Question 12.5 This is EOQ with D = 19,500 units/yr; H = \$4/unit/year; S = \$25/order.

(a) $\text{EOQ} = \text{Q} = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2(19{,}500)(25)}{4}} = 493.71 \approx 494\ units$

(b) Annual holdings costs $= \left(\frac{Q}{2}\right)\text{H} = \left(\frac{494}{2}\right)4 = \$988.00$

(c) Annual ordering costs $= \left(\frac{D}{Q}\right)\text{S} = \left(\frac{19{,}500}{494}\right)25 \approx \$987.00$

Question 12.7 This problem reverses the unknown of a standard EOQ problem to solve for S.
Given D = 240 units/yr; H = \$4/unit/year; Q = 60.

Therefore:

$$60 = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2 \text{ x } 240 \text{ x } \text{S}}{0.4 \text{ x } 10}}\ or\ 60 = \sqrt{\frac{480S}{4}}\ or\ 60 = \sqrt{120S}$$

So, solving for S results in:

$$\sqrt{S} = \frac{60}{\sqrt{120}} = 5.477225575, so\ S = 5.477225575^2 = \$30.00$$

That is, if S were \$30, then the EOQ would be 60. If the true ordering cost turns out to be much greater than \$30, then the firm's order policy is ordering too little at a time.

Question 12.9 This is EOQ with D = 15,000, H = \$25/unit/year, S = \$75

(a) $\text{EOQ} = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2 \times 15{,}000 \times 75}{25}} = 300 \text{ units}$

(b) Annual holding costs = $(Q/2) \times H$ = (300/2) × 25 = \$3,750.00

(c) Annual ordering costs = $(D/Q) \times S$ = (15,000/300) × 75 = \$3,750.00

(d) $\text{ROP} = d \times L = \left(\frac{15{,}000 \text{ units}}{300 \text{ days}}\right) \times 2 \text{ days} = 100 \text{ units}$

Question 12.15 This problem meets EOQ assumptions with D = 250; H = \$1/unit; S = \$20/order.

(a) The optimal order quantity is

$$\text{EOQ} = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2(250)20}{1}} = 100 \text{ units}$$

(b) Number of orders per year = D/Q = 250/100 = 2.5 orders per year. Note that this would mean in one year the company places 3 orders and in the next it would only need 2 orders since some inventory would be carried over from the previous year. It averages 2.5 orders per year.

(c) Average inventory = $Q/2$ = 100/2 = 50 units

(d) Given an annual demand of 250, a carrying cost of \$1, and an order quantity of 150, Patterson Electronics must determine what the ordering cost would have to be for the order policy of 150 units to be optimal.

To find the answer to this problem, we must solve the traditional economic order quantity equation for the ordering cost.

$$Q = \sqrt{\frac{2DS}{H}} \quad \text{and;}$$

$$S = Q^2 \frac{H}{2D} = \frac{(150)^2(1)}{2(250)} = \frac{22{,}500}{500} = \$45.00$$

As the calculations show, an ordering cost of \$45 is needed for the order quantity of 150 units to be optimal.

Question 12.17 This problem is a Production Order Quantity model, noninstantaneous delivery.

(a) D = 12,000/yr
H = \$.10/light-yr
S = \$50/setup
P = \$1.00/light
p = 100/day

$$d = \frac{12{,}000/\text{yr}}{300 \text{ days/yr}} = 40/\text{day}$$

$$Q = \sqrt{\frac{2DS}{H\left(1-\frac{d}{p}\right)}} = \sqrt{\frac{2(12{,}000)50}{0.1\left(1-\frac{40}{100}\right)}} = 4{,}472 \text{ lights per run}$$

(b) Average holding cost /year $= \frac{Q}{2}\left[1-\frac{d}{p}\right]\text{H} = \frac{4{,}472}{2}\left[1-\frac{40}{100}\right](0.10) = \frac{\$26{,}832}{200} = \$134.16$

(c) Average setup cost /year $= \left(\frac{D}{S}\right)H = \left(\frac{12{,}000}{4{,}472}\right)50 = \$134.16$

(d) Total cost (including cost of goods) = PD + \$134.16 + \$134.16
= (\$1 × 12,000) + \$134.16 + \$134.16 = \$12,268.32/year

Question 12.22 This problem is a Quantity Discount EOQ model with D = 45,000; S=\$200; I = 5% of unit price, H = IP.

