Perfect Competition

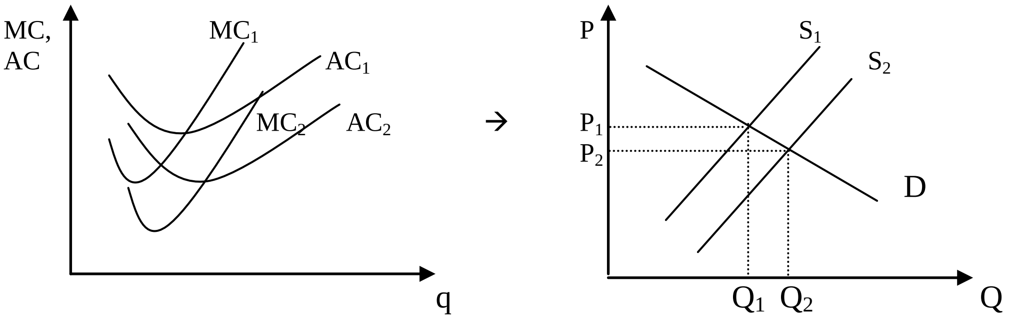
Problem 1 (APT'93, P1)

A perfectly competitive manufacturing industry is in long-run equilibrium. Energy is an important variable input in the production process and therefore the price of energy is a variable cost. The price of energy decreases for all firms in the industry.

a) Explain how and why the decrease in this input price will affect this manufacturing industry's output and price in the short run.
b) What will be the short-run effect on price, output, and profit of a typical firm in this manufacturing industry? Explain.
c) Will firms enter or exit this manufacturing industry in the long run? Why or why not?

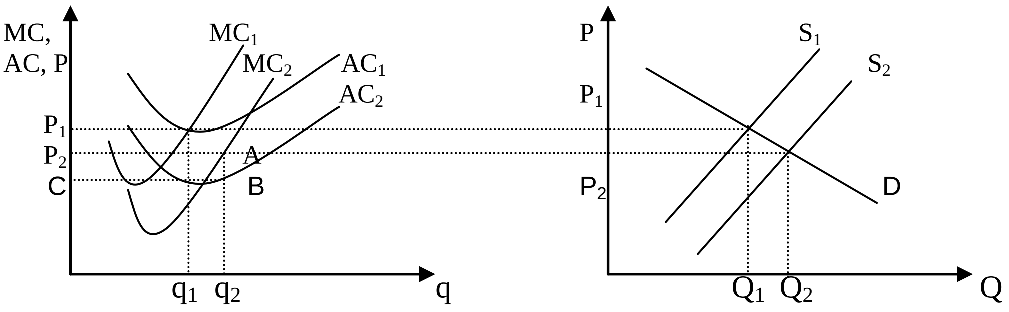
Sample answer:

a) The decrease in the price of one of the inputs, namely, energy, allows firms to produce the same level of output at a lower cost. The supply curve of a single firm coincides with its MC curve, which, together with other cost curves, shifts down, reflecting this reduction in the costs of production.



As a result, the industry supply curve, which is the horizontal sum of individual firms' supply curves, shifts out causing the industry's output to increase and the price to decrease in the short run.

b) Since firms in a perfectly competitive market are price takers, the price of a typical firm in the industry will go down.



The effect on a typical firm's output will be ambiguous. On the one hand, the reduction in costs will tend to increase the profit-maximizing level of production, but on the other, the decrease in price, entailed by the industry's expansion, will hold back further increase in output. However, provided that the market demand curve is not vertical, the first effect will be much stronger, so that ultimately output of a single firm will go up from q_1 to q_2. Initially the industry was in the long-run equilibrium, which means that the firms were just breaking even. Now, after the decrease in the price of energy, every firm is making positive economic profits depicted by the area of the rectangle P_2ABC.

c) In the long run, positive economic profits of the firms in the industry, will attract new firms into this market. The entry will continue until the price falls to the minimum AC, eliminating any incentive for other producers to enter the industry.

Problem 2 (APT'96, P3)

Assume that in a perfectly competitive market a firm's costs and revenues are

marginal cost = average variable cost at $20
marginal cost = average total cost at $30
marginal cost = average revenue at $25

(a) How will this firm determine the profit maximizing level of output?
(b) What price will this firm charge? Explain how the firm determined this price.
(c) Should this firm produce in the short run? Why or why not?
(d) Will this firm earn a profit or incur a loss? Why?

