

2016 MANITOBA ENVIROTHON FIELD TEST Mussels and Borers and Worms, Oh My!

STOP 1

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 1

This question requires materials provided at the stop.

1) Maps are common methods of showing traditional ecological knowledge for an area. Using the map of the Pimachiowin Aki labelled F-A and your knowledge of the Pimachiowin Aki area, list three (3) specific examples of the types of traditional ecological knowledge that might be represented on a map of this area. (1.5 pts)

2) Traditional ecological knowledge shifts over time due to changes on the landscape such as fire and animal movement. When desired animals become more scarce in one area, people join friends and relatives in other areas where those animals are more abundant. In this way, animals and their habitats under stress are able to recover in those areas as hunting is shifted to other areas. When populations return to healthy numbers, harvesting efforts can move back to those areas that have been rested.

Complete the sentence below with the most appropriate word(s). (0.5 pt)

This example of adapting to changing moose population demonstrates _____ management of resources.

Answer:

1) Any 3 of the following specific examples of the general types (1.5 pts - 0.5 pt each)

HARVESTING SITES: berry or medicinal harvest

HUNTING, FISHING AND TRAPPING SITES: Moose or Beaver

HABITATION AND PROCESSING SITES Cabin and Camp sites, travel routes

NAMES PLACES: rivers, camps, land and water features

SACRED AND CEREMONIAL SITES: Pictographs, ceremonies, thunderbird nest

TRAPLINES AREAS

2) Sustainable (0.5 pt)

Reference:

1) Pimachiowin Aki, p 20-58

2) Pimachiowin Aki, p 26-32

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SOILS AND LAND USE (2 pts) – STOP 1

1) Manitoba's Provincial Soil is found in southwestern Manitoba.

- a) What is name of the Soil Series of Manitoba's provincial soil? (0.5 pt)
- b) To what Soil Order does Manitoba's provincial soil belong? (0.5 pt)

2) Choose two (2) of the soil forming factors. Describe how each is different between southwestern Manitoba and here in Pinawa. (1 pt - 0.5 pt each)

Factor	Difference

Answer:

1a) Newdale (0.5 pt)

1b) Chernozem (0.5 pt)

2) Any 2 of the following (must list factor AND correct description) (1 pt - 0.5 pt each)

CLIMATE - Any 1 of the following: SW Manitoba is warmer; drier; more evaporation

ORGANISMS or BIOLOGICAL - Any 1 of the following: SW Manitoba soil developed under grass vs trees or shrubs; SW Manitoba developed with roots in the soil vs. leaf litter above the soil

PARENT MATERIAL - Any 1 of the following: SW Manitoba is shale or alkaline/basic bedrock vs granitic or acidic bedrock; SW Manitoba has different minerology; W Manitoba parent materials from softer rock vs harder rock

TIME - Any 1 of the following: SW Manitoba soils are older - retreat of the glacier was sooner in southwest Manitoba; SW Manitoba soils are older because they were dry at the time Pinawa was covered with waters of Glacial Lake Agassiz.

(There is no correct difference for Landform/Relief/Topography - both could be undulating to choppy)

Reference:

1a) Newdale Soil Series, p 1

1b) Newdale Soil Series, p 2

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2) *Soils and Land Use Document*, p 8-11, 12, 25-27, 41-42; *Soil Facts*, p 6-7; *From the Surface Down*, p 7-10; *Soil Management Guide*, p 8-11

THEME (10 pts) – STOP 1

This question requires materials provided at the stop.

You are a Provincial official responsible for overseeing environmental issues that impact your province. You receive a briefing note from your team (below) indicating that an aggressive aquatic invasive species has been found in a neighbouring province.

BRIEFING NOTE #12345

27 MAY, 2016

TO: ENVIROTHON AQUATICS EXPERT AND TEAM

RE: AQUATIC INVASIVE SPECIES PRESENT IN NEIGHBOURING PROVINCE

- The aggressive aquatic invasive species "*Dreissena polymorpha*" was recently discovered in a neighbouring province
- These organisms are present in waterways that eventually flow into our province
- This species has been shown to have major impacts on other aquatic ecosystems, such as:
 - Increased water clarity
 - Decreased nutrients
 - Extirpation of native species
 - Colonization of hard surfaces including boats, harbours, and industrial equipment
- Organisms can survive out of water for up to 10 days
- Once established, it is not possible to completely eradicate populations of these organisms

1) You and your team do some additional research and speak with a local expert about this organism. The expert shows you a specimen labelled T-A. Based on the briefing note, your knowledge, and Specimen T-A, what is the common name of this invasive species? (1 pt)

2) You recognize that invasive species do not just have the potential to impact your province, but the rest of the country as well.

a) Name the two federal government departments you will need to keep informed of the potential threat of this invasive species on ecosystems in Canada. (1 pt)

b) What document, published by one of these federal departments in July, 2015, may help you to prevent the spread of this invasive species in your province? Circle the best response. (0.5 pt)

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- i) Navigable Waters Regulations
- ii) Forest Health Protection Act
- iii) Agriculture Act
- iv) Aquatic Invasive Species Regulations

3) Accompanying the briefing note is a map labelled T-B (found in the binder at the stop), showing the lakes and streams around the border of your province. Lakes and streams are identified as “invaded” or “not invaded”. Use Map T-B to answer the following questions.

a) Lake B is not connected to an invaded stream. List two (2) possible pathways of invasion that allowed this species to become established in Lake B. (1 pt)

b) **True/False:** Indicate whether the statement is true (T) or false (F) by circling the correct answer. (1.5 pts – 0.5 pt each)

- T F The municipality of Riverbend, which gets its drinking water from the river, will need to be involved in preventing the spread of this invasive species.
- T F The municipality of Lakeview, which relies on commercial fishing, is located far from the current extent of the invasion so it does not need to take action to prevent or prepare for invasion.
- T F Lakes F and G will be primarily protected by provincial and federal governments because they are not close to any municipalities.

4) Your initial response as a provincial government to the threat of this invasive species is to _____. Circle the best response. (0.5 pt).

- a) Try to prevent the entry of this invasive into the province.
- b) Establish invasive species inspection stations at your borders.
- c) Educate the public about what they can do to prevent the spread of this species.
- d) Monitor water bodies connected to the invaded waters to check for presence of the invader.
- e) work with the government of the neighbouring province to address this invasive species issue.
- f) All of the above.

5) Aside from governments, another type of group can get involved with the prevention and mitigation of invasive species. What is this type of group called? (0.5 pt)

6) The United Nations generated a list of guiding principles in 2000 regarding invasive species.

- a) What is this document called? (0.5 pt)
- b) Name the first industrialized country to ratify this document. (0.5 pt)

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c) Are the guidelines presented in this document legally binding? (0.5 pt).

7) The Province of Manitoba has established an education program to help prevent people with boats from spreading this invasive species among water bodies. List the four (4) steps of this program. (2 pt)

8) **True/False:** Indicate whether the statement is true (T) or false (F) by circling the correct answer. (0.5 pt)

T F In Manitoba, individuals are not allowed to possess, transport, or release invasive species.

Answer:

1) zebra mussel (1 pt)

2) a) Fisheries and Oceans Canada; Environment Canada (1 pt - 0.5 pt each)

b) iv. Aquatic Invasive Species Regulations (0.5 pt)

3a) Any 2 of the following: boat ballast water, attached to boat/trailer, dumping of bait bucket, illegal transport, or another appropriate response TBD (1 pt - 0.5 pt each)

3b) T, F, T (1.5 pt - 0.5 pt each)

4) e (0.5 pt)

5) non-government organization or NGO (0.5 pt)

6a) Any 1 of the following: United Nations Environment Programme's Convention on Biological Diversity; United Nations Convention on Biological Diversity (0.5 pt)

b) Canada (0.5 pt)

c) no (0.5 pt)

7) clean, dry, drain, dispose (2 pt - 0.5 pt each)

partial marks: Slow the Spread (0.5 pt)

8) T (0.5 pt)

Reference:

1) Theme Document, p 21, 42

2) Theme Document, p 33

2b) Theme Document, p 33

3a) Theme Document, p 20, 44

3b) Theme Document, p 36

4) Theme Document, p 26, 34-5

5) Theme Document, p 36

6) Theme Document, p 31-32

7) Theme Document, p 46

8) Theme Document, p 35

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WATER AND AQUATIC ECOLOGY (2 pts) – STOP 1

This question requires BOTH materials AND features found at the stop.

The hydrological or water cycle is essential for maintaining the distribution, circulation, and quality of water that supports life and controls climate on our planet. One of processes in the cycle, surface runoff, occurs in the Winnipeg River near this stop.

Look at the diagram labelled A-A, which shows the main processes in the water cycle. The names of four processes have been replaced with red letters. Print the letter from the diagram (A, B, C, or D) beside the appropriate name in the list below. Do not use any letter more than once and do not print in the blanks beside the two processes not labelled on the diagram. (2 pts - 0.5 pt each)

- _____ Condensation
- _____ Dessication
- _____ Evaporation
- _____ Filtration
- _____ Precipitation
- _____ Transpiration

Answer:

Condensation: B (0.5 pt); Evaporation: A (0.5 pt); Precipitation: D (0.5 pt); Transpiration: C (0.5 pt)

If any letter is used twice, no points for either use.

Reference:

Aquatics water and nutrient cycles (page 4)

WILDLIFE (2 pts) – STOP 1

This question requires materials provided at the stop.

Examine the 4 specimens on the table. Indicate whether each animal was male or female. If it is not possible to determine the sex, write "indeterminate." (2 pts)

W-A _____

W-B _____

W-C _____

W-D _____

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Answer:

W-A: Male (Moose) (0.5 pt)

W-B: Undetermined/Female (Caribou) (0.5 pt)

W-C: Undetermined (Cow/Bison) (0.5pt)

W-D: Male (Elk) (0.5pt)

Reference:

Mammals of Manitoba, p 24-26; *Wildlife Document*, p 24

STOP 2

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 2

This question requires materials provided at the stop.

Look at the photo of a kitchen labelled F-A. List the sixteen (16) forest products visible in the image. (2 pts)

Answer:

Any 13-16 of the following (2 pts): clothes made of rayon; paper towel; maple syrup; bioplastics; hardwood floor; fruit - blueberries or apples; LCD screen on phone; wooden cabinetry; magazines; orange juice box; paper wrapped parcels; nail polish; pills; wooden table; paint (on walls); serviettes/napkins

Partial marks:

0.5 pt - 1-4 products

1 pt - 5-8 products

1.5 pts - 9-12 products

Reference:

The State of Canada's Forests (2015), p 9

SOILS AND LAND USE (2 pts) – STOP 2

1) Fungal hyphae are commonly found in soil systems. List two (2) benefits for soils associated with fungal hyphae. (1 pt)

2) Larger soil fauna include earthworms, microspiders, ants, beetles, mites, and termites. List two (2) benefits to soils specifically provided by these larger types of soil organisms. (1 pt)

Answer:

1) Any 2 of the following: Bind soil particles together OR help to form stable soil aggregates; Increase water infiltration rates, which leads to a reduction in soil erosion; Improves soil moisture retention to promote plant growth; Assist plants with extracting soil nutrients (extend

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the root system) OR nutrient cycling OR assist in holding carbon in the soil; Provide food for fungi, bacteria, and nematodes

(1 pt - 0.5 pt each)

2) Any 2 of the following: Shred dry leaves and stems OR assist in decomposing plant residue; Produce by-products that feed smaller organisms; Add to soil biodiversity by carrying smaller organisms (hitchhikers) with them; Movement creates soil pores/channels

Movement promotes mixing of organic and mineral soil components (1 pt - 0.5 pt each)

Reference:

1) Soil Quality Information Sheet, Soil Quality Resource Concerns: Soil Biodiversity, p 1-2

2) Soil Quality Information Sheet, Soil Quality Resource Concerns: Soil Biodiversity, p 1-2

THEME (2 pts) – STOP 2

Briefly describe four (4) ways that invasive species can affect biodiversity. (2 pts)

Answer:

Any 4 of the following: act as new competitor, act as new predator, spread pathogens, act as new parasites, hybrid with native species, alter habitat (2 pts - 0.5 pt each)

Reference:

Manitoba Theme Document, p 12-14

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 2

This question requires materials provided at the stop.

Aquatic plants grow in many forms. Examine the page of photos labelled A-A. Match each of the plants with the description that best matches its structure by writing the appropriate letter in the blank. (2 pts - 0.5 pt each)

- _____ Free floating aquatic plants
- _____ Emergent aquatic plants
- _____ Floating leaved aquatic plants
- _____ Submergent aquatic plants

Answer:

Free Floating aquatic plants: A; Emergent aquatic plants: B; Floating leaved aquatic plants: D; Submergent aquatic plants: C

Reference:

Identifying Aquatic Plants, p 3

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WILDLIFE (10 pts) – STOP 2

This question requires BOTH materials AND features found at the stop.

