

**Part A**    *Multiple-Choice Questions*

**Questions 1 to 10**

Each question is worth 4 marks.

**Question 1**        D

**Question 2**        C

**Question 3**        B

**Question 4**        B

**Question 5**        C

**Question 6**        A

**Question 7**        D

**Question 8**        C

**Question 9**        A

**Question 10**      D

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## Part B *Constructed-Response Questions*

### Questions 11 to 20

- NOTE:**
- The following examples of appropriate responses are guidelines and are not exhaustive. Teachers should use their professional judgement when correcting this exam.
  - Significant figures will be evaluated in questions 14 and 17. Please note that particular significant figure rules have been used when answering questions 14 and 17. If you have taught rules that are slightly different with respect to significant figures, then please correct accordingly.

#### Question 11

##### *Example of an appropriate response*

Explanation:

When animals ingest chemicals such as PCBs, the toxins are not broken down in the body but are instead stored in fatty tissue. The toxins therefore accumulate in the organism (bioaccumulation).

Through biomagnification (or bioaccumulation) in a food chain, animals higher up in the food chain ingest and store higher concentrations of these chemicals.

The killer whale is at the top of its food chain and therefore the concentration of contaminants in its body fat is the highest. This concentration could lead to health problems in individuals and eventually a decline in this population of killer whales.

**Note:** Accept explanations using *bioconcentration*.

##### **Marking Scale**<sup>1</sup>

4 marks	Appropriate response and provides a complete explanation
3 marks	Appropriate response, but provides an incomplete explanation (e.g. not mentioning that concentration builds over time/trophic levels)
2 marks	Appropriate response, but provides only a partial explanation (e.g. that the killer whale is at the top of its food chain)
1 mark	Partially appropriate response, but one that demonstrates a partial understanding (e.g. only mentioning the term bioaccumulation or bioconcentration)
0 marks	Inappropriate response, or did not provide a response

**Note:** Accept explanations using bioaccumulation.

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1. All Marking Scales adapted from *MELS, 555-410, Science and Technology, Marking Guide, June 2012.*

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## Question 12

### *Examples of appropriate responses*

#### **Answer**

The genotypes of the two parent flies are: **bb Bb**.

Explanation:

Since the mother has red eyes and red-eye colour is a recessive trait, her genotype must be bb.

The only possible genotype that would yield red-eyed offspring for the father is Bb, since BB would result in 100% black-eyed offspring.

Parent	B	b
b	Bb	bb
b	Bb	bb

Parent	B	B
b	Bb	Bb
b	Bb	Bb

#### **Marking Scale**

4 marks	Two correct genotypes and two correct explanations
3 marks	Two correct genotypes and one correct explanation
2 marks	One correct genotype and its correct explanation OR two correct genotypes
0 marks	Incorrect genotypes, or did not provide a response

**Note:** Punnett square is only one way of answering this question. It is not obligatory.

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### Question 13

#### *Examples of appropriate responses*

<b>Pollutant (Contaminant)</b>	<b>Effect on Environment</b>
Plastic bags	Animal suffocation
Cigarette butts	Danger to wildlife; ingested and not digested by animals
Sunscreen	Phosphate in sunscreen could contribute to eutrophication
Oil spill	Animals covered by oil are not able to breathe, fly, etc.

**Note:** The students may choose to provide specific examples of pollutants (e.g. phosphates etc.). These answers (assuming the explanation is correct) are perfectly acceptable.

