

Intermediate Science 7
STSE- Would You Like Salt On That?



Student Name: _____

PART A: MULTIPLE CHOICE

Instructions: Shade the letter of the correct answer on the computer scorable answer sheet provided.

1. How much de-icing material does Canada use on its roads each year?

- (A) 4.75 tonnes
- (B) 4.75 hundred tonnes
- (C) 4.75 thousand tonnes
- (D) 4.75 million tonnes



2. Which of the following is most commonly used as a de-icing material

- (A) Calcium chloride
- (B) Magnesium chloride
- (C) Potassium chloride
- (D) Sodium chloride

3. What is another name for sodium chloride that is used as a de-icing material

- (A) Rock Pebbles
- (B) Rock Salt
- (C) Sandstone
- (D) Table salt

4. Which of the following is true for the amount of de-icing material used in Newfoundland and Labrador?

	Sodium Chloride (Tonnes)	Calcium Chloride (Tonnes)
(A)	800	800
(B)	800	200 000
(C)	200 000	200 000
(D)	200 000	800

5. What can cause unsafe driving conditions?

- (A) Poor Traction between tire and the road
- (B) Slippery road conditions caused by moisture from fog, rain or snow on the road
- (C) Trucks and cars drive over snow and compact it unto the road
- (D) All are correct

6. What is the main reason for using sodium chloride as a de-icing material to prevent the freezing of moisture and the compaction of snow on the roads?
- (A) It is commonly found in Newfoundland and Labrador
 - (B) It lowers the freezing point of water
 - (C) It increases the freezing point of water
 - (D) It is environmentally friendly to the environment
7. Which of the following refers to the addition of one substance to another causes the freezing point to be lowered?
- (A) Anti -icing
 - (B) Colligative property
 - (C) Freezing point depression
 - (D) Salt Tolerant
8. Which of the following describes properties that depend upon the number of particles dissolved, not the type of particle.
- (A) Anti -icing
 - (B) Colligative property
 - (C) Freezing point depression
 - (D) Salt Tolerant
9. At which temperature, does salt have no effect on preventing ice from freezing?
- (A) 9°C
 - (B) 0°C
 - (C) -9°C
 - (D) -19°C
10. What is the chemical symbol for sodium?
- (A) Ca
 - (B) Cl
 - (C) Mg
 - (D) Na
11. According to figure 1, which of the following has the greatest freezing point depression?
- (A) Ammonium sulfate
 - (B) Calcium chloride
 - (C) Magnesium chloride
 - (D) Sodium chloride
12. According to figure 1, what is the advantage of using potassium acetate?
- (A) Biodegradable
 - (B) Fertilizer
 - (C) Keeps road surfaces dry
 - (D) Melts ice faster than salt
13. According to figure 1, what is the disadvantage of using calcium chloride?
- (A) Attracts moisture
 - (B) Attracts moisture, surfaces slippery below -18°C
 - (C) Corrosive
 - (D) Damages concrete and vegetation causes metals to rust

14. When is best to apply salt to the road?
- (A) During a clear day because the road is dry
 - (B) Beginning of storm to prevent precipitation from freezing and create a brine solution
 - (C) After the storm and the roads have been plowed because it allow for salt to stay on the road
 - (D) Any time is good
15. Listed below are the steps involved in ice removal . What order do they occur?
1. Remaining snow/ice floats on brine, breaking bond with road surface
 2. Vehicle traffic breaks through the surface, reducing snow/ice to plowable slush and moving it to sides of road
 3. Salt is spread on surface
 4. Salt melts through snow/ice forming brine
- (A) 3 →2→1→4
 - (B) 3 →1→2→4
 - (C) 3 →4→1→2
 - (D) 3 →4→2→1
16. How is salt used to deice the road affecting water ?
- (A) Causing groundwater to become salty
 - (B) Making drinking water dangerous for humans to drink
 - (C) Kill off living organism in freshwater ecosystems
 - (D) All are correct
17. What is the effect of road salt on soil?
- (A) Causes soil to become harder
 - (B) Water will not percolate through it
 - (C) Prevent plants from taking root
 - (D) All above
18. Which of the following is true for the effect of salt on vegetation?
- I) High concentration will cause damage to trees, grasses and shrubs
 - II) Salt tolerant plant will start to grow along side of the roads
 - III) It will cause the ecosystem to reach the climax community at a much faster rate
- (A) I and II
 - (B) I, II and III
 - (C) II and III
 - (D) III only
19. Why may moose and other wildlife be more prevalent on roads during the winter months?
- (A) They eat the salt on the road to stay healthy
 - (B) They road salt has killed all the vegetation
 - (C) They are in search of fresh water to drink
 - (D) There is better traction on the salted road