1) Using the field guides provided, identify the species labelled W-A through W-F. (6 pts - 1pt each)

W-A _____

W-B _____

W-C _____

W-D _____

W-E _____

W-F _____

2) Identify the furs labelled W-G and W-H. (2 pts - 1pt each)

W-G _____

W-H _____

3) Identify the scat labelled W-J and W-K. (2 pts - 1pt each)

W-I _____

W-J _____

Answer:

1) W-A: Long-Eared Owl (1 pt)

W-B: Golden Eagle (1 pt)

W-C: Duck (1 pt)

W-D: Duck (1 pt)

W-E: American Marten/Pine Marten (1 pt)

Partial marks: 0.5 pt - Marten

W-F: River Otter (1 pt)

Partial marks: 0.5 pt - Otter

2) W-G: White-Tailed Deer (1 pt)

Partial marks: 0.5pt - Deer

W-H: American Mink Fur (1 pt)

Partial marks: 0.5pt - Mink

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3) W-I: Red Fox (1 pt)

Partial marks: 0.5pt - Fox

W-J: Any 1 of the following: Squirrel, Red Squirrel, Grey Squirrel (1pt)

Reference:

1) - 3) Ability to use a field guide; Wildlife Training; Mammals of Manitoba; Birds of Manitoba

STOP 3

NATIVE PLANTS AND FORESTRY (10 pts) – STOP 3

This question requires BOTH materials AND features found at the stop.

The trees labelled F-A and F-B at this stop were last measured in 2012 when the Manitoba Envirothon used this site.

Using the equipment provided, take the measurements that are missing on the tally sheet provided at the stop. Record the information in the correct places on the tally sheet and perform the calculations required. Write your team number on the tally sheet and return it with the rest of your test. (10 pts)

Answer:

TBD, including marking range where half points are given for "close" answers.

Reference:

Regional/Provincial Forestry Training

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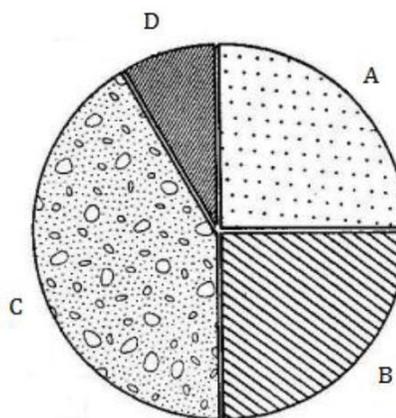
KEY

SOILS AND LAND USE (2 pts) – STOP 3

1) Look at Chart A which shows a breakdown of solid soil and soil pore space components. Write the label that corresponds to each chart segment, based on the proportions shown. (1 pt)

Chart A

- A _____
- B _____
- C _____
- D _____



2) Soil quality is linked to the presence and proportions of the four main soil components. Name the soil component that is reduced by the following factors: microbial oxidation, topsoil erosion, and summer fallowing. (0.5 pt)

3) Complete the sentence with the most appropriate word(s). Blanks may contain more than one word. (0.5 pt)

The composition of the soil pore space is susceptible to factors such as climate change. Climate change is expected to increase air temperatures, as well as the frequency of extreme weather events such as drought. Drier and hotter conditions will _____ nitrogen uptake, which will _____ root growth.

Answer:

1) A: Air or Water; B: Air or Water; C: Mineral Matter; D: Organic Matter (1 pt)

Partial Marks: 0.5 pts - 2 or 3 correct

2) Organic Matter (0.5 pt)

3) decrease, limit (0.5 pt - no partial marks)

Reference:

1) Soils and Land Use Document, p 11

2) Soils and Land Use Document, p 31

3) Soils and Land Use Document, p 51

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THEME (2 pts) – STOP 3

This question requires materials provided at the stop.

- 1) The Red-eared Slider Turtle is a common pet that is often released into the wild. List two (2) effects this turtle may have on the native turtles in Manitoba. (1 pt)

- 2) The animal shown in the photo labelled T-A is an invasive species found in Manitoba.
 - a) Identify the invasive species in Photo T-A. (0.5 pt)

 - b) Name one (1) mechanical method of control that can be used to manage the spread of this species. (0.5 pt)

Answer:

- 1) Any 2 of the following: *Competes for food, competes for habitat, brings foreign diseases into the area* (1 pt - 0.5 pt each)
- 2a) *Wild Boar* (0.5 pt)
- 2b) Any 1 of the following: *trapping, hunting* (0.5 pt)

Reference:

- 1) *Manitoba Theme Document, p 24*
- 2) *Manitoba Theme Document, p 25, 29*

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 3

This question requires BOTH materials AND features found at the stop.

Measure the Secchi depth from the Winnipeg River by following the directions below, and then answer the questions.

Directions:

Put on a provided personal flotation device (PFD).

Go to the outer end on the dock. Watch your footing.

Pay close attention to the depth markings (0.1m = blue, 0.5m = black, 1.0m = red) on the line while determining the Secchi depth. Return the Secchi disk to the stop attendant when finished.

- 1) Record the Secchi depth you measured to the nearest tenth (0.1) of a metre. (1 pt)

_____ metres.

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2) Given what you got for a Secchi depth, how deep do you expect photosynthesis to occur in the Winnipeg River? (0.5 pt)

_____ metres.

3) Examine the graph labelled A-A which shows light versus depth profiles in two lakes (A and B). Circle which is the clearer lake. (0.5 pt)

A B

Answer:

1) TBD (1 pt)

2) 2 to 3 times the measured Secchi depth determined on the day of the field test. (0.5 pt)

3) A (0.5 pt)

Reference:

1) *Aquatic Sampling Techniques*, p 1

2) - 3) *Aquatic Sampling Techniques*, p 1; *Lake Ecology*, p 6

WILDLIFE (2 pts) – STOP 3

1) Define ETHOLOGY. (1pt)

2) Research in this field is wide ranging and can involve many different approaches. Name one (1) of the three approaches described in the Wildlife Document and describe it briefly. (1pt)

Answer:

1) *Ethology is the systematic study of the behaviour of animals in the wild (1pt)*

2) *Any 1 of the following approaches (0.5 pt) PLUS an appropriate description (0.5 pt):*

OBSERVATIONAL (FIELD): animal behaviour is observed in a natural environment without interference.

MANIPULATIVE (FIELD): animal behaviour is observed in a natural environment with some manipulation by the researcher.

MANIPULATIVE (LAB): animal behaviour is studied at zoos or other captive environment.

Reference:

1) *Wildlife Document*, p 56

2) *Wildlife Document*, p 58

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STOP 4

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 4

This question requires BOTH materials AND features found at the stop.

Forest health is affected by pests, and these pests can be grouped by the type of damage they cause to the tree.

1) At the tree labeled F-A. The leaves on the tree labelled F-A have been chewed by a forest pest. What type of forest pest caused this damage? Circle the best response. (1 pt)

- a) Bark beetles
- b) Terminal feeders
- c) Defoliators

2) The feature on the specimen labeled F-B was created by a forest pest.

- a) What is this feature called? (0.5 pt)
- b) What does the insect do to create this feature? (0.5 pt)

Answer:

1. c (1 pt)

2a) Gall (0.5 pt)

2b) produces chemicals causing the tree to form a swelling within which the insect carries out part of its life cycle (0.5 pt)

Reference:

Tree Physiology, p 30

SOILS AND LAND USE (10 pts) – STOP 4

This question requires materials provided at the stop.

After submitting a soil sample to a nutrient testing laboratory, you receive the Soil Test Report from Agvise Laboratories labeled S_A. Using the report, answer the following questions.

1) Indicate the amounts of the following nutrients in the soil sample. Include the correct units!

- a) Nitrate 0-24" (0.5 pt)
- b) Phosphorus (0.5 pt)
- c) Potassium (0.5 pt)

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- 2) Why are the above three nutrients known as macronutrients? (0.5 pt)
- 3) How does nitrogen found in the soil become plant available? (0.5 pt)
- 4) How do phosphorus and potassium found in the soil become plant available? (0.5 pt)
- 5) You are thinking of growing soybeans, a legume in the same family as alfalfa. You notice that there is no recommendation for nitrate application for soybeans even though soil nitrate levels are very low. Explain why there is no recommendation for nitrate for soybeans. (1 pt)
- 6) Soil pH affects the availability of soil nutrients.
- a) What is the pH of this soil from 0-6"? (0.5 pt)
- b) This soil is _____. Circle the best response. (0.5 pt)
- i) Strongly acid
 - ii) Moderately acid
 - iii) Neutral
 - iv) Moderately alkaline
 - v) Strongly alkaline
- c) Briefly describe two (2) specific effects that this pH could have on soil characteristics. (2 pts)
- 7) Soil salinity also affects the availability of soil nutrients. What is the amount of soluble salts in the root zone? (0.5 pt)
- 8) List two (2) major reasons why it is important for agricultural producers to soil test. (2 pts)

Answer:

1a) 29 lb/ac (0.5 pt) or 0 pt without units

1b) 23 ppm (0.5 pt) or 0 pt without units

1c) 230 ppm (0.5 pt) or 0 pt without units

2) nutrients needed by plants in large amounts (0.5 pt)

3) decomposed from organic matter/microorganisms (0.5 pt)

4) weathering of parent material (0.5 pt)

5) Soybeans have nitrogen-fixing bacteria living in root nodules, so they don't need N fertilizer. (1 pt)

6a) 5.3 (0.5pt)

6b) i)

6c) Any 2 of the following: low availability of calcium, magnesium, and phosphorus; the solubility of aluminum, iron, and boron

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is high; and low for molybdenum; many heavy metals become more water soluble under acid conditions and can move downward with water through the soil, and in some cases move to aquifers, surface streams, or lakes; likely to be highly corrosive to concrete; unfavourable environment for microorganisms/plants

7) 0.09 mmho/cm or dS/m (0.5 pt) or 0 pt without units

8) economic reasons (fertilizers cost money, etc) (1 pt) and environmental reasons (runoff, leaching, etc.) (1 pt)

Reference:

1a)-c) material provided

2) - 5) *Soils and Land Use*, p 28

6a) Ability to read and interpret material

6b) *Soil Quality Indicators: pH*

6c) *Soil Quality Indicators: pH*

7) Ability to read and interpret material

8) *Soil Management Guide*, p 52

THEME (2 pts) – STOP 4

Name two (2) invasive species that were intentionally introduced to North America. For each, briefly describe the human activity that helped them become established in their new location. (2 pts - 0.5 pt each)

Species	Human Activity

Answer:

Any 2 of species (1 pt - 0.5 pt each), with the appropriate human activity (1 pt - 0.5 pt each)

GARLICH MUSTARD: brought from Europe to use as an edible herb

STARLINGS: introduced as a project to bring all the birds mentioned in the works of Shakespeare to North America

WILDBOARS: introduced to Manitoba in the early 1980's as an agricultural diversification initiative

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*EUROPEAN BUCKTHORN: used for urban landscaping and in parks
 Other answers may be acceptable*

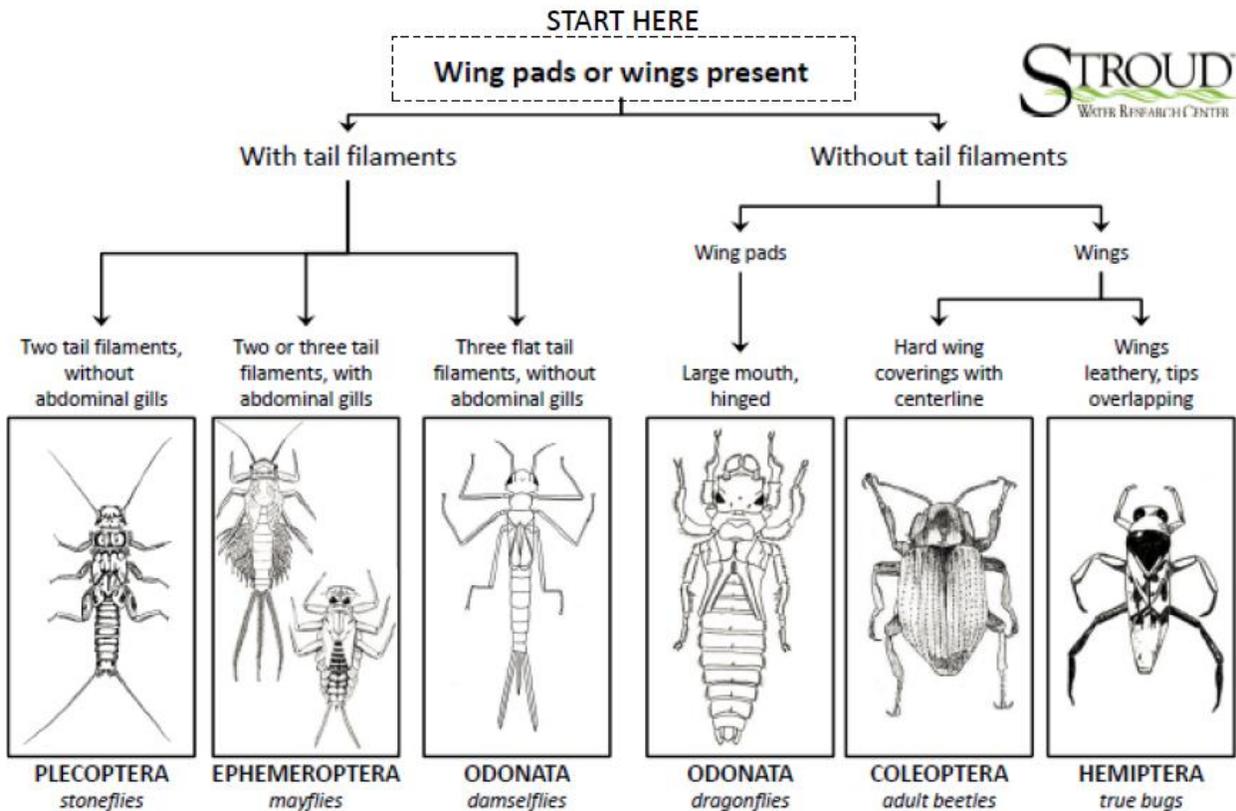
Reference:

Manitoba Theme Document, p 16, 17, 25

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 4

This question requires materials provided at the stop.