#### ***Marking Scale***

4 marks	2 correct pollutants (contaminants) with the correct corresponding effect on the environment
2 marks	1 correct pollutant (contaminant) with the correct corresponding effect on the environment
0 marks	Incorrect response, or did not provide a response

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## Question 14

### *Example of an appropriate procedure*

1.

$$M = (8 \times 12.01) + (10 \times 1.01) + (4 \times 14.01) + (2 \times 16.00)$$

$$M = 194.22 \text{ g/mol}$$

2.

$$m = 76.5 \text{ mg}$$

$$m = 0.0765 \text{ g}$$

3.

$$V = 245 \text{ mL}$$

$$V = 0.2450 \text{ L}$$

4.

$$n = \frac{0.0765 \text{ g}}{194.22 \frac{\text{g}}{\text{mol}}}$$

$$n \approx 3.94 \times 10^{-4} \text{ mol}$$

5.

$$C = \frac{n}{V}$$

$$C \approx \frac{3.94 \times 10^{-4} \text{ mol}}{0.2450 \text{ L}}$$

$$C \approx 1.61 \times 10^{-3} \text{ mol/L}$$

### **Answer**

The molar concentration of caffeine in this drink is  $1.61 \times 10^{-3} \text{ mol/L}$  (significant figures).

#### **Marking Scale**

4 marks	Appropriate procedure with a correct answer
3 marks	Appropriate procedure with a minor error, such as an error in calculation or transcription, or an incorrect or missing unit of measure, or incorrect significant figures
2 marks	Appropriate procedure with a major error, such as an incorrect application of a law, formula or rule (e.g. correct calculation of molar mass of caffeine but incorrect application of mole ratio)
1 mark	Partially appropriate procedure (e.g. calculates one variable)
0 marks	Inappropriate procedure, or did not show any work regardless of the answer

## Question 15

### *Examples of appropriate responses*

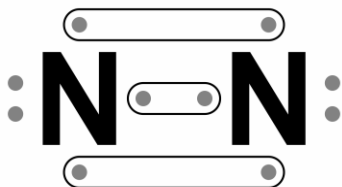
#### Answer

- a) The type of bond formed in a molecule of  $N_2$  is a **covalent bond**.

#### **Marking Scale**

2 marks	Correct answer
0 marks	Incorrect answer, or did not provide an answer

- b)



#### **Marking Scale**

2 marks	Appropriate representation of bonding (i.e. 3 circled pairs of shared electrons)
1 mark	Partially appropriate representation with an error (e.g. did not circle paired electrons)
0 marks	Inappropriate response, or did not provide a response

## Question 16

### *Examples of appropriate responses*

- a) 3  
b) 5  
c) 2  
d) 1  
e) 4

#### **Marking Scale**

4 marks	4 or 5 correct answers
3 marks	3 correct answers
2 marks	2 correct answers
1 mark	1 correct answer
0 marks	0 correct answers

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## Question 17

### *Example of an appropriate procedure*

1.

$$F = mg$$

$$F = 87 \text{ kg} \times 9.8 \text{ N/kg}$$

$$F = 852.6 \text{ N}$$

2.

$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\cos 47^\circ = \frac{F_{\text{eff}}}{852.6 \text{ N}}$$

$$F_{\text{eff}} \approx 581.47 \text{ N}$$

3.

$$1 \text{ km} = 1000 \text{ m}$$

$$W = F\Delta d$$

$$W = 581.47 \text{ N} \times 1000 \text{ m}$$

$$W = 581\,470 \text{ J}$$

### **Answer**

The work done by Brad is  **$5.8 \times 10^5 \text{ J}$  (580 000 J)** (significant figures).

#### **Marking Scale**

4 marks	Appropriate procedure with a correct answer
3 marks	Appropriate procedure with a minor error, such as an error in calculation or transcription, or an incorrect or missing unit of measure, or incorrect significant figures
2 marks	Appropriate procedure with a major error, such as an incorrect application of a law, formula or rule
1 mark	Partially appropriate procedure (e.g. calculates one variable)
0 marks	Inappropriate procedure, or did not show any work regardless of the answer

