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| CHAPTER 3 | Research SCUBA Answer Key | BLM 3.1.4A |
| ANSWER KEY | | |
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1. Oceanographer Jacques Cousteau and engineer Emile Gagnan invented SCUBA (Self-Contained Underwater Breathing Apparatus) in 1943. While both were born in France, Gagnan moved to Montreal, Quebec in 1947. SCUBA gear was originally referred to as an aqualung.
2. In order to explore the deep sea environment, humans must have access to breathable air; we need protective clothing to shield us from the extreme cold of the ocean depths; we need goggles and underwater lighting to see through the dark waters; and we must have weights to overcome our natural buoyancy and help us to descend. In addition, we must cope with extremes of pressure.
3. A SCUBA tank contains a large quantity of air in a relatively small volume. The air must be compressed, or stored at high pressure, in order to fit in this volume. A person cannot breathe directly out of the tank because the air emerges with enough force to cause severe damage to the lungs. The tank is, therefore, fitted with a regulator, which reduces the pressure from the tank to a pressure that is safe for a person to inhale.
4. Compressed air is a blend containing 21 percent oxygen, 78 percent nitrogen, and 1 percent trace gases. The ratio of nitrogen to oxygen can be varied depending on the diving conditions, and other gases such as helium, hydrogen, and neon may be added to the mixture for diving at extreme depths.
5. As pressure increases, the solubility of gases in the diver's body increases. This results in a greater amount of nitrogen and oxygen dissolved in the blood, as compared with normal atmospheric pressure.
6. At depths of 30 metres or more, nitrogen narcosis occurs as a result of high levels of nitrogen dissolved in the blood. It causes impaired judgment and drowsiness, similar to a drunken state. It can be alleviated by ascending to a safer depth.
7. Just as the solubility of gases increases with an increase in pressure, the effect is reversed as pressure decreases at shallower depths. Residual nitrogen in the blood within body tissues comes out of solution as pressure approaches atmospheric levels. As the diver rises to the surface, residual nitrogen leaves body tissues and returns to a gaseous state. However, if the diver rises too quickly, nitrogen bubbles form in the blood, blocking blood vessels and causing decompression sickness, also known as "the bends". Blockage of blood vessels can cause skin rashes, dizziness, joint pain, stroke, heart attack, or paralysis.
8. Oxygen toxicity occurs as pressure increases and the concentration of oxygen dissolved in the blood becomes elevated. Oxygen is converted into unstable forms, known as reactive oxygen species or free radicals, which cause damage to body tissues. Oxygen toxicity can result in dizziness, nausea, and convulsions or seizures. These symptoms are particularly dangerous to a diver, who must maintain alertness in the dangerous underwater environment.
9. As a diver ascends, pressure decreases and gases expand. If you hold your breath while ascending to the surface, you run the risk of an embolism or a collapsed lung. Embolism occurs when the air in your lungs expands to the point where it blocks blood circulation. A pneumothorax, or collapsed lung, occurs when air pressure in the cavity between the lung and

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the chest wall builds up and prevents the lung from expanding. This condition makes breathing nearly impossible.

- 10.** Risks involved with SCUBA diving include decompression sickness, nitrogen narcosis, oxygen toxicity, and gas expansion in the lungs, as discussed in the previous questions. Other risks include exposure to extreme cold and potentially dangerous encounters with marine life, such as sharks or stingrays. SCUBA diving is also an expensive sport, involving the cost of equipment purchase or rental, boat rental, and other travel expenses. On the other hand, diving provides incredible opportunities for people to explore the wide range of flora and fauna under the sea. It offers not only physical activity, but also an element of risk that is appealing for thrill-seekers.