

Unit Three FRQ Practice One:

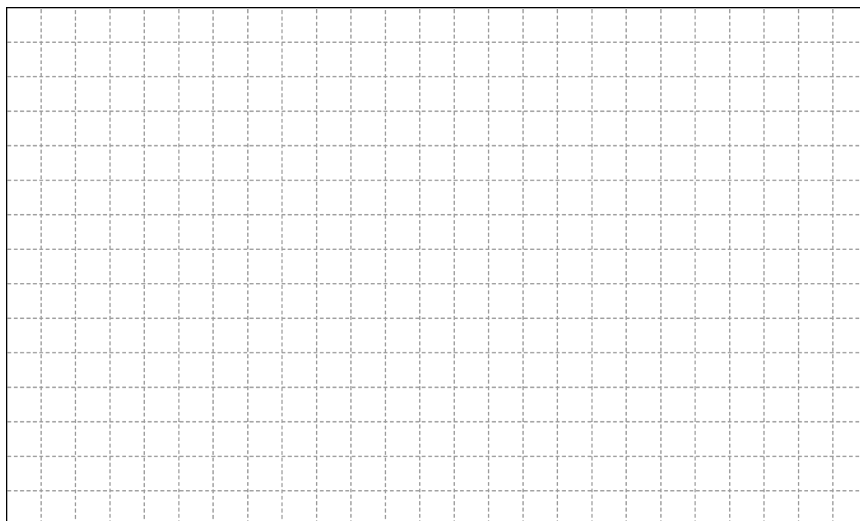
Researchers studied the relationship between glucose concentration, oxygen level, and ATP production in one type of mammalian cell. Cells were isolated and cultured in growth medium containing either 1.5mM glucose or 25 mM glucose and at oxygen levels that varied from 0% to 21%. The researchers determined the concentration of ATP per cell under the different conditions. The ATP concentrations are shown as relative to the maximum ATP concentration obtained when cells were cultured in the presence of 25 mM glucose and 21% oxygen, standard culture conditions.

The data are shown in Table 1.

Concentration of Glucose in Growth Medium	Percent of Oxygen	Relative concentration of ATP per cell
1.5mM	0	0.3
1.5mM	5	0.65
1.5mM	10	0.75
1.5mM	21	0.85
25mM	0	0.4
25mM	5	0.7
25mM	10	0.8
25mM	21	1.0

(a) **Describe** the role of oxygen in cellular respiration.

B) (b) Using the template, **construct** an appropriately labeled graph to represent the data in Table 1.



C) **Describe** the relationship between the concentration of glucose in the culture medium and the ATP concentration in the cells.

D) In a further experiment, the researchers add a compound to the cell growth medium that both binds and releases protons (H^+) also passes through lipid membranes. **Predict** the effect of this added compound on ATP production by the cells. **Justify** your prediction.

Unit Three FRQ Practice Two:

Enolase is an enzyme that catalyzes one reaction in glycolysis in all organisms that carry out this process. The amino acid sequence of enolase is similar but not identical in the organisms. Researchers purified enolase from *Saccharomyces cerevisiae*, a single-celled eukaryotic yeast that grows best at 37°C, and from *Chloroflexus aurantiacus*, a bacterium that grows best at the much higher temperature of 55°C. The researchers compared the activity of purified enolase from the two organisms by measuring the rate of the reaction in the presence of varying concentrations of substrate and a constant amount of each enzyme at both 37°C and 55°C.

Depending on the organism, the optimal pH for enolase to catalyze its reaction is between 6.5 and 8.0.

(a) **Describe** how a pH below or above this range is likely to affect enolase and its catalytic ability.

B) **Identify** the appropriate negative control the researchers most likely used when measuring the reaction rate in the presence of each organism's enolase.

C) The researchers predict that for any particular concentration of substrate, the *C. aurantiacus* enolase-catalyzed reaction is more rapid at 55°C than at 37°C. Provide reasoning to **justify** the researchers' prediction.