Sample answer:

a) The profit maximizing level of output is the one where the marginal cost equals the marginal revenue. Since the firm operates in a perfectly competitive market, its marginal revenue is equal to the market price, i.e. average revenue, for all levels of output. Hence, the maximum profit is achieved where the marginal cost is equal to $25.
b) Any perfectly competitive firm is a price-taker and has to charge the price given to it by the market, which, in turn, equals average revenue. Consequently, the firm will sell its product for $25 a unit.
c) To determine whether the firm will produce in the short run we need to compare its price with its average variable cost. At the minimum, the average variable cost is equal to the marginal cost, consequently, this firm's minimum average variable cost is $20. As one can see, this is less than the market price, so that by producing in the short run the firm will cover all of its variable costs and part of its fixed costs. On the contrary, if the firm chose to shut down it would incur bigger losses, as it would have to pay its entire fixed costs. Thus, the firm must produce in the short run, even if it means making losses.
d) As with average variable costs, we find the minimum average total cost to be equal to $30. With the market price being $25, the firm will certainly incur a loss, as its revenues do not cover fully its costs.

Problem 3 (APT'2001, P1)

(a) Assume that a profit-maximizing firm in a perfectly competitive industry is earning economic profits. For a given market price, draw a correctly labeled graph and show each of the following for a typical firm in this perfectly competitive industry.

(i) Marginal revenue
(ii) Output
(iii) Economic profits

(b) Using the information in (a), draw correctly labeled side-by-side graphs for the industry and a typical firm.

(i) Given the existence of economic profits of the typical firm, show on the graphs how the industry adjusts in the long run and explain the process that leads to the long-run equilibrium.
(ii) Show on the graphs each of the following for the industry and for the typical firm in long-run equilibrium.

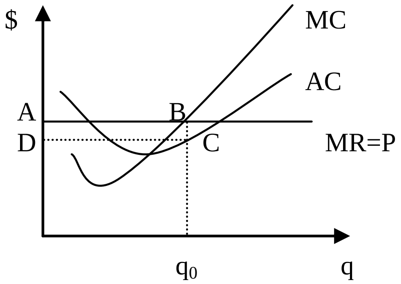
- Price
- Output

(c) Now assume that the government sets a price that is less than the equilibrium price but greater than average variable cost. Indicate how each of the following will change for the typical firm and explain why the change occurs

(i) Marginal revenue
(ii) Level of output
(iii) Short-run total cost
(iv) Short-run total revenue

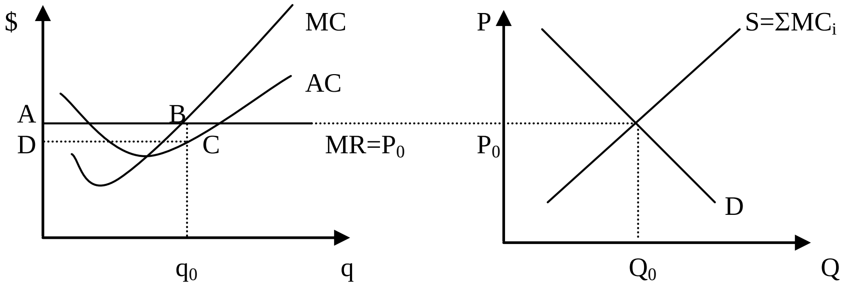
Sample answer:

(a) Firstly, the distinctive feature of a perfectly competitive industry is that any individual firm is such a tiny part of the whole market that it can sell any feasible quantity of its output at the going price without affecting it at all. As a result, marginal revenue, which is the incremental change in the total revenue of the firm from selling one additional unit of its produce is just equal to the market price and independent of the firm's level of output. Thus, marginal revenue curve represents a horizontal line running at the level of the industry price (see the graph below). Secondly, in order for a firm operating in a perfectly competitive industry to earn economic profits in the short run the market price must be above the minimum average cost. Thirdly, the output of the firm is given by the intersection of the marginal revenue curve and the upward-sloping part of the marginal cost curve. The firm's economic profit can then be depicted as the area of the region enclosed by the vertical axis, the vertical line at the optimal level of production, the marginal revenue curve and the horizontal line drawn at the level of average total costs at the corresponding output:



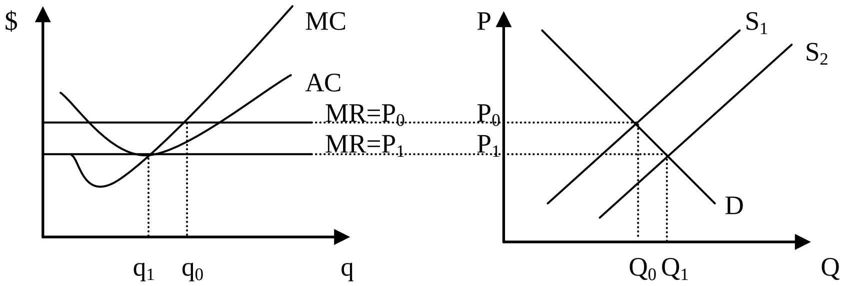
(i) Marginal revenue – horizontal line AB.
(ii) Output – q_0.
(iii) Economic profit – area ABCD

(b) The graph below shows the link between the equilibrium in the industry and the optimal output of a typical firm. In the right hand diagram the intersection of the supply and demand curves occurs at the same price level that we have been assuming so far (i.e. the price level high enough in order for individual firms to earn economic profits in the short run):



(i) Given the absence of barriers to entry the positive economic profits will attract new firms to the industry. With more firms on the market, the industry's supply will expand until the price falls down to the level where no profit can be earned and there is hence no incentive for new participants to enter the market. Thus in the long run the entry of new firms will cause the supply curve to shift out to the position where the equilibrium price is just equal to the minimum average cost of a typical firm.

(ii)



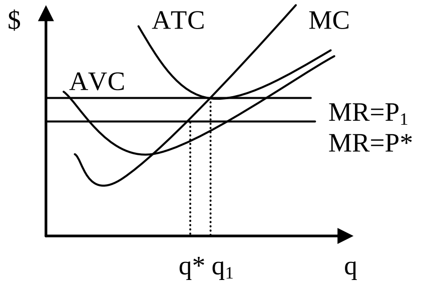
Q_1 and P_1 – the industry's long run output and price, respectively.
q_1 and P_1 – the typical firm's long run output and price, respectively.

(c) (i) Since now firms are allowed to sell their product only at the price fixed by the government, which is less than the initial equilibrium price, marginal revenue of a typical firm will go down.

(ii) At the new lower price the intersection of the marginal revenue curve and the marginal cost curve, which determines the firm's output, will occur to the left of the original point (q_1). However, provided that initially the industry was in the long run equilibrium, after the imposition of the price ceiling firms will be suffering losses even at this profit-maximizing level of output. Still, since the new price is greater than average variable cost, it is better for the firms to produce this lower output and compensate part of the fixed costs than to shut down completely.

(iii) Total costs consist of fixed and variable costs. Fixed costs, as their name suggests, are beyond the firm's control in the short run and therefore independent of output. Variable costs, by contrast, represent that part of total costs which directly responds to changes in the volume of production. Thus, given that now firms produce less their variable and total costs must also be lower.

(iv) Since both the price at which firms sell their produce and the output itself have been reduced the total revenue of the typical firm, which is the product of the two, will also decrease.



P_1 and q_1 – equilibrium price and output, respectively.
P* and q* - maximum price set by the government and the corresponding output.