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## Question 18

### *Example of an appropriate procedure*

1.  $V_1 = 50 \text{ km/1 h}$

$$V_1 = \frac{50\,000\text{m}}{3600\text{ s}}$$

$$V_1 = 13.89 \text{ m/s}$$

$V_2 = 40 \text{ km/1 h}$

$$V_2 = \frac{40\,000\text{m}}{3600\text{ s}}$$

$$V_2 = 11.11 \text{ m/s}$$

2.  $E_{k_1} = \frac{1}{2} mv^2$

$$E_{k_1} \approx 0.5 (1500 \text{ kg}) (13.89 \text{ m/s})^2$$

$$E_{k_1} \approx 144675.9 \text{ J}$$

3.  $E_{k_2} = \frac{1}{2} mv^2$

$$E_{k_2} \approx 0.5 (1500 \text{ kg}) (11.11 \text{ m/s})^2$$

$$E_{k_2} \approx 92592.549 \text{ J}$$

$$E_{k_1} - E_{k_2} \approx 144675.9 \text{ J} - 92592.549 \text{ J}$$

$$E_k \approx 52083.31 \text{ J}$$

### **Answer**

The difference in kinetic energy is  $\cong 52083.31 \text{ J (52 kJ)}$ .

NOTE: Given that students may round off differently than the above example, please accept all correct answers (close to answer above).

#### **Marking Scale**

4 marks	Appropriate procedure with a correct answer
3 marks	Appropriate procedure with a minor error, such as an error in calculation or transcription, or an incorrect or missing unit of measure
2 marks	Appropriate procedure with a major error, such as an incorrect application of a law, formula or rule
1 mark	Partially appropriate procedure
0 marks	Inappropriate procedure, or did not show any work regardless of the answer

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## Question 19

### *Examples of appropriate responses*

- a) When electricity is applied, that is when the switch is turned on, a magnetic field is created and the core (nail) is pulled into the coil. The nail then hits the metal bar which should cause a sound (chime).
- b) When electricity is cut off, that is when the switch is turned off, the magnetic field ceases to exist and therefore the core (nail) falls back down and hits the lower metal bar. This causes a second sound (chime).
- c) Three options: (i) change the material the core is made of, (ii) increase the number of coils, (iii) increase the current intensity.
- d) Doorbell

### **Marking Scale**

4 marks	4 correct answers
3 marks	3 correct answers
2 marks	2 correct answers
1 mark	1 correct answer
0 marks	0 correct answers

## Question 20

### *Examples of appropriate responses*

Treatment Processes	Number
Removal of sand and grit in a degritter	2
Transfer of wastewater into the secondary treatment unit	4
Screening wastewater for large pieces	1
Collecting organic matter in a tank in order for it to be removed	3

### **Marking Scale**

4 marks	4 correct answers
3 marks	3 correct answers
2 marks	2 correct answers
1 mark	1 correct answer
0 marks	0 correct answers

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# Feedback Questionnaire

(also available on <http://bimonline.qc.ca>)

**EST-400.A07**  
**Environmental Science and Technology – Secondary 4**

4 = Very satisfied

3 = Satisfied

2 = Not very satisfied

1 = Dissatisfied

<b>Teacher's Guide</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
Visual presentation (layout)				
Time allotted for the examination				
Procedure / Instructions				
Information regarding materials (provided, required, authorized)				
Quality and use of the evaluation tools provided (rubrics, observable elements, etc.)				
In accordance with the QEP, Progression of Learning, Evaluation Framework				
<b>Student Booklet</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
Level of difficulty				
Instructions				
Reading level				
Language accuracy				
Other supporting reference materials (video, magazine, etc.)				

If you have indicated *Not very satisfied* or *Dissatisfied* with any of the above, please comment and provide recommendations:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Overall assessment of the examination: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Comments or recommendations: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

School Board: _____
Name: _____ Telephone / Email: _____

Please return to: **BIM**, GRICS, 5100, Sherbrooke Street East, Suite 300, 3<sup>rd</sup> floor, Montréal (Québec) H1V 3R9  
 Fax: 514 251-3920, email: [bim@grics.ca](mailto:bim@grics.ca)