animal health issue.

Answer **all** parts of this question:

In your answers to a) to d) below, try to include examples of the application of evidence-based reasoning e.g., reference to actual cases, examples, and/or data; clear rationale in answer; justified statements; evidence of independent research as a basis for knowledge; and grounded knowledge (e.g., alignment to main example; use of other examples and/or applied information; awareness of regulatory aspects; personal experience.

a) Describe the current World Organisation for Animal Health (OIE) status of bTB in Australia and New Zealand **and** contextualise to this the respective public health impacts of this disease in **each** country. (6 marks)

b) Given the difference in current OIE status for bTB in Australia and New Zealand, contrast the respective approaches for reducing public health risks in **each** country? (8 marks)

c) Using bTB as an example, compare how a One Health approach would differ from the classical Veterinary Public Health approach in preventing and controlling this disease? (10 marks)

d) One of the most common Non-Tuberculosis Mycobacteria of veterinary and human relevance is Mycobacteria avium complex (MAC). Explain how MAC could be a potential public health threat, **and** how veterinarians may play a role in risk mitigation of this threat (6 marks)

(30 marks in total)

Continued over page

2. A client comes into the practice with a mature-age cat for its annual check-up. While chatting he asks whether he should be concerned about having the cat now that he and his wife have just found out that she is pregnant. He has heard something about *Toxoplasmosis* and its potential impact on pregnancy.

Answer **all** parts of this question:

- a) Briefly explain to the client the relevant life cycle **and** clinical/zoonotic impacts of *T. gondii*. (10 marks)
 - b) What hygienic measures can the client and expectant mother apply to mitigate any risks. (10 marks)
 - c) In 2 b) above, you presented the measures that can be taken to mitigate the risk of contracting *Toxoplasmosis*. Name **three (3)** important common risk factors that result in susceptible people potentially getting *toxoplasmosis* **and** rank these risk factors from highest risk to lowest risk where a score of one is the highest risk factor and three the lowest. (5 marks)
 - d) Provide **five (5)** other important soil or water borne zoonoses of public health concern. (5 marks)
3. You are being asked by the plant management of a cattle abattoir to advise on suitable stunning methodology. You are asked to lay out the options, discuss technical requirements, potential problems and animal and human welfare concerns.

Explain the basic principles **and** potential pitfalls/problems that may occur with different stunning methods (compare location/placements of implements to illustrate your arguments). (30 marks)

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4. The Codex Alimentarius Commission of The Food and Agriculture Organization (FAO)/World Health Organisation (WHO) uses the NAS-NRC model (National Academy of Science -National Research Council, 1983) specifically for microbiological food safety risk analysis, which has been adopted by Ministry for Primary Industries (MPI) and The Australian Department of Agriculture, Water and the Environment (DAWE) in both New Zealand and Australia as a basis for conducting a microbiological food safety risk assessment.

Answer **all** parts of this question:

- a) Indicate the three (3) major components of the NAS-NRC model and their sub-components. (5 marks)
- b) For the Risk Assessment Component of NAS-NRC model, discuss what is carried out under that component when doing a risk analysis for food safety. (10 marks)
- c) As part of a food safety risk assessment, qualitative and quantitative methods can be used. Explain the difference between qualitative risk analysis (assessment) and quantitative risk analysis (assessment) **and** compare where / how these methods are commonly applied in food safety. (8 marks)
- d) If a HACCP team were to conduct a hazard analysis for the production of frozen cooked beef patties, then enteric pathogens in the raw meat would be identified as hazards.
 - Name **two (2)** common enteric pathogens that you could expect to find in Australian or New Zealand raw meat. (2 marks)
 - Conduct a brief Quantitative assessment of the risk of having one of these enteric pathogens in a raw meat patty **and** include a control measure that could be implemented to mitigate that risk. (5 marks)



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Paper 2

Perusal time: **Fifteen (15)** minutes

Time allowed: **Two (2)** hours after perusal

Answer **ALL FOUR (4)** questions

Only Elective A is included in this paper

Elective A: Answer **FOUR** questions, each worth 30 markstotal 120 marks

Paper 2: Veterinary Public Health

Elective A: Answer all four (4) questions Only Elective A has been included in this paper

1. Answer **all** parts of this question:
 - a) Describe the normal biochemical and ultrastructural changes that occur as muscle converts into meat. *(10 marks)*
 - b) With respect to your answer in a) above, contrast the abnormal changes that can affect meat quality if live animals and their carcasses are not handled correctly. In your answer, provide the biochemical and ultrastructural basis for these changes, how these impact on the meat quality **and** how they can be counteracted. *(10 marks)*
 - c) What interventions can be applied to avoid the abnormal changes leading to meat quality downgrading that you described in b) above. Structure this to include interventions/applications at the live animal and carcass levels. *(10 marks)*