1) The organism labelled A-A is the adult stage of an invertebrate that begins its life in the water, belonging to the order Odonata (dragonflies). On the identification key below, trace the path you would follow from the first characteristic (wing pads or wings present) to end up at Odonata (dragonflies). (1.5 pt)



2) Larval organisms in the group Odonata have large, strong, hinged jaws. Based on this information, which material do you think they eat during this stage? Circle the best response. (0.5 pt)

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- a) algae
- b) other invertebrates
- c) aquatic plants
- d) detritus

Answer:

- 1) *without tail filaments --> wing pads --> large mouth, hinged (1.5 pts - 0.5 pt each)*
- 2) *other invertebrates (0.5 pt)*

Reference:

- 1) *Stroud Centre Macroinvertebrate Guide; ability to follow keys; Virtual Training*
- 2) *Lake Ecology, p 31*

WILDLIFE (2 pts) – STOP 4

For each of the pathogens listed below, name one (1) potential host that is specific to that pathogen. (2 pts - 0.5 pt each)

- 1) *Giardia lamblia* : _____
- 2) *White-nose Syndrome*: _____
- 3) *Chronic Wasting Disease*: _____
- 4) *Rabies virus*: _____

Answer:

- 1) *Any 1 of the following: beavers, dogs, cats, sheep, cattle, humans (0.5 pt)*
- 2) *Bats (0.5 pt)*
- 3) *Any 1 of the following: Mule deer, white-tailed deer, Rocky Mountain elk, moose (0.5 pt)*
- 4) *Any 1 of the following: Humans, domestic animals (pets, livestock species), wild animals (skunks, foxes, bats, etc.) (0.5 pt)*

Reference:

- 1) - 4) *Pathogens, Parasites & Disease in Wildlife, p 1-6*

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STOP 5

NATIVE PLANTS AND FORESTRY (10 pts) – STOP 5

This question requires BOTH materials AND features found at the stop.

1) Using the Field Guide to Native Trees of Manitoba, identify the trees labelled F-A, F-B, F-C and F-D. State the full common or scientific name. (4 pts - 1 pt each)

F-A _____

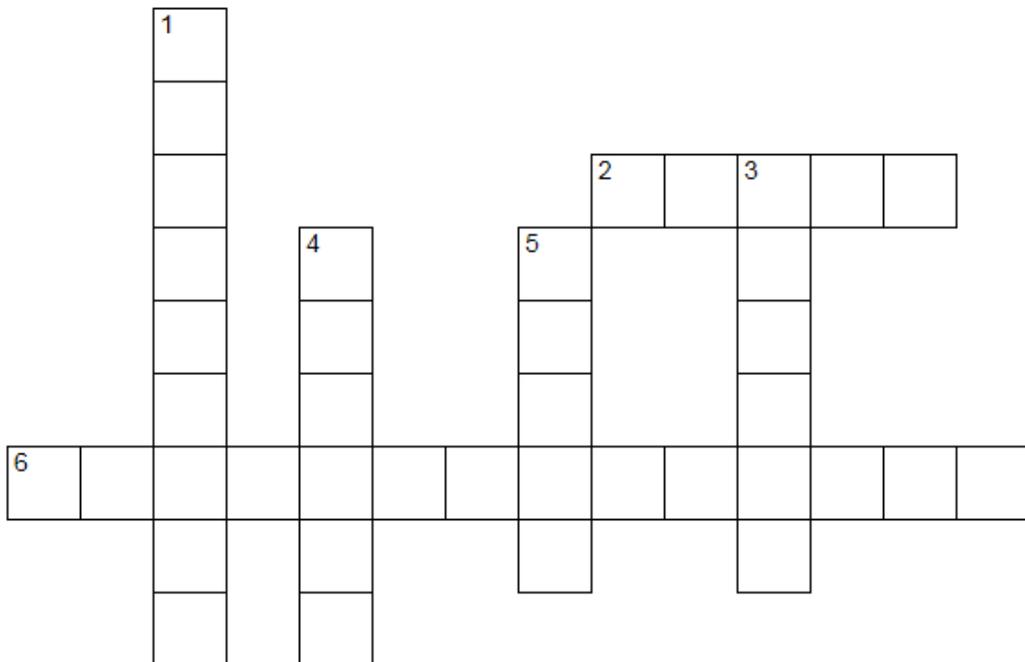
F-B _____

F-C _____

F-D _____

2) Complete the following crossword puzzle. (6 pts - 1 pt each)

Tree Physiology



Across

2. _____ transports water to the crown, but is not necessarily living.

6. _____ is a process unique to green plants and produces sugars, which are "tree food."

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Down

1. Cell walls are made of _____.
3. _____ are the primary site of photosynthesis and the production of hormones and other chemicals in a tree.
4. _____ is the living tissue that transports materials from the crown to the roots.
5. The two main functions of the _____ are transport and support.

Answer:

1) F-A TBA (1 pt)

Partial marks: TBD

F-B TBA (1 pt)

Partial marks: TBD

F-C TBA (1 pt)

Partial marks: TBD

F-D TBA (1 pt)

Partial marks: TBD

2) 1 - Cellulose (1pt); 2 - Xylem (1 pt); 3 - Leaves (1 pt); 4 - Phloem (1 pt); 5 - Trunk (1pt); 6 - Photosynthesis (1 pt)

Reference:

1) *Field Guide to Native Trees of Manitoba*

2) *Tree Physiology*, p 3-5, 7

SOILS AND LAND USE (2 pts) – STOP 5

This question requires features found at the stop.

As evidenced by the 'Mutt Mitts' dispenser, this trail is commonly used for dog walking. Dog urine can be a concentrated source of nitrogen and excess nitrogen can be an environmental concern.

1) What is the most common form of nitrogen in the soil? (0.5 pt)

2) Complete the sentence with the most appropriate word(s). (0.5 pt)

_____ is the process through which nitrogen reaches groundwater.

3) Which one (1) of the following agricultural capability subclasses is susceptible to the process described in 2)? Circle the best response. (0.5 pt)

C

D

E

M

N

P

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4) What is the name of the condition in which high levels of nitrogen in drinking water cause decreased oxygenation in infants? (0.5 pt)

Answer:

- 1) Nitrate or NO₃- (0.5 pt)
- 2) Leaching (0.5 pt)
- 3) M (0.5 pt)
- 4) Blue Baby Syndrome or methemoglobinemia (0.5 pt)

Reference:

- 1) -3) Soil Management Guide, p 52
- 4) Soil Management Guide, p 53

THEME (2 pts) – STOP 5

List two (2) general characteristics of invasive species. Explain why each characteristic gives invasive species an advantage in successfully establishing new populations. (2 pts - 0.5 pt each)

Characteristic	Advantage

Answer:

Any 2 of following characteristics (1 pt - 0.5 pt each) with an appropriate explanation (1 pt - 0.5 pt each)

FEW NATURAL ENEMIES: less predation, competition, pathogens - nothing to slow population growth

HIGH REPRODUCTIVE RATES: fast population growth, range of reproductive strategies

HIGH SURVIVAL: can tolerate wide range of environmental conditions, generalists - use a variety of food sources/pollinators

GOOD DISPERSAL: can distribute into new environments, lack of barriers, predators

AGGRESSIVE COMPETITORS: more effective at obtaining resources like food, water, and/or space (e.g., hunting territory, nesting or denning sites, etc.), avoiding predators, use a wider variety of resources

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Reference:

Manitoba Theme Document, p 9

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 5

This question requires materials provided at the stop.

- 1) List two (2) reasons why healthy riparian areas are valuable. (1 pt)
- 2) Refer to the photo of the Pembina River labelled A-A. Briefly describe two (2) negative impacts on fish that can arise from allowing cattle into the riparian area and stream. (1 pt)

Answer:

1) Any 2 of the following: protection of water quality, protection from erosion, protection of property values, protection from flooding, quality of life, protection of wildlife and fisheries habitat, protection of water supply, breeding, travel corridor, feeding, rearing, aquatic component, cover & shade, water quality, habitat diversity, soil moisture, fertility, nutrient filter, erosion control & temperature control. (1 pt - 0.5 pt each)

2) Any 2 of the following: Lower dissolved oxygen in the water or increased sediment in water can decrease fish spawning success by covering eggs; reduced vegetation and shade over the water may cause the water temperature to increase too high; increased suspended sediment decreases the penetration of light into the water and reduces food supply; suspended sediment in high concentrations irritates the gills of fish, and can cause death, make fish more susceptible to infection and disease; particles can carry toxic agricultural compounds (1 pt - 0.5 pt each)

Reference:

1) *On the Living Edge, p 6-10*

2) *Aquatic Ecology Document, p 39-45*

WILDLIFE (2 pts) – STOP 5

- 1) Briefly describe one (1) wildlife management technique. (1 pt)
- 2) White-tailed deer are the most abundant large mammal in Manitoba, and are commonly found near urban areas.
 - a) Briefly describe one (1) example of human-wildlife conflict involving white-tailed deer. (0.5 pt)
 - b) Briefly describe one (1) way human-wildlife conflict with white-tailed deer can be minimized? (0.5 pt)

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Answer:

- 1) Any 1 of the following: Research, Monitoring, Refuges, Management Areas, Seasons and Bag Limits, Habitat Management and Conservation, Hunting and Trapping, Public Education, Compliance, Cooperative Management Agreements, or Species Introductions. (1 pt)
2a) Any 1 of the following: eat garden or landscape plants, create dangers to human health on roadways, can carry ticks that transmit Lyme disease (0.5 pt)
2b) Any 1 of the following: Do not feed them, put fences around property (0.5 pt)

Reference:

- 1) Wildlife Document, p 33-35
2) Wildlife Document, p 36

STOP 6

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 6

- 1) Pioneer species play important ecological roles.
- a) Define PIONEER SPECIES. (0.5 pt)
 - b) Give one (1) example of a native tree which meets that definition. (0.5 pt)
- 2) Name the two (2) main uses of harvested wood which are considered “long-term storage” of carbon and, as such, do not contribute to an increase of atmospheric CO₂. (1 pt)

Answer:

- 1a) A plant capable of invading bare sites such as a newly exposed soil surface, and persisting there until supplanted by successor species. (0.5 pt)
1b) Any 1 of the following: Jack Pine, Trembling Aspen, Tamarack, Black Spruce (0.5 pt)
2) housing timber, furniture, and others as appropriate (1 pt - 0.5 pt each)

Reference:

- 1) Forestry Document, p 26; Virtual Training
2) What Trees can do to reduce atmospheric CO₂, p 6; Provincial Training

SOILS AND LAND USE (10 pts) – STOP 6

This question requires BOTH materials AND features found at the stop.

- 1) The name of the soil on this site is shown on the sign by the soil pit.
- a) What soil order does the soil belong to? (0.5 pt)

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b) What soil great group does the soil belong to? (0.5 pt)

2) A dilute hydrochloric acid solution is used to find the top of the C horizon in Prairie soils.

a) Use the dilute HCl provided to find the top of the C horizon. Record the approximate depth in cm. (0.5 pt)

b) What is the acid reacting to when it mixes with soil from the C horizon? (0.5 pt)

c) Name one (1) soil forming process that has occurred in the upper part of the C horizon. Describe what has happened in this soil. (1 pt)

3) A Munsell colour chart helps us to classify soil.

a) What is the Munsell colour of the A horizon? (1 pt - 0.5 pt each)

Hue: 10YR

Value: _____

Chroma: _____

b) Dull gray or blue-gray colours and rusty red spots anywhere in the soil profile indicate gleying and mottling. What does this mean? (1 pt)

4) Remove a handful of soil from the A horizon. Try to form a ball. If it is too dry, add water. Use both the soil texturing flow chart and the textural triangle provided to determine the percentages of clay and silt in the sample. Circle the best answer. (1 pt)

a) 60% clay and 20% silt

b) 40% clay and 10% silt

c) 30% clay and 50% silt

d) 10% clay and 20% silt

5) What is the mode of deposition and origin of the parent material of this soil? Circle the best answer. (1 pt)

a) Organic deposit from accumulated dead vegetation

b) Lacustrine deposit from Glacial Lake Agassiz

c) Aeolian deposit originating from beach sand

d) Morainal deposit from granite pulverized by a glacier

6) As you may have noticed, farming is rare in this area.

a) Name two (2) specific agricultural capability limitations of soils in this area (2 pts)

b) Name two (2) land uses that are more suited for the soils of this area. (1 pt)

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Answer:

1a) Soil Order TBD (0.5 pt)

1b) Soil Great Group TBD (0.5 pt)

2a) C Horizon Depth TBD (0.5 pt; up to 10 cm of deviation from our answer is acceptable)

2b) Calcium carbonate (0.5 pt)

2c) One of the following (1 pt - 0.5 pt for process, and 0.5 pt for the description)

TRANSLOCATION: Calcium carbonate is moved from upper layers into the C horizon

TRANSFORMATION: Chemical reactions (reduction and oxidation leading to gleying or mottling) as a result of water being present in the C-horizon.

