

Section 6.2: Factors Affecting Reaction Rates

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1. (a) nature of reactant

(b) temperature

(c) surface area

(d) nature of reactant

(e) catalyst

(f) concentration

(g) temperature

(h) temperature

(i) surface area

(j) catalyst

2. Answers may vary. Sample answers:

- Nature of reactant – A coat of zinc keeps steel from rusting.
- Temperature – Food cooks faster in a hotter oven.
- Surface area – Small twigs burn faster than a large log.
- Catalyst – Catalysts are used to add hydrogen to oils to make margarine.
- Concentration – Increasing the concentration of detergent dissolves grease on dishes faster.

3. To decrease the rate of a reaction by a factor of 4, the chemist should decrease the temperature by 20 °C, because rates tend to halve with a 10 °C decrease.

4. Digestive enzymes are not needed in large amounts, even though they are used by almost all biochemical processes in the body, because the enzymes are not used up by the reactions—a single molecule can take part in many reactions, one after another.

5. Two ways to increase the rate of the reaction of metal ores with carbon to produce elemental metal are to increase the temperature or increase the surface area by using smaller particles.

6. (a) Answers may vary. Sample answer: Butylated hydroxytoluene or BHT is an antioxidant commonly used as a preservative in food containing large amounts of fats and oils. Because oxygen favours reactions with BHT, it can slow or hinder the start of lipid oxidation. BHT can be found in a wide range of products such as desserts, candy, potato chips, and sausage. In addition, spraying food containers with BHT can lengthen the shelf life of a product. This is especially common in boxed food, such as breakfast cereal.

(b) Answers may vary. Sample answer:

Costs and Benefits of Use of Butylated Hydroxytoluene (BHT) in the Food Industry

Cost	Benefit
<ul style="list-style-type: none">• Since BHT is broken down and absorbed by the body, it has biological effects, some of which may be harmful.• Some studies have linked BHT with an increase in tumours and malignant cancers.• Some people have difficulty metabolizing BHT, which is thought to result in behavioral problems and hyperactivity.• BHT can cause allergic reactions.• BHT may be toxic to the nervous system and liver.• High doses of BHT may mimic estrogen and prevent expression of male sex hormones, resulting in adverse reproductive affects.• BHT is toxic to aquatic organisms and has the potential to bioaccumulate.• BHT is not very degradable in the environment.	<ul style="list-style-type: none">• BHT is widely used by the food industry as a preservative, to prevent oils in foods from oxidizing and becoming rancid. Oxidation affects the flavour, colour, and odour of foods and reduces some nutrients.• By inhibiting the oxidation of fats and oils, BHT extends the shelf life of food products.• Because BHT is highly fat soluble, manufacturers can mix it into food as it is produced so that consumers will not notice its appearance or flavour.• BHT possesses some antimicrobial properties and may therefore reduce the incidence of some foodborne illnesses.• Risks of ingesting oxidized fats—including food poisoning, heart disease, and cancer—may be greater than the risk of ingesting preservatives.• Some studies have suggested that BHT may help to protect the body from free radicals which cause cancer.