2. Discuss the key slaughter processes that take place in an export abattoir, from the time a cow enters the abattoir until the production of frozen and processed meat is reached. Indicate in your answer the different steps in production of these products, where by-products are taken off in this process and how they are processed further. (including how edible and inedible offal is processed further), what common methods are used to produce processed meat and where odour and effluent treatment would occur. (30 marks)

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3. Discuss the factors that may affect the presence or impact of foodborne pathogens in **each** of the following components of the food chain:

- a) On farm or at the place of harvest. (5 marks)
- b) During transport to the processing plant. (5 marks)
- c) During slaughter processing. (5 marks)
- d) During storage and distribution of product. (5 marks)
- e) In the preparation of food – Retail or at home. (5 marks)
- f) Knowing all the above, identify **five (5)** key Critical Control points in the food chain and develop a HACCP plan for **each** point. (5 marks)

4. Concentrated Animal Feeding Operations (CAFOs) represent significant sources of hazards that have human and animal health significance.

What are the most significant public health hazards derived from animal wastes associated with CAFOs? Give some examples of these as part of your answer. (5 marks)

Describe the transmission dynamics of antimicrobial residues between CAFOs and humans. (5 marks)

What applied approaches to CAFO waste treatment are used to **reduce the risk** of human and animal health hazards being cycled to humans and animals? (10 marks)

What specific public health **risks** are associated with circulation of AM residues to and from CAFOs, providing examples where appropriate? (5 marks)

Discuss the processes that exist in New Zealand or Australia that aim to **manage** these AM residues risks? (5 marks)End of Elective A

End of Paper



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Paper 2

Perusal time: **Fifteen (15)** minutes

Time allowed: **Two (2)** hours after perusal

Answer **ALL FOUR (4)** questions

Only Elective B is included in this paper

Elective B: Answer **FOUR** questions, each worth 30 marks.....total 120 marks

Paper 2: Veterinary Public Health

Elective B: Answer all four (4) questions

Only Elective B has been included in this paper

5. On Saturday, March 17, a group of 15 men and women met at a bush camp for a planning session prior to opening of the camp for a fishing club competition. They arrived at the camp about 10:00 am and left immediately after supper.

The lunch consisted of bread, butter, cold chicken, potato salad, milk, and jam and was served at 12:30 pm. The supper included fruit cocktail, baked ham, cold asparagus, bread, coffee, and ice cream and was served promptly at 6:00 pm. All foods except the coffee were prepared or purchased on the day before and carried to the camp kitchen facilities.

That evening, 8 of the 15 who spent the day together and shared the common foods became ill. All had recovered within 48 hours.

The people were interviewed, and a master table was prepared recording their answers, (see Table 1 over page).

Question one continued over page

Table 1

CASE NO. SEX-AGE	LUNCH	SUPPER	ONSET	SYMPTOMS
1 M-23	Cold chicken, Potato salad, Milk	Baked Ham, Bread, Coffee, Ice cream	7:30 pm	Abd. cramps, Diarrhoea
2 M-46	Bread, Butter, Potato salad, Milk	Fruit cocktail, Baked ham, Bread, Ice cream		Not ill
3 M-22	Bread, Butter, Cold chicken, Potato salad, Milk, Jam	Fruit cocktail, Baked ham, Cold asparagus, Coffee	8:00 pm	Diarrhoea, Vomiting, Headache, Abd. cramps
4 F-37	Cold chicken, Milk, Jam	Fruit cocktail, Cold asparagus, coffee		Not ill
5 F-29	Cold chicken, Potato salad, Milk	Fruit cocktail, Baked ham, Cold asparagus, Coffee, Ice cream	10:30 pm	Diarrhoea
6 M-52	Bread, Potato salad, Jam	Fruit cocktail, Baked ham, Coffee, Ice cream, Bread		Not ill
7 M-32	Bread, Butter, Cold chicken, Potato salad, Milk, Jam	Fruit cocktail, Baked ham, Cold asparagus, Coffee, Ice cream	8:30 pm	Vomiting, Diarrhoea
8 F-31	Cold chicken, Milk	Baked ham, Cold asparagus, Bread, Coffee, Ice cream		Not ill
9 M-40	Bread, Butter, Cold chicken, Potato salad, Milk, Jam	Fruit cocktail, Bread, Coffee, Ice cream	10:00 pm	Diarrhoea, Abd. cramps
10 M-30	Bread, Butter, Potato salad, Milk, Jam	Fruit cocktail, Baked ham, Bread, Ice cream		Not ill
11 F-28	Cold chicken, Milk, Jam	Fruit cocktail, Baked ham, Cold asparagus, Ice cream	9:15 pm	Diarrhoea
12 M-38	Bread, Butter, Potato salad, Milk, Jam	Fruit cocktail, Baked ham, Cold asparagus, Coffee, Ice cream		Not ill
13 M-40	Bread, Butter, Milk, Jam	Fruit cocktail, Baked ham, Cold asparagus, Coffee, Ice cream	8:30 pm	Diarrhoea, Abd. cramps, Bloody stools
14 M-35	Bread, Butter, Milk, Jam	Fruit cocktail, Cold asparagus, Coffee		Not ill
15 M-42	Bread, Butter, Cold chicken, Potato salad, Milk	Baked ham, Bread, Coffee, Ice cream	12:30 am	Diarrhoea