3a) Value and Chroma of A horizon TBD (1 pt - 0.5 pt each)

3b) Any 1 of the following: temporary or permanent presence of water; poor or imperfect drainage in the soil; oxidation and reduction of iron (1 pt)

4) soil texture of A horizon TBD (1 pt)

5) b (1 pt)

6a) rock and wetness/excess water (1 pt - 0.5 pt each)

6b) Any 2 of the following: recreation (e.g. camping, sports, golf course); residential or urban development; hunting or trapping; set-aside (preserve); forest harvest; wildcraft (collecting plants for food, materials, or medicine) (1 pt)

Reference:

1a) Canadian System of Soil Classification, p A.9

1b) Canadian System of Soil Classification, p A.9

2a)-c) Training, Soils and Land Use Document, p 19-20; Soil Management Guide, p 16-17

3a)-b) Training Soils and Land Use Document, p 16, 19; Soil Management Guide, p 14, 15

4) Training, Soil Management Guide, p 148

5) Soils and Land Use Document, p 8-9; From the Surface Down, p 11-13; Soils and Land Use Document, p 25-26

6a)-b) Soil Management Guide, p 33

THEME (2 pts) – STOP 6

1) Invasive species can impact the ecosystems they invade in many ways, but not all invasive species have the same impacts. From the list below, circle the two (2) impacts that are ONLY characteristic of invasive plants and are not applicable to other types of invasives. (1 pt)

- a) cause extinction of native species
- b) alter the fire regime
- c) alter the hydrology
- d) hybridize with native species
- e) introduce new parasites and pathogens
- f) alter the food web

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2) Briefly explain why aquatic invasive species have the potential to impact new ecosystems more quickly than terrestrial organisms. (1 pt)

Answer:

1) *b, c (1 pt - 0.5 pt each)*

2) *Some variation of: organisms can spread rapidly in aquatic environments due to the fluid nature and connectivity of water bodies. Impacts may be felt throughout the water body as the species disperses. (1 pt)*

Reference:

1) *Manitoba Theme Document, p 14*

2) *Manitoba Theme Document, p 21*

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 6

This question requires materials provided at the stop.

1) Bathymetry is the measurement of water depths at various places in a body of water. When you put those data together you can create bathymetric maps which show water depth all over a water body. As a researcher, you are going in the field to complete a bathymetric survey of the Assiniboine River to help map the floodplain. This is an important step in understanding where water will flow during a flood.

In order to provide the most accurate description of the river bottom and river banks, the water level must be low. What is the best time of year to complete this survey? (0.5 pts)

2) Culverts (the metal pipes between ditches under roads) help to move water across our landscape. Their size is determined based on the drainage area of the watershed that will be flowing through it. If a culvert is too small, water can back up and cause damage or flooding.

a) Look at the diagram of a watershed labelled A-A. Determine the area of the watershed using the equation provided below (1 pt).

Area of watershed = (number of dots within watershed) + (0.5 x (number of dots that fall on the watershed boundary))

b) Based on the area you determined in 2a) and the information provided in the table below, what size of culvert should be installed at the location indicated on the map? (0.5 pts)

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Watershed Area	Size of Culvert
0 – 40 km ²	5.5 feet
40km ² – 80 km ²	9.75 feet
80 km ² – 120 km ²	14.25 feet
120 km ² – 160 km ²	18.50 feet

Answer:

- 1) late summer/fall (0.5 pt)
2a) $100 + 12/2 = 106 \text{ km}^2$ (1 pt)
Partial marks: 0.5 pt - plus or minus 10 km²
2b) 14.25 feet (0.5 pt)

Reference:

- 1) *Aquatic Ecology*, p 16
2a) *How to Read a Topographic Map and Delineate a Watershed*, p 3-4
2b) Ability to follow directions and read a table

WILDLIFE (2 pts) – STOP 6

This question requires materials provided at the stop.

- 1) List two (2) physical features that can be used to identify a bird. (1 pt)
- 2) Look at the skull labelled W-A.
- a) Is the skull representative of a bird of prey? (0.5 pt)
- b) Explain how you know. (0.5 pt)

Answer:

- 1) Any 2 of the following: Plumage, size, how does it fly, shape of the wings, length of legs, shape of tail or bill. (1 pt - 0.5 pt each)
2a) no (0.5 pt)
2b) the bill/beak is not made for tearing flesh (0.5 pt)

Reference:

- 1) *Birds of Manitoba*, p 3-6
2) *Birds of Manitoba*, p 11-15, 16-21

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KEY

STOP 7

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 7

Multiple Choice: Which of the choices is correct? Circle the best response. (2 pts - 0.5 pt each)

1) The term "carbon cycle" refers to the movement of carbon from the land and water through the atmosphere and living organisms. When forests remove carbon from the atmosphere through photosynthesis, where is the carbon stored?

- a) leaves, roots
- b) stems, branches
- c) stems, branches and roots
- d) branches, leaves and fruit

2) Forests are a vital part of the carbon cycle, and release carbon when _____ .

- a) a forest dies
- b) a forest decays
- c) a forest burns
- d) All of the above release carbon.

3) A forest is considered a carbon sink if _____ .

- a) it absorbs more carbon than it releases
- b) unexplained sinkholes develop
- c) it expels more carbon than it consumes.
- d) it suddenly starts to stop growing

4) What major change occurred recently for the international greenhouse gas (GHG) reporting rules with respect to harvested wood products?

- a) Net GHG balance of non forested ecosystems and harvested wood products are measured separately.
- b) Net GHG balance of forested ecosystems and harvested wood products are measured separately.
- c) Net GHG balance of forested ecosystems and harvested wood products are measured together.
- d) Net GHG balance of harvested wood products are measured.

Answer:

1) c (0.5 pt)

2) d (0.5 pt)

3) a (0.5 pt)

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KEY

4) b (0.5 pt)

Reference:

1) - 4) *The State of Canada's Forests (2015), p 34*

SOILS AND LAND USE (2 pts) – STOP 7

This question requires features found at the stop.

At this stop, you will notice a well used walking path.

- 1) What form of soil degradation has been caused by the walking path? (0.5 pt)
- 2) List one (1) observable characteristic of this degradation. (0.5 pt)
- 3) Provide one (1) method that can reduce this degradation and is applicable to this trail. (0.5 pt)
- 4) *Complete the sentence with the most appropriate word(s).* (0.5 pt)

This type of soil degradation increases _____, which is a concern as the path is close to the lake.

Answer:

- 1) *Compaction (0.5 pt)*
- 2) *Lack of vegetation (0.5 pt); other answers may be possible, will have to double check the site*
- 3) *Any 1 of the following: reduce traffic in the area; maintain or increase organic matter in the soil (0.5 pt)*
- 4) *Runoff (0.5 pt)*

Reference:

1) - 4) *Compaction (USDA, NRCS, Soil Quality Information Sheet)*

THEME (2 pts) – STOP 7

This question requires features found at the stop.

In Manitoba, most species of earthworms are invasive.

- 1) Describe the primary effect that earthworms have on forest ecosystems. (0.5 pt)
- 2) List two (2) reasons why that effect is a concern. (1 pt)
- 3) Briefly describe one (1) way human activity evident at this stop could increase the spread of earthworms. (0.5 pt)

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Answer:

- 1) *Disappearance or decomposition of the forest floor (0.5 pt)*
- 2) *Any 2 of the following: loss of habitat/biodiversity, soil erosion, loss of C sequestration, changes in nutrient cycling, susceptibility to drought (1 pt - 0.5 pt each)*
- 3) *Any 1 of the following: Human-driven fragmentation of forests, building home sites with gardens and plants (imported soil), fishing (0.5 pt)*

Reference:

- 1) *Earthworm Invaders Have Huge Implications for Forest Health, p 1*
- 2) *Earthworm Invaders Have Huge Implications for Forest Health, p 1-2*
- 3) *Earthworm Invaders Have Huge Implications for Forest Health, p 2-3*

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 7

This question requires materials provided at the stop.

A typical lake has distinct zones, each with specific conditions that affect the biological community. Look at the diagrams labelled A-A and A-B to answer the following questions.

- 1) Which image shows lake zones defined by temperature? Circle the correct choice. (0.5 pt)

A B

- 2) In which zone would you most likely find a population of invertebrates? (0.5 pt)
- 3) In which zone would you find the thermocline? (0.5 pt)
- 4) In which zone does photosynthesis occur? (0.5 pt)

Answer:

- 1) *A (0.5 pt)*
- 2) *Benthic zone (0.5 pt)*
- 3) *Metalimnion (0.5 pt)*
- 4) *Photic or euphotic zone (0.5 pt)*

Reference:

- 1) *Lake Ecology, p 9.*
- 2) *Lake Ecology, p 19*
- 3) *Lake Ecology, p 9*
- 4) *Lake Ecology, p 19*

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KEY

WILDLIFE (10 pts) – STOP 7

This question requires BOTH materials AND features found at the stop.

As a wildlife biologist you have been tasked with determining the local population of geese within Pinawa Park. You will estimate the goose population using the quadrat sampling method. To do so, you will count fresh goose scat. A goose defecates an average of 60 times per day.

The survey is being taken in a 10m x 125m area near the marina. There are 5 sample quadrats in this area. Each sample quadrat is 1m x 1m. Each pipe cleaner (or other substitute) represents one fresh goose poop.

Collect the data from the quadrats and record it below. Then, calculate the estimated size of the goose population.

Be sure to include units, and clearly show your work.

1) Number of scats in each 1m x 1m quadrat. (2.5 pts - 0.5 pt each)

Sample 1 _____

Sample 2 _____

Sample 3 _____

Sample 4 _____

Sample 5 _____

2) Total number of scats in sample quadrats. (0.5 pt)

3) Average number of scats per m^2 . (2 pts)

4) Total area of survey plot. (1 pt)

5) Estimated total number of scats in survey plot. (2 pts)

6) Estimated population of geese in survey plot. (2 pts)

Answer:

1) 4, 4, 5, 5, 5 (in any order) (2.5 pts - 0.5 pt each)

2) 23 scats (0.5 pt)

3) 23 scats/(5 x 1m x 1m) (1 pt); = 4.6 scats/ m^2 (1 pt)

4) 25m x 50m = 1250 m^2 (1 pt)

5) 1250 m^2 x 4.6 scats/ m^2 (1pt); = 5750 scats (1 pt)

6) 5750 scats/60 scats per day per goose (1 pt); 95.8 geese (95 or 96 accepted) (1 pt)

Reference:

1) - 6) Wildlife Document, p 48-49

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KEY

STOP 8

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 8

This question requires materials provided at the stop.

1) Look at the specimens labelled F-A. These cones are closed by waxy materials and open up with heat. What species of tree makes this type of cone? (0.5 pt)

2) List the three (3) components which need to exist for fire to occur. (1.5 pts)

_____ + _____ + _____ = FIRE

Answer:

1) *Jack Pine (0.5 pt)*

2) *Fuel, Oxygen and Heat (1.5 pts - 0.5 pt each)*

Reference:

1) *Forest Ecology 2, p D-8*

2) *Forest Fire, p S-2*

SOILS AND LAND USE (2 pts) – STOP 8

1) You are walking in a field near a river, along the top of its' banks. Erosion of the bank has exposed the soil profile. You notice that a darker and relatively uniform soil layer near the top of the profile is overlaid by a less dense stratified layer. What mode of deposition most likely created the stratified layer? (1 pt)

2) Parent material is a key factor in soil formation. In Manitoba, the most common type of parent materials are granite, shale, and limestone. Draw a line connecting each parent material to each of the soil textures associated with it. Each texture type may be used more than once. (1 pt)

<u>Parent Material</u>	<u>Soil Texture</u>
granite	sand
shale	silt
limestone	clay

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Answer:

1) Alluvial deposition (1 pt)

2) Granite - Sand; Shale - Clay; Limestone - Sand, Silt, Clay (1 pt)

Partial Marks: 0.5 pts - 2 parent materials correct

Reference:

1) Soil Quality Information Sheet, Soil Quality Resource Concerns: Sediment Deposition on Cropland, p 1-2; Manitoba Envirothon Soils & Land Use, p 25

2) Manitoba Envirothon Soils & Land Use, p 8

THEME (2 pts) – STOP 8

Invasive species use many mechanisms of dispersal into new ecosystems, including natural range expansion. List four (4) ways in which humans may accidentally assist dispersal mechanisms and cause the spread of invasive species. (2 pts)

Answer:

Any four (4) of the following: ballast water, hull fouling, transporting contaminated forest products, packing materials, making canals and changes to waterways, movement of equipment, construction equipment, all-terrain vehicles, movement of diseased wildlife and animal byproducts, escape of non-native wildlife in captivity (e.g., exotic pets), transportation of topsoil, recreational and commercial boating and fishing, or other acceptable answers not listed here (2 pt - 0.5 pt each)

Reference:

Manitoba Theme Document, p 20

WATER AND AQUATIC ECOLOGY (10 pts) – STOP 8

This question requires BOTH materials AND features found at the stop.

The Winnipeg River, which drains a large region of the Precambrian Shield in northwestern Ontario and eastern Manitoba, is normally the largest supplier of water to Lake Winnipeg. However, during periodic flooding events in the Red and Assiniboine River watersheds, the Red River can briefly become the largest supplier of water to Lake Winnipeg. Follow the directions below to collect and test a sample of water from the Winnipeg River.