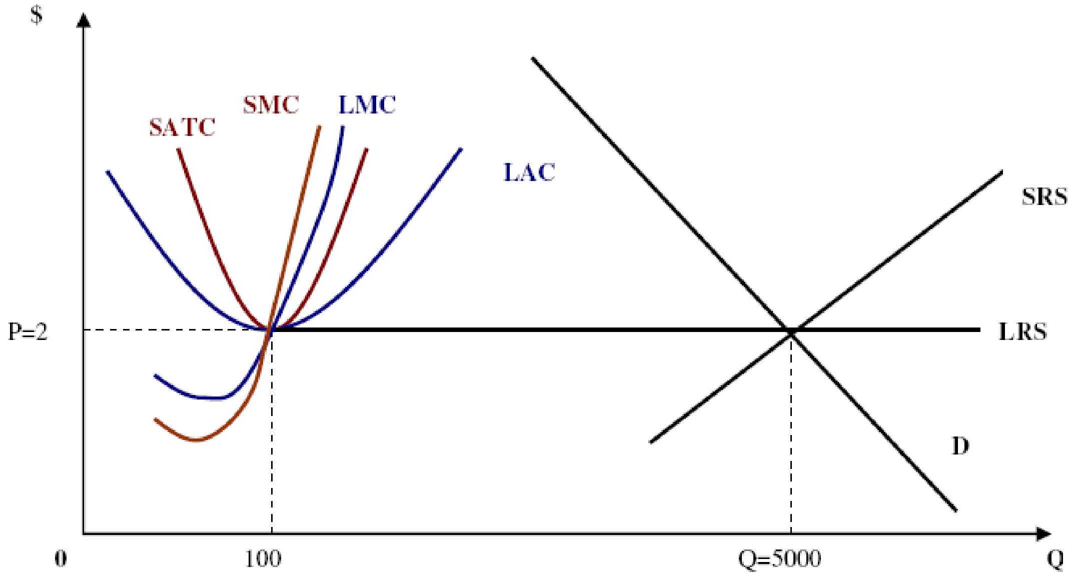
Rice is the main agricultural product in the country of Riceland, and rice production is a constant average cost perfectly competitive industry. For a typical rice farm, the minimized long run average cost can be realized at the production of 100 kg at the price of $2 per kg. The demand for rice is given by the function $P(Q)=10002–2Q$.

A. What are the equilibrium price and output of the industry? How many farms is the industry composed of? (Here and in other parts of the question you may round the number of farms to the nearest integer.)

Answer: P*=$2, Q*=5000. The number of farms is 50.

B. Draw the graphs of both the individual farm and the whole rice industry in Riceland in the short run and in the long run. Include both short run and long run cost curves.

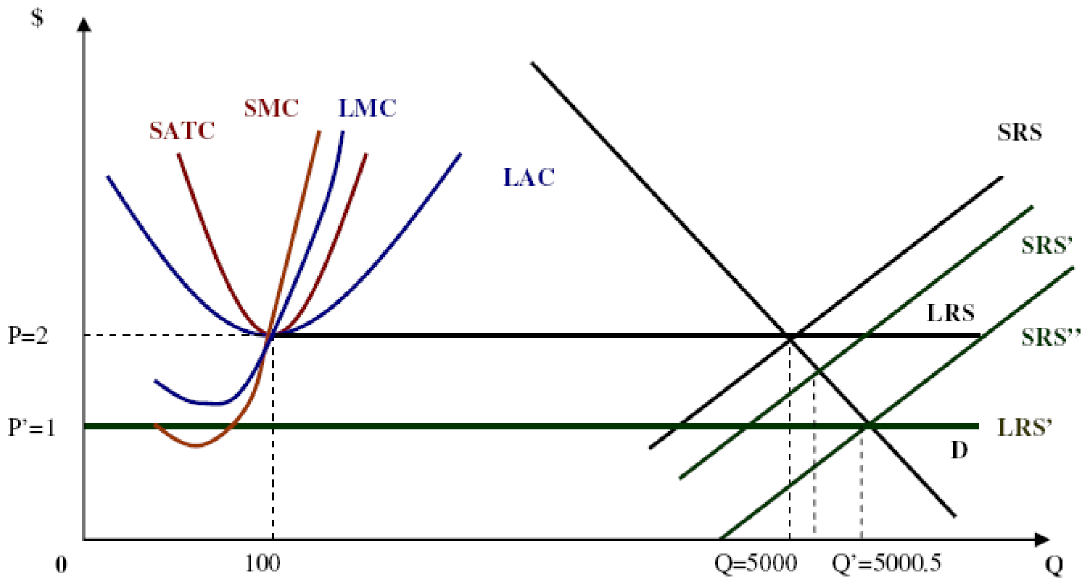
Answer: see below. Note that increase in output over the current minimum efficient scale is more costly in the short run than in the long run, since the firm cannot increase all of its factors to the optimal level in the short run. A decrease in output, however, can be achieved at a lower marginal cost in the short run.



Suppose that production technology has been improved, so that the minimum efficient scale is now achieved at 200 kg instead of 100 kg, and at the cost of $1 instead of $2.

C. At the industry level, use your graph to show the new short run and long run equilibrium in this market. Mark the equilibrium price and quantity in the long run. How many farms would there be in the new long run equilibrium?

Answer: See graph below. The number of farms is 25.


$
SATC
SMC
LMC
LAC
SRS
SRS'
LRS
SRS''
P=2
P'=1
LRS'
D
0
100
Q=5000
Q'=5000.5
Q