Question 1 continued over page

Answer **all** parts of this question:

- a) What type of epidemic pattern best describes this scenario and justify your answer. Describe the steps you would follow to conduct an outbreak investigation specific to this situation. Include in your answer a clear case definition **and** the relevant information you have available from Table 1 in **each** step. *(10 marks)*
- b) Analyse the data given to you in the Table and use this to support an hypothesis as to food stuff(s) most likely to be the reservoir for the food poisoning. This requires working out the relevant measures of association and using these to support your hypothesis. In the interests of time, only analyse the data relevant to lunch for this question. Note, no marks will be given for unsubstantiated hypotheses. *(10 marks)*
- c) You are given information on common organisms that cause food poisoning and some of their characteristics (Table 2 and Table 3). Using your answer to question 2 **and** the information in Table 1:
- Provide a strong quantitative argument as to which of the organisms in Table 2 and 3 is most likely to be the cause of the food poisoning *(5 marks)*
 - Give a description of what samples should be collected to confirm your hypothesis **and** how they should be preserved, stored, and shipped to the relevant government laboratory. *(5 marks)*

Question one continued over page

Table 2. Summary of characteristics of the more common causative agents

A. Intoxication		
ORGANISM	INCUBATION	FOODS
<i>Clostridium botulinum</i>	2 h–8 d (1–2 d)	canned or processed meats
<i>Staphylococcus aureus</i>	1–6 h (2–4 h)	ham
B. Infectious		
<i>Bacillus coli</i>	4–24 h (8–16 h)	cream sauces
<i>Clostridium perfringens</i>	8–22 h (9–12 h)	variable
<i>Escherichia coli</i>	12–72 h (variable)	faecal-oral cycle
<i>Salmonella spp.</i>	2–72 h (12–24 h)	poultry
<i>Shigella spp.</i>	1–7 d (2–3 d)	faecal-oral cycle
<i>Streptococcus faecalis</i>	2–18 h (8–12 h)	meat products

Question one continued over page

Table 3: Characteristics of important food poisoning organisms

Organism	<i>Salmonella</i>	<i>Staph. Aureus</i>	<i>C. perfringens</i> & <i>B. cereus</i> (Diarrhoeal type)	<i>B. cereus</i> (Vomiting type)	<i>Campylobacter jejuni</i>	<i>C. botulinum</i>
Source of organism	faeces, water	skin, mucous membranes (nose) of man, subclinical Staph mastitis, septic wounds, discharges	dust, faeces	dust, spores in the air, grain	faeces, water	dust, soil
Incubation	6–48 hours (usually: 12-24 hours)	2–6 hours	8–22 hours	1–5 hours	2–10 days	12–96 hours (usually 18–36 hours)
Duration	2 days	6–24 hours	12–24 hours	12–24 hours	Less than 1 week (20% relapse)	Death in 1–8 days or slow recovery 6-8 weeks
Diarrhoea	Yes (++++)	Common (++)	Yes (++++)	Sometimes (+)	Yes & bloody stools common	Rare
Abdominal pain	+	+	+++	+++	+	Head-/body-ache
Vomiting	Yes	Yes	Rare	Yes	Yes	No
Nervous symptoms	-	-	-	-	-	++++
Other signs and symptoms	Fever, headache, occasionally localised infection or septicaemia	Occasional fever & Headache, Hypotension. Prostration & shock in severe cases	<i>C. perfringens</i> : Fever absent, short duration, abdominal distension & collapse in severe cases. <i>B. cereus</i> : Sudden onset; short duration; no fever	Sudden onset Short duration No fever	Malaise, fever, headache, arthralgia, myalgia	Lassitude fatigue, visual disturbance (diplopia & decrease visual acuity), dysphagia, muscular weakness, constipation