Directions:

Put on a personal flotation devices.

Use a small jar to dip a sample of Winnipeg River water from the nearby dock and return it to the table where the filtration apparatus is located.

Install a clean filter paper in the filtration apparatus and carefully filter 100 mm of this Winnipeg River water

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Note the colour and consistency of both the residue collected on the filter and the filtrate collected in the flask below the filter.

Carefully remove the used filter paper and save it in the plastic container provided.

A second filter, containing residue from the Red River in Winnipeg, is on display at the table. Note any similarities and/or differences between the Red River filter residue and the filtered residue that you have just collected.

- 1) What is the primary purpose of filtering raw water when conducting a chemical analysis of an aquatic system? (1 pt)
- 2) In which fraction (residue or filtrate) would we expect to find dissolved nutrients? (1 pt)
- 3) The Red River and the Winnipeg River flow through different landscapes.

- a) On which of the two filters (Red River or Winnipeg River) do you observe the most residue? (1 pt)
- b) From your knowledge of the land each river flows through, list one (1) landscape characteristic for each river that explains the amount of residue found on its corresponding filter. (2 pts - 1 pt each)

Winnipeg River: _____

Red River: _____

- c) List two (2) types of particles that would typically be a significant component in the residue from the Red River. (1 pt)
 - d) List two (2) types of particles that would typically be a significant component in the residue from the Winnipeg River. (1 pt)
- 4) Both the Red River and the Winnipeg Rivers are major tributaries of Lake Winnipeg.
 - a) Which of these rivers would you expect to deliver the most sediment to that lake per cubic meter of flow? (1 pt)
 - b) What additional information would you require in order to calculate the total input of sediment to Lake Winnipeg from each river over a given time period. (1 pt)

5) **True/False:** Indicate whether each of the following statements is true (T) or false (F) by circling the correct letter. (1 pt - 0.5 pt each)

- T F Nitrogen may be present in both dissolved and particulate fractions of a water sample.

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KEY

T F Dissolved phosphorus is more readily available for stimulating algal growth than is particulate phosphorus.

Answer:

- 1) Separation of the dissolved and particulate fractions of various chemicals in the raw water (1 pt)
- 2) filtrate (1 pt)
- 3a) Red River (1 pt)
- 3b) Any 1 of the following for Red River watershed: extensive deep, erodible clay soils; more constant flows with few lakes or reservoirs (1 pt); PLUS any 1 of the following for Winnipeg River watershed: thin soils; extensive exposed bedrock; numerous lakes/reservoirs to slow flow rates (1 pt)
- 3c) Any 2 of the following: soil or clay particles, zooplankton, organic debris (1 pt - 0.5 pt ea)
- 3d) Any 2 of the following: phytoplankton or algae, zooplankton, organic debris (1 pt - 0.5 pt ea)
- 4a) Red River (1 pt)
- 4b) Average river flow rates or volume of water input to lake by each river over the time span (1 pt)
- 5) T, T (1 pt - 0.5 pt each)

Reference:

- 1) Aquatic Sampling Techniques, p 3-4; Think Trees TV: Chemical Considerations; Provincial Training
- 2) Aquatic Sampling Techniques, p 3-4; Think Trees TV: Chemical Considerations; Provincial Training
- 3a) Visual observation of filters
- 3b) Aquatic Ecology: Rivers, Sculpting the Earth, p 15-16; Erosion and Sedimentation, p 44; General knowledge of regional watersheds
- 3c) -3d) Think Trees TV: Chemical Considerations; Provincial on-site training
- 4a) Deduction based on observation of filters; Provincial Training
- 4b) Deduction based on preamble information on flows; Aquatic Ecology: Rivers, Measuring River Flows, p 16; Suspended Sediment Load, p 47
- 5) Water Quality Testing: 5: Nitrates, p 10; Water Quality Testing: 6: Total Dissolved Solids & Salinity, p 13; Water Quality Testing: Testing for Phosphorus, p 17; 6: Total Dissolved Solids & Salinity, p 13

WILDLIFE (2 pts) – STOP 8

This question requires materials provided at the stop.

- 1) Look at the specimen labelled W-A. State the common name of this species. (1 pt)
- 2) Briefly describe one (1) defense mechanism commonly used by this species. (1 pt)

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KEY

Answer:

1) *Western Hognose Snake (1 pt)*

Partial marks: 0.5 pt Hognose Snake

2) *Any 1 of the following: rolling over and playing dead, mimicking sound of rattlesnake (1 pt)*

Reference:

1) -2) *Herpetology Guide, p 23*

STOP 9

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 9

1) What material made by a tree is the main component of wood? (0.5 pt)

2) List the three (3) growth zones on a tree. (1.5 pts)

Answer:

1) *Cellulose (0.5 pt)*

2) *the twig tips (branch meristem), the root tips (root meristem) and around the outside of the trunk, branches and roots (cambium) (1.5 pts - 0.5 pt each)*

Reference:

1) *Tree Physiology, p 7*

2) *Tree Physiology, p 8*

SOILS AND LAND USE (2 pts) – STOP 9

This question requires materials provided at the stop.

Use the soil sample labelled S-A to answer the following questions.

1) What the soil texture? (1 pt)

2) What parent material is most likely to be the source of this soil? (0.5 pt)

3) Does this soil have a low, moderate or high infiltration rate? (0.5 pt)

Answer:

1) *TBD, including partial mark distribution (1.0 pt)*

2) *TBD (0.5 pt)*

3) *TBD (0.5 pt)*

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Reference:

- 1) *Soils and Land Use*, p 17
- 2) *Soils and Land Use*, p 9
- 3) *Soil Quality Indicators: Infiltration*

THEME (10 pts) – STOP 9

- 1) There are generally considered to be four stages of invasive species cycles or plans.
 - a) List the four (4) stages of invasive species management cycles or plans. (4 pts)
 - b) Which stage is the most cost-effective? (1 pt)
- 2) There are four things that should be considered when deciding what areas to prioritize for invasive species management. Briefly describe three (3) of these considerations. (3 pts)
- 3) Dutch elm disease is an example of a pest that has been managed in Manitoba for a long time. List two (2) important components of Dutch elm disease management. (1 pt)
- 4) Gypsy moth is an example of a more recent arrival in Manitoba. The Manitoba government responds to new detections of gypsy moth with eradication programs. Gypsy moth can be very damaging to the natural environment and can also have economic impacts. What economic impact could there be for Manitoba businesses if gypsy moth were to become established in the province? (1 pt)

Answer:

- 1a) *Preventing invasive species, detecting invasive species, response and control of detected invasive species, long-term management of invasive species (4 pts - 1 pt each)*
- 1b) *Preventing invasive species (1 pt)*
- 2) *Any 3 of the following: protect areas where invasive species are absent or just appearing, protect rare species and communities, protect important habitats and land values, cost and effort (3 pts - 1 pt each)*
- 3) *Any 2 of the following: surveillance, pesticides, sanitation (1 pt - 0.5 pt each)*
- 4) *Any 1 of the following: trade restrictions/quarantines for xmas trees, logs, or nursery plants (1 pt)*

Reference:

- 1a) *Manitoba Theme Document*, p 26-29
- 1b) *Manitoba Theme Document*, p 26
- 2) *Manitoba Theme Document*, p 29
- 3) *DED Management in Manitoba*
- 4) *Gypsy Moth*

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WATER AND AQUATIC ECOLOGY (2 pts) – STOP 9

This question requires materials provided at the stop.

- 1) Use the Key to Manitoba Sport Fish to identify the species of the fish labelled A-A. (1 pt)
- 2) Using the instructions for identifying external features of fish found on the Key to Manitoba Sport Fish, name the two features identified with tags labelled A-B and A-C. (1 pt - 0.5 pt each)

A-B: _____

A-C: _____

Answer:

- 1) TBD
 - 2) A-B: TBD
- A-C: TBD

Reference:

- 1) - 2) *Key to Manitoba's Sport Fish; Virtual Training*

WILDLIFE (2 pts) – STOP 9

This question requires materials provided at the stop.

- 1) Refer to the equipment labeled W-A and W-B to answer the following questions.
 - a) Give one (1) example of an animal that is commonly tracked using the object labeled W-A. (0.5 pt)
 - b) Give one (1) example of an animal that is commonly tracked using the object W-B. (0.5 pt)
- 2) List two (2) examples of information you could gather by tracking and monitoring wildlife? (1 pt)

Answer:

- 1a) *Bats (0.5 pts)*
- 1b) *Either of the following: Caribou, Polar Bear (0.5 pts)*
- 2) *Any 2 of the following: Tracking migration routes, estimating population size, monitoring populations (1 pt - 0.5 pts each)*

Reference:

- 1) *Wildlife Document, p 33-35*

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2) *Wildlife Document, p 36*

STOP 10

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 10

- 1) What is the name of the Act that protects Manitoba's trees against forest threats? (1 pt)
- 2) According to the above mentioned Act's Regulations, when is pruning elm trees prohibited? Circle the best response. (1 pt)
 - a) December 1 - March 31
 - b) March 1 - June 30
 - c) April 1 - July 31
 - d) May 1 - August 30

Answer:

- 1) *Manitoba's Forest Health Protection Act (1 pt)*
- 2) *c (1 pt)*

Reference:

- 1) *Manitoba's Forest Health Protection Act*
- 2) *Manitoba's Forest Health Protection and Regulations, p 7*

SOILS AND LAND USE (2 pts) – STOP 10

Which four (4) of the following statements are true? Circle all correct responses. (2 pts)

- a) Tillage decreases erosion.
- b) Tillage erosion causes lower yields on top slope positions.
- c) Cover crops can be used with other crops to decrease erosion from wind and water.
- d) Shelterbelts are being removed to decrease water erosion on flat land.
- e) Based on texture, cloddy soil is more susceptible to erosion than single grained soil.
- f) Doubling the length of slope increases soil loss by 1.5 times.
- g) Flat stubble is more effective than standing stubble at preventing water erosion.

Answer:

- 1) *b, c, f, g (2 pts - 0.5 pt each)*

Reference:

Soil Management Guide, p 87-89

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THEME (2 pts) – STOP 10

Education and outreach programs can be helpful in limiting the spread of invasive species.

1) Name one (1) invasive species education or outreach program in Manitoba that is important for preventing the spread of invasive species into the Pinawa region. (1 pt)

2) Briefly describe one (1) advantage and one (1) disadvantage to using invasive species education and outreach programs. (1 pt)

Answer:

1) Slow the Spread zebra mussel campaign (1 pt). Other responses may be accepted.

2) Any 1 of the following advantages: Can prevent or reduce invasion, brings awareness, citizens can gather more information (ie "citizen science"), early detection, acceptance of the actions needed to protect our valuable resources (0.5 pt) PLUS Any 1 of the following disadvantages: Cost, cost:benefit ratio, may not accomplish anything (0.5 pt)

Reference:

1) Manitoba Theme Document. p 46

2) Manitoba Theme Document, p 10, 36, 41

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 10

This question requires features found at the stop.

1) The Winnipeg River is flowing next to the trail test site. Rivers and streams provide a particular type of aquatic habitat that is different from habitats found in lakes and ponds. The list below identifies several characteristics of aquatic habitats. Circle the two (2) characteristics that are specifically associated with rivers and streams. (1 pt - 0.5 pt each)

- a) well oxygenated/aerated water
- b) still water
- c) stratified water
- d) fast flowing water
- e) anoxic water

2) Fast-flowing waters can have high concentrations of suspended particulates (turbidity) because the water moves quickly enough to carry the particles along.

- a) Does such an environment favor organisms that rely on sight to forage, or organisms that rely on other senses? (0.5 pt)
- b) Give one (1) reason for this. (0.5 pt)

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Answer:

1) a, d (1 pt - 0.5 pt each)

2a) organisms who rely on other senses (0.5 pt)

2b) some variation of: it's difficult to see in turbid water (0.5 pt).

Reference:

1) *Aquatic Ecology Document*, p 8-9

2) *Aquatic Ecology Document*, p 55, and ability to reason

WILDLIFE (10 pts) – STOP 10

This question requires BOTH materials AND features found at the stop.

You are a Wildlife Technician and are working on a project site out in the field. All of the data you collect and observations you make regarding this site must be recorded in your field notes. The data you have already collected is displayed on the table. There is one remaining site of interest flagged in the field that needs the UTM coordinates recorded.

Using the GPS Unit, and other equipment provided, complete your field notes for the day on the sheet provided at the stop. Include information from the items collected on the table as well as from your visual observations. (10 pts)

*Points will be given for full details and legibility.