20. Which of the following is true for road salt?
- I) Speeds up the rusting process of vehicles
 - II) Cause damage to concrete
 - III) Weaken concrete bridges
- (A) I and II
 - (B) I, II and III
 - (C) II and III
 - (D) III only
21. Which of the following will reduce the negative impacts of salt?
- I) Developing better rust resistant paints
 - II) Salt resistant concrete
 - III) Using anti-ice technology to better determine when de-icing material is needed.
 - IV) Pre-wetting the road to reduce the amount of salt used
- (A) I, II and III
 - (B) I, III and IV
 - (C) II, II and IV
 - (D) I, II, III and IV
22. By using anti-icing technology, what percentage has it reduced the amount of salt used on the roads?
- (A) 10%-15%
 - (B) 20%-30%
 - (C) 20%-30%
 - (D) 30%-45%
23. By pre-wetting, what percentage has it reduced the amount of salt used on the roads?
- (A) 10%-15%
 - (B) 20%-30%
 - (C) 20%-30%
 - (D) 30%-45
24. Which of the following is affected by using de-icing material on roads?
- I) Vegetation
 - II) Wildlife
 - III) Groundwater
 - IV) Humans
- (A) I, II and III
 - (B) I, III and IV
 - (C) II, II and IV
 - (D) I, II, III and IV
25. Which of the following is not being studied as a way of modifying the amount of salt based de-icing used on roads?
- (A) Combining salt with other chemicals
 - (B) Ensuring that it is spread on the road in such a way as to minimize its effectiveness and maximize its environmental affects.
 - (C) Mixing salt with sand in different amounts
 - (D) Pre-wetting the salt before it is applied to the road

PART B : MATCHING

Instruction: Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once. Place your answers on the scantron.

TERM	DESCRIPTOR
26. _____ Sodium chloride	A. Hi-tech Road Weather System (RWIS) that provides information to the department of highways about road conditions and determining when de-icing material needs to be applied.
27. _____ Freezing point depression	B. The ability of organisms to sense and adapt to high concentrations of salt in their growth environment.
28. _____ Colligative properties	C. The material most commonly used as a de-icing material
29. _____ Salt tolerant	D. properties that depend upon the concentration of solute molecules or ions, but not upon the identity of the solute.
30. _____ Ant- Icing	E. the addition of one substance to another causes the freezing point to be lowered

PART C: WRITTEN RESPONSE

1. List and briefly describe the five problems created by using road salt (sodium chloride) on our roads.

2. When 10 grams of sodium chloride, NaCl, dissolves in 100 grams of water, the freezing point of the water goes down to -5.9° C. When 10 grams of table sugar, C₁₂H₂₂O₁₁, dissolves in 100 grams of water, the freezing point only goes down to -0.56° C. How do you account for this difference?

3. The Department of Transportation use mostly sand on the roads in Labrador. Why? Are the driving conditions in Labrador different from those in places that use salt? Explain your answer.

4. What is the purpose and advantages of Road Weather Information Systems?

5. What are two advantages of pre-wetting the salt before it is put on the road?

Further Research

1. Choose a chemical that may be used instead of sodium chloride as a de-icing chemical. Discuss the cost, advantages and disadvantages of its use.
2. Where are the Road Weather Information Systems located in Newfoundland and Labrador? Discuss how they work and how they are being used by our Department of Transportation.
3. Investigate why sugar is used to de-ice aircraft even though it is not as effective as salt in lowering the freezing point of water?