Foods commonly Implicated	Poultry, other meats, eggs, dairy products	Cold meats dairy products, especially ice cream and custard	Preheated meat, especially casseroles, pies, meat pastes, soups	Boiled/fried rice, cereals, spices	Poultry, unpasteurised milk and cream	Bottled/canned foods - meat, fish, vegetables, meat pastes
Type of food Poisoning: Infection, Intoxication	Both occur, infection mainly	Preformed toxin Heat stable	Both occur	Preformed toxin	Infection	Toxin
Prognosis	Ordinarily deaths rare. Morbidity costs high. Typhoid mortality rates 2% treated, higher untreated	Good. Fatalities rare. May on occasion require hospitalisation	<i>C. perfringens</i> Type A: mild self-limiting Type C: more often fatal. Necrotising enterocolitis	Good	Most recover 1 week Infrequently extra intestinal complications; cystitis, pancreatitis, cholecystitis. Rarely death	Up to 65% mortality rate. With good respiratory care & specific antitoxin 15% mortality.

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6. The recent discovery of Japanese encephalitis virus (JEV) infections in populations along the mostly eastern seaboard of Australia has seen emergency responses being activated in both Australia and New Zealand.

Answer **all** parts of this question:

- a) Contextualise key features with respect to the aetiology and epidemiology of JEV to either New Zealand or Australia (specify your choice). *(5 marks)*
- b) Describe the national emergency response mechanisms or frameworks in your country, using JEV as an example. *(20 marks)*
- c) Contrast your response above to the international emergency response obligations Australia has with the current JEV outbreak **and** some VPH measures you would recommend be put in place with respect to tourists **and** neighbouring countries. *(5 marks)*

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7. Bovine brucellosis (brucellosis in cattle) has been eradicated from all states of Australia and New Zealand since the late 1980s. Assume you are a dairy veterinarian practicing in Northern Queensland and have had an abortion storm in a herd of dairy cattle.

Because of the nature of the abortion storm the veterinarian decides to include brucellosis in his list of differential diagnoses and test the herd serologically for brucella antibodies. The laboratory used two diagnostic tests; the Rose Bengal Test (RBT) with a sensitivity (Se) = 81.20% and a Specificity (Sp) = 86.30% and the Indirect ELISA with a Se = 96.00% and Sp = 93.80%.

Answer **all** parts of this question:

- a) The RBT was used for preliminary screening of the sera as it is quick to carry out. Comment on whether this is an appropriate test to use for screening the sera for brucellosis. Rationalise your answer. *(5 marks)*
- b) A few of the sera came up positive for brucellosis on their Rose Bengal Test for Brucellosis. Given that brucella is not supposed to be in the cattle population in Queensland and, if present, the prevalence is likely to be very low, how would you interpret the positive result? *(3 marks)*
- c) Only the positive RBT sera were then tested by the laboratory using the indirect ELISA. What do we call this type of testing using two tests together to make a diagnosis? Will this increase the sensitivity or specificity of the diagnosis? *(2 marks)*
- d) While the veterinarian is waiting for the results to come back from the laboratory, what advice would you give the farmer regarding the cattle herd, the milk and milking process **and** the people and other animals on the farm? *(8 marks)*
- e) Brucellosis is a notifiable disease. Does the veterinarian need to report the disease if they suspect brucellosis? *(2 marks)*
- f) Brucellosis is endemic in many countries and animals with brucellosis are routinely sent to abattoirs for slaughter.
- Evaluate how an animal marked as brucellosis positive should be handled antemortem and the dangers that slaughtering these animals pose to abattoir workers. Include the important critical control points in the slaughter process **and** under what conditions could the meat still be certified fit for human consumption. *(8 marks)*
 - Apart from Brucellosis, select **two (2)** other zoonotic bacterial diseases that could potentially cause large scale abortions in a naïve dairy herd. *(2 marks)*

Continued over page

8. Meat and meat-like products created using genetic technology are emerging on global markets.

Answer **all** parts of this question:

Provide an example of such a product, **and** how it is produced in basic terms. Justify its intended market niche, i.e. what is it trying to achieve as compared to the natural product?. (4 marks)

Evaluate the potential advantages and disadvantages of such a product, as compared to traditional versions of the same product? (6 marks)

In Australia or New Zealand, what would be the main regulatory hurdles related to the development, production, and sale of such a product? (6 marks)

Critique some of the common public perception issues that may work to promote, and/or, inhibit the acceptability of such a product? (6 marks)

There are possibilities that such technologies may be applied to cultured meat, rather than to animals directly. Compare additional benefits and challenges that cultured meat possibly has over the genetically modified animals with respect to food security? (8 marks)

End of Elective B

End of Paper