Answer: Next page

Reference:

Wildlife Document, p 47; *Wildlife Training*

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Field Notes		0.5pt If Legible
<u>Individual Observers:</u> Justin Reid	<u>Project Name:</u> Envirothon 2016	0.5
Site Information		
Site Name	Stop 11	0.5
Site Location	Pinawa	
Habitat Type	Mixed Forest	
0.5pt for All Filled		
Observation Time	Site Weather Information	
0.5	Observation Date (DD/MM/YY) 23/05/2016	Air Temperature (oC) 15 oC
	Time Of Day (24 Hr Clock) 14:35	Wind Speed (KPH) 1mph=1.61kph 8.05 kph
	0.5pt for All Filled	Wind Direction (Degrees) 360o
	GPS Coordinates (UTM)	Cloud Cover (%) 25%
2	W-A 14U 538167 m E 5451197 m N	Precipitation in Past 24 Hrs (Yes/No) No
	0.5pt each for correct E, N, Zone, & Units	Precipitation in Past 3 Days (Yes/No) Yes
		1pt for All Filled, 0.5pt for Partially Filled
Data & Site Observations		
	<ul style="list-style-type: none"> - Observed Deer Antlers near tree at marker labelled W-A - Observed Troll Doll near rock on site - Observed Snake at base of tree on site - Observed Birds Nest in tree on site 	2
	At least 4 Observations Recorded (0.5pts each - max 2)	
1	Species Observed	Photos Taken
	<ul style="list-style-type: none"> - White Spruce - Red Oak 	<ul style="list-style-type: none"> - Photo was taken of Antlers at marker W-A
	At Least 2 Species Recorded (0.5pt each - max 1)	Record Photo Taken (0.5pt) & what it was taken of (0.5pt)
0.5	Invasive Species Present	Site Water Samples
	<ul style="list-style-type: none"> - No Invasive Species were observed 	Water Samples Taken (Yes/No) No Water Sample ID Numbers: N/A N/A
	Record if Invasives present or not and which spp (0.5pt)	0.5pt for All Filled
10		

- 0.5 Points Will Be Awarded For Legibility
- 0.5 Points Will Be Awarded For Observers & Project Name (Both Fields Must Be Filled)
- 0.5 Points Will Be Awarded For Site Information (All Fields Must Be Filled)
- 0.5 Points Will Be Awarded For Observation Time (Both Fields Must Be Filled - Correct Units/Format Must Be Used)
- 1 Point Will Be Awarded For Weather Observations (All Fields Must Be Filled - Correct Units Must Be Used)
- 2 Points Will Be Awarded For GPS Coordinates - 0.5 Point Each For Easting, Northing, Proper Units, and Zone
- 2 Points Will Be Awarded For Data & Site Observations - At Least 4 Observations Must Be Recorded (0.5 Points Each)
- 1 Point Will Be Awarded For Species Observed - At Least 2 Observations Must Be Recorded (0.5 Points Each)
- 1 Point Will Be Awarded For Photos Taken - Must Record if Photos were taken (0.5pt) and what they were taken of (0.5pt)
- 0.5 Points Will Be Awarded For Invasive Species Information (At Least One Species Present Must Be Recorded Or "No Inv. Seen")
- 0.5 Points Will Be Awarded For Site Water Sample Information (Must Record if No Samples Were Taken)
- 10 Points Total Will Be Awarded For Completion Of The Field Notes Sheet With All Required Information & Units/Formats

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STOP 11

NATIVE PLANTS AND FORESTRY (10 pts) – STOP 11

This question requires materials provided at the stop.

1) While fire is a destructive force to individual trees and other life, it is an important ecological process in that it rejuvenates our boreal and mixed-woods forests. Manitoba has collected data, mapped and designated Fire Protection Zones to prioritize action in the case of a wildfire. These zones are designated as follows:

AZ - Agriculture Zone

OZ - Observation Zone

PPZ - Primary Protection Zone (High, Medium, Low)

Indicate how each of the areas on the map labelled F-A would be classified as a Fire Protection Zone (AZ, OZ or PPZ). (4 pts - 1 pt each)

Zone A: _____

Zone B: _____

Zone C: _____

Zone D: _____

2) Complete the sentence below with the most appropriate words. (2 pts - 1 pt each)

Fire can benefit forests and is an important ecological process because it releases _____ and stimulates new _____.

3) During the fire season (from April 1st to October 31st) people working in the forest need to consider implementing fire safety Best Management Practices (BMP). Circle the four (4) best examples from the list below that describe BMP to follow for the fire season. (2 pts)

- a) Submit daily employee list and work schedule to the Canadian Interagency Forest Fire Centre
- b) Inspect fire extinguishers daily
- c) Train employees in the use of fire suppression equipment
- d) Harvest only close to water bodies
- e) Patrol for 1 hour after operations shut-down.
- f) Have a documented emergency fire response plan that includes fire reporting phone numbers.
- g) Use only machines that do not require gasoline
- h) Cancel company picnics

4) **True/False:** Indicate whether the statement about afforestation and deforestation is true (T) or false (F) by circling the correct answer. (2 pts - 0.5 pt each)

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- T F Afforestation is the action of replanting existing forest land.
T F Deforestation is the clearing of forests to make way for new, non-forested land uses.
T F Permanent forestry access roads result in thousands of hectares of deforested area in Canada each year.
T F Naturally caused additions and removals of tree cover are considered neither deforestation or afforestation.

Answer:

- 1) A: PPZ, B: OZ, C: PPZ, D: AZ (4 pts - 1 pt each)
2) Any 1 of the following: nutrients, phosphorus, calcium, potassium (1 pt) PLUS growth (1 pt)
3) b, c, e, and f (2 pts - 0.5 each)
4) F, T, T, T (2 pts - 0.5 pt each)

Reference:

- 1) - 2) *Forestry Document*, p 5-11
3) *Best Management Practices*, p 51, 52
4) *State of Canada's Forests*, p 20, 23

SOILS AND LAND USE (2 pts) – STOP 11

The Provincial Soil of Manitoba is the Newdale clay loam.

True/False: Indicate whether each statement about Newdale soil is true (T) or false (F) by circling the correct answer. (2 pts – 0.5 pt each)

- T F The Newdale soil is an Orthic Black Chernozem.
T F The Newdale soil is used for peat production for sod farms.
T F The Newdale soil is an Orthic Humic Gleysol.
T F The Newdale soil is commonly used for cultivated crop production.

Answer:

T, F, F, T (2 pts - 0.5 pt each)

Reference:

Soil Management Guide, p 41

THEME (2 pts) – STOP 11

You are an environmental scientist working for a consulting company that specializes in ecosystem approaches to invasive species. You have just been contacted by Mitchell Timberman,

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a farmer in Western Manitoba, who has been growing soybeans on his 200-acre farm for 35 years. His crop is clearly failing. You suspect it is Soybean Cyst nematode.

- 1) Name one (1) crop symptom that led you to this conclusion. (0.5 pt)
- 2) Name one (1) example of a cultural control method for this problem. (0.5 pt)
- 3) Name one (1) example of a biological control method for this problem. (0.5 pt)
- 4) What control method would you recommend to Mitchell? Explain why. (0.5 pt)

Answer:

- 1) Any 1 of the following: stunted growth, yellow leaves, roots that are dwarfed, discoloured, covered in white cysts (0.5 pt)
- 2) crop rotation (0.5 pt)
- 3) nematicides/fumigants (0.5 pt)
- 4) I would say cultural as chemical can have devastating effects on the biome, but I am open to other answers! (0.5 pt)

Reference:

- 1) - 4) *Soils, Land Use, and Invasive Species*, p 5

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 11

This question requires materials provided at the stop.

Examine the two sheets of aerial photos labelled A-A and A-B.

While the Winnipeg River is an important aquatic element in Pinawa, wetlands are also a major component of the regional landscape. The photo at the top of the sheet labelled A-A is a satellite image of the Pinawa region, in which several extensive wetland areas have been outlined in broken yellow lines. You may recall having driven through one of these wetland areas when coming to Pinawa. The photo at the bottom of the same sheet is an aerial view of a commercial operation in a wetland 27 km southwest of Pinawa. The sheet labelled A-B shows two surface photos of this acidic, low productivity type of wetland, common in this part of Manitoba, and throughout much of northern Canada.

- 1) What is this wetland type called in Canada's wetland classification system? (0.5 pt)
- 2) What moss is the dominant vegetative component of this wetland type? (0.5 pt)
- 3) List one (1) reason the surface waters of these types of wetlands tend to be acidic. (0.5 pt)

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4) The dead plant material that becomes stored in wetlands can be harvested and used for commercial purposes, as shown in the bottom image on sheet A-A. What is this material called? (0.5 pt)

Answer:

1) bog (0.5 pt)

2) sphagnum moss (0.5 pt)

3) Any 1 of the following: poor drainage, decay of plant material (0.5 pt)

4) peat (0.5 pt)

Reference:

1) - 4) Aquatic Ecology Document, p 23

WILDLIFE (2 pts) – STOP 11

This question requires materials provided at the stop.

1) Calculate the dental formula for the skull labelled W-A. (1pt)

2) Using the field guide provided, identify what species the skull belongs to based on the dental formula. (1pt)

Answer:

1) $I3/3 \ C1/1 \ P4/4 \ M1/4$ (0.5 pt); = 38 (0.5 pt)

2) Gulo (Wolverine) (1 pt)

Reference:

1) Wildlife Document, p 16-20

2) Ability to use field guides

STOP 12

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 12

This question requires BOTH materials AND features found at the stop.

Trees and logs can make many useful things, including this seat on trail bench at this stop. Using the magnifying glass and toothpick provided, determine the age of the log used to make the seat. The ends of the bench are labelled F-A and F-B. You can use either end of the bench. Write your answer beside the appropriate label. (2 pts)

F - A _____ years

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F - B _____ years

Answer:

TBD (2 pts: + or - 2 years)

F-A (left end)

F-B (right end)

Partial marks: 1 pt - + or - 5 years

Reference:

Regional and Prov Forestry Training

SOILS AND LAND USE (2 pts) – STOP 12

This question requires features found at the stop.

At this stop, you will notice a shelter with a sloped roof. Rocks have been placed underneath the lower edge of the slope.

- 1) What specific type of soil degradation is this design intended to reduce or prevent? (0.5 pt)
- 2) How do these rocks prevent this type of degradation? (0.5 pt)
- 3) List two (2) major effects this type of soil degradation can have on the Winnipeg River. (1 pt)

Answer:

1) Water erosion (0.5 pt); erosion (0 pt)

2) Any 1 of the following: maintaining a protective cover on the soil; creating a barrier to the erosive agent; modifying the landscape to control runoff amounts and rates (0.5 pt)

3) Any 1 of the following: Accumulation of nutrients, eutrophication, algal blooms (0.5 pt) PLUS Any 1 of the following: sedimentation, deposition of eroded materials (0.5 pt)

Reference:

1) -3) Soil Quality Resource Concerns: Soil Erosion

THEME (2 pts) – STOP 12

This question requires features found at the stop.

The three shrubs labelled T-A were planted by the town of Pinawa. Read the nursery tags labelled T-B attached to them.

- 1) Should these shrubs be considered invasive species? (0.5 pt)

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2) Support your decision with three (3) reasons based on the information on the nursery tag. (1.5 pts)

Answer:

1) no (0.5 pt)

2) Any 3 of the following: doesn't appear to spread from areas of planting; reproduction doesn't permit easy dispersal; doesn't compete with other plants; has several native pests; others as appropriate (1.5 pts - 0.5 pt each)

Reference:

1) - 2) Manitoba Theme Document, p 8

WATER AND AQUATIC ECOLOGY (10 pts) – STOP 12

This question requires materials provided at the stop.

1) Follow the directions for the water quality test outlined below to determine the amount of nitrate present in Winnipeg River water. (3 pts)

Directions:

Remove your sunglasses and put on the safety gloves and goggles.

Use the sample water from the bucket provided.

Follow the instruction on the laminated card labeled Nitrate (see reverse side for colour chart) to assess the nitrate concentration.

Continue with questions 2) to 4) while waiting for test to complete.

Use the colour chart on the reverse side of the laminated card to determine the Nitrate concentration.

Record the result below, in ppm. If the colour of your treated sample is in between colours on the chart, report your result halfway between the numbers on the colour chart.

Concentration of nitrate in the river _____

2) Name three (3) other common types of physical, chemical or biological tests that can be done to evaluate water quality (excluding nitrate). (3 pts)

3) **True/False:** Indicate whether the statement is true (T) or false (F) by circling the correct answer. (2 pts - 0.5 pt each)

T F Nitrogen is considered a nutrient because it supports plant growth.

T F Elevated nitrite levels can cause fish to develop "brown blood disease" due to a lack of blood oxygen.

T F Nitrogen fixation has a direct impact on fish populations.

T F Nitrogen concentrations typically decrease in the spring from snowmelt, runoff and spring turnover.

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4) Indicate which of the following factors contribute to an increased level of dissolved oxygen in a water body by writing "Yes" next to those that contribute and "No" next to those that don't contribute. (2 pts)

Higher salinity _____
More plant life _____
Less organic waste _____
Higher mineral content _____

Answer:

1) Full marks: TBD

Partial marks: TBD

2) Any 3 of the following: Temperature, pH, Dissolved Oxygen (or DO), Biochemical Oxygen Demand (or BOD), Total Dissolved Solids (or TDS), Salinity, Turbidity, Total Coliform, Phosphates, Salinity (3 pts - 1 pt each)

3) T, T, F, F (2 pts - 0.5 pt each)

4) Higher salinity: no; More plant life: yes; Less organic waste: yes; Higher mineral content: no (2 pts - 0.5 pt each)

Reference:

1) Ability to follow written instructions; familiarity with Water Quality document

2) Water Quality

3) Water Quality: Test 5: Nitrates, p 10; Water Quality: Test 5: Nitrates, p 12; Understanding Lake Ecology: Primary Producers, p 28; Understanding Lake Ecology: Nutrients, p 18

4) Aquatic Ecology Document, Test 3: Dissolve Oxygen, p 7

WILDLIFE (2 pts) – STOP 12

Multiple Choice: Which of the choices is correct? Circle the best response. (2 pts - 1 pt each)

1) Over a period of a few years, a population of white-crested hornbacks (a fictional species of songbird) saw a population decrease of over 90% in their native range. According to the categories created by the International Union for Conservation of Nature (IUCN), which term best describes the population following that decrease?

- a) Extinct
- b) Extinct In The Wild
- c) Critically Endangered
- d) Endangered
- e) Vulnerable
- f) Near Threatened
- g) Least Concern

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2) Ten years after consideration by the IUCN, an exhaustive survey of the population of white-crested hornbacks failed to provide evidence of this species in the wild. However, several breeding populations exist in zoos. Which IUCN category best describes the new status of this population?

- a) Extinct
- b) Extinct In The Wild
- c) Critically Endangered
- d) Endangered
- e) Vulnerable
- f) Near Threatened
- g) Least Concern

Answer:

1) c (1 pt)

2) b (1 pt)

Reference:

1) - 2) *Wildlife Document*, p 39-40

STOP 13

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 13

Describe two (2) benefits of stand thinning when managing a woodlot. (2 pts)

Answer:

Any 2 of the following: speed growth of remaining trees, shortening rotation time; reduce insect and disease outbreaks; improve aesthetics of the woodlot; improve wildlife habitat for some species; early income from products sold; improve access for livestock, wildlife, recreation; produce more valuable products by controlling tree species and stem form; reduce final harvest costs by growing more merchantable volume on less trees, with larger more uniform stem sizes; increase merchantable volume by concentrating growth on selected crop trees; increase light to the understory, which may increase production of forage and browse (2 pts - 1 pt each)

Reference:

Stand Tending, p 5

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KEY

SOILS AND LAND USE (2 pts) – STOP 13

This question requires materials provided at the stop.

1) Where can you find the First (or Principal) Meridian, which is used as a measuring reference for the Dominion Land Survey? Circle the best response. (0.5 pt)

- a) longitudinally, near the western-most point in Canada (Dawson City, Yukon Territory)
- b) along the 49th parallel of latitude (southern border of Western Canada)
- c) longitudinally, through Greenwich, England
- d) longitudinally, though a location near Winnipeg, Manitoba

2) The outer edge of this soil map shows the labels pertaining to the Dominion Land Survey Grid (also called the Section-Township-Range System). Use this and your knowledge of soil survey interpretation to answer the following questions.

a) Name one (1) town or village that is located in Township 13, Range 11. (0.5 pt)

b) How many quarter sections are in Township 10, Range 10? (0.5 pt)

c) According to the map and its legend, what is the parent material associated with the name of the soil that is dominant at the Pinawa townsite (which is located about halfway between Natalie Lake and Dorothy Lake)? (0.5 pt)

Answer:

1) d (0.5 pt)

2a) Seven Sisters Falls OR River Hills (0.5 pt)

2b) 144 (36 sections x 4 quarters per section) (0.5 pt)

2c) Any 1 of the following: Granitoid rock with stratified drift and peat deposits (as verbatim from the Legend); granite/shield rock with layered mineral and peat deposits. (0.5 pt) (Just saying granite rock or shield rock is 0 pts).

Reference:

1) Land Survey Systems, p 1

2a) Map provided, Land Survey Systems, p 1-2

2b) Map provided, Land Survey Systems, p 1-2

2c) Map provided, Land Survey Systems, p 1-2

THEME (10 pts) – STOP 13

This question requires materials provided at the stop.

1) Refer to the photo of a harp trap labelled T-A to answer the following questions.

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a) What common Manitoba mammal are harp traps are used to capture without harming the animal? (0.5 pt)

b) Briefly describe how this trap works to capture these animals? (1.5 pts)

2) Two species of this mammal have recently been listed as endangered both nationally and provincially due to the threat of an invasive fungal disease, WNS. This disease has caused the largest mammalian decline on record.

a) What does WNS stand for? (1 pt)

b) Where did the disease get its name? (1 pt)

c) How does this disease kill infected individuals? (2 pt)

d) Give two (2) examples of how WNS is spread. (1 pt)

e) Name two (2) aspects of the ecology of this hibernating animal that allows for easy transfer of the disease. (1 pt)

Multiple Choice: Which of the choices is correct. Circle the best answer.

3) What year was WNS introduced into North America? (0.5 pt)

a) 2010

b) 2006

c) 2000

d) 1986

4) How far can WNS travel each year? (0.5 pt)

a) 10 km

b) 200 km

c) 500 km

d) 1000 km

5) How much of the year do these mammals spend in hibernation? (0.5 pt)

a) 4 weeks

b) 3 months

c) 8 months

d) 10 months

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5) Why are these animals economically important to humans? (0.5 pt)

- a) They are the only pollinators of many common plants.
- b) They eat many species of insects that cause crop damage.
- c) They are a big tourist attraction.
- d) They aren't economically important.

Answer:

1a) Bats (0.5 pt)

1b) There are two sets of strings in the frame, and the front and back set are offset. (0.5 pt) The bat flies through the first set of strings and collides with the second) (0.5 pt), and falls down safely into the bag underneath (0.5 pt)

2a) White-Nose Syndrome (1 pt)

Partial marks: 0.5 pt for each correct word

2b) It is called White-nose syndrome because dead individuals have white fungus growing from their noses (1 pt)

2c) It causes skin lesions on the wings of infected individuals (1 pt) which causes them to wake up more frequently from hibernation, as well as for longer periods of time, causing them to starve (1 pt)

2d) Any 2 of the following: bat-to-bat contact, from soil, from human contact (1 pt - 0.5 pt each)

2e) Any 2 of the following: Bats like to huddle for warmth, they fly long distances between summer and winter roosts, they hibernate in cool damp caves where the fungus thrives (1 pt - 0.5 pt each)

3) b

4) b

5) c

6) b

Reference:

1) *Animal Tracks in Manitoba*, p 4

2) - 6) *Manitoba Theme Document*, p 48

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 13

This question requires materials provided at the stop.

Aquatic organisms can survive the winter in a lake because of the unique properties of water. The diagram labelled A-A is a graph that shows the density-temperature relationship for water.

1) What is the main reason that lakes do not freeze to the bottom? Circle the best response. (0.5 pt)

- a) Bottom water is warmed by the sediment.
- b) Solid water is less dense than liquid water.

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- c) Snow on the ice is like warm blanket.
- d) Chemical processes going on in the lake generate heat.

2) At what temperature is water most dense? (0.5 pt)

3) **True/False:** Indicate if the following statement is true (T) or false (F) by circling the correct response. (0.5 pt)

T F Denser water is heavier and will sink.

4) Lakes in temperate climates tend to stratify. What does the term stratify mean? Circle the best response. (0.5 pt)

- a) Have different zones from the edge to centre of the lake.
- b) The waters are always thoroughly mixed.
- c) Separate into distinct layers from top to bottom.
- d) Become full of algae in the summer.

Answer:

- 1) b (0.5 pt)
- 2) 4°C (0.5 pt)
- 3) T (0.5 pt)
- 4) c (0.5 pt)

Reference:

- 1) - 4) *Lake Ecology*, p 8

WILDLIFE (2 pts) – STOP 13

This question requires BOTH materials AND features found at the stop.

1) The Stop Attendant will play a wildlife call for you three (3) times. Identify the mammal that makes that call. (1 pt)

2) Look at the shrub labelled W-A. What evidence of the same mammal can you see on the shrub? (1.0 pt)

Answer:

- 1) *White-tailed Deer* (1.0 pt)
- 2) *Tree rub* (1.0 pt)

Reference:

- 1) *Wildlife Calls*
- 2) *Animal Tracking*, p 3

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STOP 14

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 14

Multiple Choice: Which of the choices is correct? Circle the best response. (2 pts - 0.5 pt each)

1) Boreal Forests account for _____ of the carbon sequestered in all forests and their soils worldwide.

- a) 12%
- b) 27 %
- c) 43 %
- d) 98 %

2) Tree growth rates are determined by _____, local site conditions, tree health, tree age, genetics and competition among trees for light, space and nutrients.

- a) water
- b) air quality
- c) climate
- d) insects

3) As Canada's climate changes, so will its forests. Which of the following changes is most likely?

- a) There will be more fires.
- b) Most tree species will migrate or adapt.
- c) Most tree species will grow more quickly.
- d) Most forest pests will migrate with their hosts.

4) Climate changing emissions trap _____ in our atmosphere, altering long-term weather patterns, or climate.

- a) ions
- b) wind
- c) rain
- d) heat

Answer:

- 1) c (0.5 pt)
- 2) c (0.5 pt)
- 3) a (0.5 pt)
- 4) d (0.5 pt)

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Reference:

- 1) *Climate Change Connection, p 1*
- 2) *The State of Canada's Forests (2015), p 22*
- 3) *The State of Canada's Forests (2015), p 36*
- 4) *Climate Change Connection, p 3*

SOILS AND LAND USE (10 pts) – STOP 14

This question requires materials provided at the stop.

1) According to the pie chart in the Soil Management Guide (one of the soils resources), the following five sectors emit greenhouse gases. Circle the three (3) top emitters in Manitoba. (1 pt)

- a) Waste Management
- b) Energy
- c) Transport
- d) Industry/Manufacture
- e) Agriculture

2) Which of the following is not an impact of climate change? Circle the best answer. (0.5 pt)

- a) northerly shift of suitable environment for trees, grasses, crops, and invasive species
- b) more sunburns and skin cancer in animals and people
- c) more heat stress for certain wildlife and livestock
- d) more variability in temperatures and rainfall

3) List the three (3) most significant greenhouse gases from human sources. These gases also are formed naturally in soil. For each gas, describe one (1) process that results in emission of that gas from soil. (3 pts)

Gas	Process

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- 4) To counteract greenhouse gas emissions, people can increase carbon sinks.
- a) Describe what a CARBON SINK is. (1 pt)
 - b) Which of the soils labelled S-A and S-B has sequestered more carbon? (0.5 pt)
- 5) What do planting trees or perennial vegetation, summer fallowing, planting cover crops, and practicing minimum or zero tillage have in common for counteracting greenhouse gas emissions? (1 pt)
- 6) Successful drainage of wet soils can reduce emissions of two of the three main greenhouse gases from soil.
- a) Which two (2) gases are they? (1 pt)
 - b) Which atmospheric gas, if present, will prevent emission of these two (2) greenhouse gases from soil? (0.5 pt)
 - c) Describe how the greenhouse gas not listed in 6a) would respond to drainage of wet soils if they have a lot of organic matter? (0.5 pt)
 - d) There are a number of environmental, economic, and/or societal benefits of wetlands or wet soils that need to be considered before deciding if they should be drained. List two (2) of these benefits. (1 pt)

Answer:

1) b, c, e (1 pt)

Partial marks: 0.5 pt - 2 correct answers

2) b (0.5 pt)

3) (3 pts – 0.5 for each gas, and 0.5 for each correct description)

CARBON DIOXIDE OR CO_2 - any 1 of the following: aerobic respiration by soil microorganisms, respiration of plant roots, aerobic decomposition of organic matter in or on the soil, burning of plant litter or other organic matter on the soil surface

METHANE OR CH_4 – any 1 of the following: anaerobic respiration by soil microorganisms, aerobic decomposition of organic matter in wet soil

NITROUS OXIDE OR N_2O – any 1 of the following: nitrification of ammonium to nitrate in soil, denitrification of nitrate in wet soil, anaerobic respiration of soil microorganisms when nitrate is present.

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4a) Any 1 of the following: a process that removes carbon dioxide from the atmosphere, a process that stores carbon in a different form, a place where carbon has been stored (1 pt)

4b) Soil B (0.5 pt)

5) Either of the following: they all involve plant growth which takes in CO₂ and part of it becomes solid organic matter (wood, fiber, stems, roots, etc.) which can be stored OR they all increase sequestration of carbon (1 pt)

6a) methane and nitrous oxide (1pt – 0.5 pt each)

6b) oxygen (0.5 pt)

6c) more CO₂ would be emitted via aerobic decomposition of the organic matter (0.5 pt)

6d) Any 2 of the following: wildlife habitat; source of water for livestock or other uses; biodiversity (plant, animal or landscape); refugia for pollinators and predators of pests; groundwater recharge; flood mitigation by storing water; capturing or filtering nutrients, sediments or contaminants; preventing leaching or runoff of nutrients, sediment or contaminants; prevent aerobic decomposition of organic matter; aesthetic values (1 pt - 0.5 pt each)

Reference:

1) Soil Management Guide, p 122

2) Soils and Land Use Document, p 48-52

3) Soils and Land Use Document, p 48

4a) Soils and Land Use Document, p 52

4b) Soil Management Guide, p 8-11

5) Soils and Land Use Document, p 52

6a) - 6d) Soils and Land Use Document, p 124-125

THEME (2 pts) – STOP 14

This question requires features found at the stop.

Look carefully at the flagged trees labelled T-A, T-B, T-C and T-D.

1) One of the flagged trees is vulnerable to an invasive species that is expected but has not yet been found in Manitoba.

a) Name that invasive species. (0.5 pt)

b) Which tree is vulnerable to that invasive species? (0.5 pt)

2) One of the flagged trees is not native to this area.

a) Is this tree species likely to be invasive in Manitoba? (0.5 pt)

b) Briefly describe one (1) thing you can observe on that tree which supports your answer. (0.5 pt)

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Answer:

1a) Emerald ash borer (0.5 pt)

1b) Green ash (0.5 pt)

2a) no (0.5 pt)

2b) Woodpecker holes indicate that Scots pine is vulnerable to a pest found in Manitoba (0.5 pt)

Reference:

1) Theme Document, p 22, 51-53

2a) Theme Document, p 9

2b) Ability to make observations and inferences

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 14

This question requires materials provided at the stop.

1) Climate change is a global phenomenon that affects all ecosystems. There are a number of greenhouse gases that are causing this change, produced by both human activities and natural sources. The most abundant greenhouse gas is emitted primarily from a natural source. What is this gas? (1 pt)

2) Map A-A shows predictions for changes in spring and summer precipitation across North America by the years 2071-2099. Use this map to answer the following questions.

a) Is precipitation in Winnipeg in the summer projected to increase, decrease, or stay the same? (0.5 pt)

b) What is the projected percent change in spring precipitation for Winnipeg? Make sure to note whether it is an increase or decrease. (0.5 pt)

Answer:

1) Any 1 of the following: water vapour, water, H₂O (1 pt)

2a) stay the same (0.5 pt)

2b) increase by 20-30% (0.5 pt)

Reference:

1) *Puzzled About Climate Change*, p 1; *Aquatic Ecology Document*, p 82

2) Ability to read and interpret a map

WILDLIFE (2 pts) – STOP 14

1) Define CLIMATE CHANGE. (1 pt)

2) List two (2) effects of climate change on wildlife. (1 pt)

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Answer:

- 1) *the alteration and lasting change of the distribution of weather patterns over period of time (1 pt)*
- 2) *Any 2 of the following: loss of habitat, decline in sea ice, increase in parasitic nematodes from shortening of life cycle due to warming temperatures, increase/decrease in habitat range (1 pt - 0.5 pt each)*

Reference:

- 1) - 2) *Wildlife Document, p 44, 45*

STOP 15

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 15

Multiple Choice: *Which of the choices is correct? Circle the best response. (2 pts - 1 pt each)*

- 1) How many years has Dutch elm disease been established in Manitoba?
 - a) 10 -20 years
 - b) 20 - 30 years
 - c) 30 - 40 years
 - d) 40 - 50 years
 - e) more than 50 years

- 2) Which of the following is NOT approved for elm storage in Manitoba?
 - a) removing all bark
 - b) covering with a secure tarp
 - c) kiln drying to a moisture content of 18% or less
 - d) chipping the wood into chips that have a thickness of wood adhering to the bark in any dimension of not more than 5 cm
 - e) obtaining a storage permit from the director of Forestry and Peatlands Management

Answer:

- 1) *d (1 pt)*
- 2) *b (1pt)*

Reference:

- 1) *Dutch Elm Disease Management in Manitoba, p 1-2*
- 2) *Manitoba's Forest Health Protection Regulations, p 6*

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SOILS AND LAND USE (2 pts) – STOP 15

This question requires materials provided at the stop.

- 1) What feature of the soil sample labelled S-A limits plant growth? (1 pt)
- 2) What does electrical conductivity (expressed in dS/m or mmho/cm) measure? (1 pt)

Answer:

1) Salinity (from the sample showing white flecks) (1 pt)

2) Soluble salts in the soil solution (1 pt)

Partial marks: 0.5 pt - just soluble salts

Reference:

1) Soil Management Guide, p 63

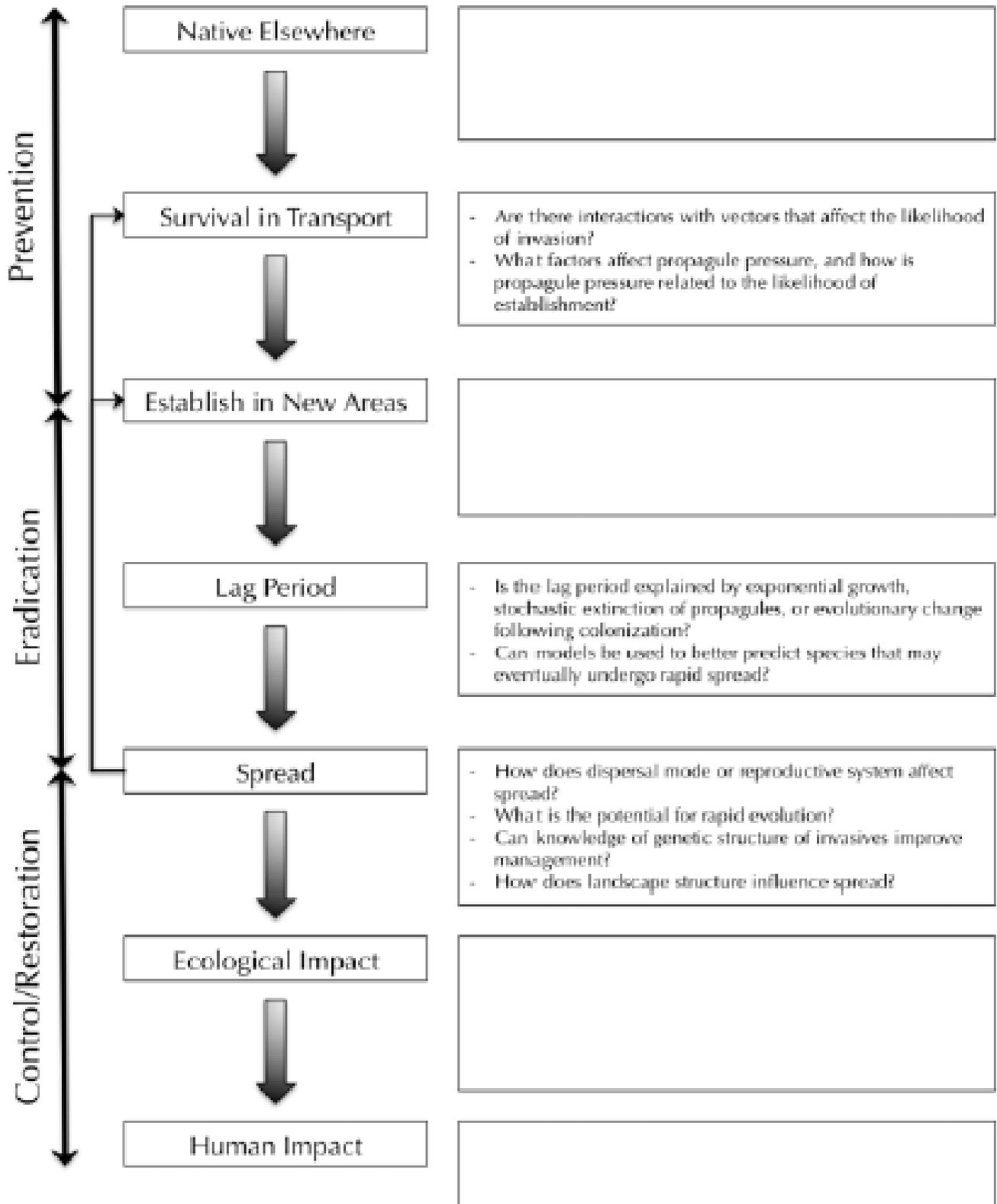
2) Soil Management Guide, p 65

THEME (2 pts) – STOP 15

You are an invasive species risk assessment officer. Complete the table below with an example of a question you would ask when assessing the risk of the introduction of an invasive species to Manitoba. (2 pts)

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Answer:

NATIVE ELSEWHERE: Any 1 of the following: Can invasiveness be predicted by life history traits?; Are there genetic differences between invasive and non-invasive populations?; How do the genetic diversity and biology of invasives differ in native vs introduced areas? (0.5 pt)

ESTABLISH IN NEW AREAS: Any 1 of the following: Is environmental tolerance greater in invasives?; How does the recipient environment affect the degree of invasiveness?; Are particular life history stages better targets for management of invasives? (0.5 pt)

ECOLOGICAL IMPACT Any 1 of the following: Impacts of of invasives on biodiversity and ways to measure?; Linear effects vs invasive meltdown?; What factors determine impact of invasives on residents? (0.5 pt)

HUMAN IMPACT: Any 1 of the following: Economic impacts?; Traits of invasive or natives that allow prediction of restoration success (0.5 pt)

Reference:

Manitoba Theme Document, p 40

WATER AND AQUATIC ECOLOGY (10 pts) – STOP 15

The year is 1950 and you, an employee of Manitoba Hydro, are involved in the decommissioning of the Pinawa Generating Station. Manitoba Hydro has decided to convert the generating station into a diversion dam to direct more flow on Winnipeg River to the Seven Sisters Generating Station downstream. Decommissioning the generating station will increase the discharge of flow on the Winnipeg River by 25%.

1) The table below shows the mean monthly discharge of the Winnipeg River at the outlet of the Pinawa Generating Station before decommissioning, except for May. You have measured a cross-section of the channel and found it is 30 metres wide and 1.25 metres deep. You have collected data showing that the average velocity in this cross-section in May is 2.25 metres per second. Calculate the river's discharge in cubic metres per second (cms) for May. Write the answer in the table. (2 pts)

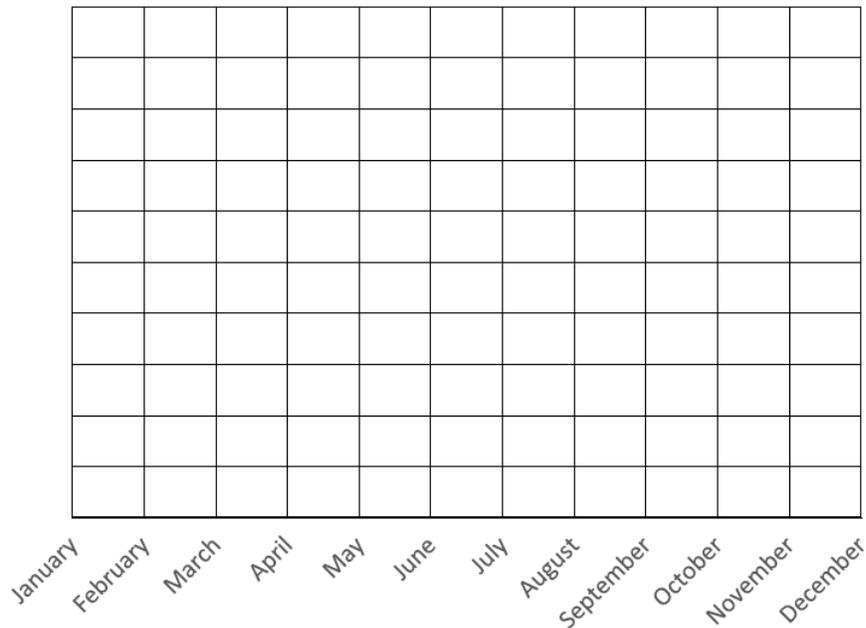
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Table 1. Winnipeg River discharge (monthly means)

Month	Mean Discharge (cms)
January	3.50
February	5.20
March	30.60
April	75.50
May	
June	67.30
July	46.20
August	31.70
September	19.50
October	16.25
November	12.70
December	5.60

2) Use the information in the table above and the graph paper below to create a line graph (called a hydrograph) showing the mean monthly discharge of water flowing through the generating station over the year. Be sure to label the y-axis with the appropriate title, units, and values. (5 pts)



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3) The future discharge without the Pinawa Generating Station can be estimated by multiplying the current discharge by 125%. Using the value you determined for May in question 1, calculate the total discharge of flow Manitoba Hydro can expect on the Winnipeg River system in May after the generation station is decommissioned. (1 pts)

4) Damming of waterways for hydropower production can affect the ability of other people/groups to use the water body. List two (2) uses of water and/or water bodies that may be affected by dams on the Winnipeg River. (2 pts)

Answer:

1) a) $30 \times 1.25 \times 2.25 = 84.375$ cubic metres per second (2 pts)

2) Title: Mean Monthly Discharge (1 pt); units: cms (1 pt); scale values: 0-100ish (1 pt); accuracy of line on graph (2 pts) (total 5 pts)

3) 84.4 cubic metres per second $\times 125\% = 105.5$ cubic metres per second (1 pt)

4) Any 2 of the following: fisheries and wildlife, tourism, recreation, water supply, sewage dilution, navigation, irrigation, agriculture, industry, storage of the spring freshet (a high river flow caused by rapidly melting snow) removes the natural variability of streamflows (2 pts - 1 pt each).

Reference:

1) - 3) Ability to follow directions, do simple calculations on a calculator, and generate a graph.

4) Aquatic Ecology Document, p 51-54, 64-66

WILDLIFE (2 pts) – STOP 15

This question requires materials provided at the stop.

1) Identify the internal structures labelled W-A, W-B and W-C on the bird dissection. (1.5 pts - 0.5 pt each)

W-A _____

W-B _____

W-C _____

2) Name one (1) internal structure that is unique to birds? (0.5 pt)

Answer:

1) W-A: Heart (0.5 pt)

W-B: Small Intestine (0.5 pt)

W-C: Liver (0.5 pt)

2) Any 1 of the following: Crop, Gizzard, Cecum (0.5 pt)

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Reference:

- 1) *Wildlife Document, p 10-15*
- 2) *Wildlife Document, p 15*