The best option must be determined first.

At \$1.80, $Q^* = \sqrt{\frac{2DS}{IP}} = \sqrt{\frac{2(45{,}000)200}{0.05(1.80)}} = \sqrt{\frac{18{,}000{,}000}{0.09}} = 14{,}142.14 \approx 14{,}143$

At \$1.60, $Q^* = \sqrt{\frac{2DS}{IP}} = \sqrt{\frac{2(45{,}000)200}{0.05(1.60)}} = \sqrt{\frac{18{,}000{,}000}{0.08}} = 15{,}000$

At \$1.40, $Q^* = \sqrt{\frac{2DS}{IP}} = \sqrt{\frac{2(45{,}000)200}{0.05(1.40)}} = \sqrt{\frac{18{,}000{,}000}{0.07}} = 16{,}035.67 \approx 16{,}036$

At \$1.25, $Q^* = \sqrt{\frac{2DS}{IP}} = \sqrt{\frac{2(45{,}000)200}{0.05(1.25)}} = \sqrt{\frac{18{,}000{,}000}{0.0625}} = 16{,}970.56 \approx 16{,}971$

Since all solutions yield Q values greater than 10,000, the best option is the \$1.25 price.

(a) $Q^* = \sqrt{\frac{2DS}{IP}} = \sqrt{\frac{2(45{,}000)200}{0.05(1.25)}} = \sqrt{\frac{18{,}000{,}000}{0.0625}} = 16{,}970.56 \approx 16{,}971$

(b) Annual holding costs $= \frac{Q}{2}(IP) = \left(\frac{16{,}971}{2}\right)(0.05)(1.25) = \$530.33$

(c) Annual order (setup)costs $= \frac{D}{Q}(S) = \left(\frac{45{,}000}{16{,}971}\right)(200) = \$530.33$

(d) Unit costs = P x D = (\$1.25)(45,000) = \$56,250.00

(e) Total annual costs = \$530.33 + \$530.33 + \$56,250.00 = \$57,310.66

Question 12.26 This problem is a Quantity Discount EOQ model with D = 9,600; S=\$50; I = 50% of unit price, H = IP.

(a) Calculation for EOQ:

Vendor 1:

At \$17.00, $Q^*= \sqrt{\frac{2DS}{IP}} = \sqrt{\frac{2(9{,}600)50}{0.5(17)}} = \sqrt{\frac{960{,}000}{8.5}} = 336.07 \approx 336$ feasible

At \$16.75, $Q^*= \sqrt{\frac{2DS}{IP}} = \sqrt{\frac{2(9{,}600)50}{0.5(16.75)}} = \sqrt{\frac{960{,}000}{8.375}} = 338.57 \approx 338$ not feasible

At \$16.50, $Q^*= \sqrt{\frac{2DS}{IP}} = \sqrt{\frac{2(9{,}600)50}{0.5(16.50)}} = \sqrt{\frac{960{,}000}{8.25}} = 341.12 \approx 341$ not feasible

Vendor 2:

At \$17.10, $Q^*= \sqrt{\frac{2DS}{IP}} = \sqrt{\frac{2(9{,}600)50}{0.5(17.10)}} = \sqrt{\frac{960{,}000}{8.55}} = 335.08 \approx 335$ feasible

At \$16.85, $Q^*= \sqrt{\frac{2DS}{IP}} = \sqrt{\frac{2(9{,}600)50}{0.5(16.85)}} = \sqrt{\frac{960{,}000}{8.425}} = 337.56 \approx 337$ not feasible

At \$16.60, $Q^*= \sqrt{\frac{2DS}{IP}} = \sqrt{\frac{2(9{,}600)50}{0.5(16.60)}} = \sqrt{\frac{960{,}000}{8.3}} = 340.09 \approx 340$ not feasible

At \$16.25, $Q^*= \sqrt{\frac{2DS}{IP}} = \sqrt{\frac{2(9{,}600)50}{0.5(16.25)}} = \sqrt{\frac{960{,}000}{8.125}} = 343.74 \approx 343$ not feasible

(b), (c) Calculation of Total cost:

Qty	Price	Ordering	Holding	Purchase	Total	
336	\$17.00	\$1,428.57	\$1,428.00	\$163,200.00	\$166,056.57	Vendor 1
500	\$16.75	\$960.00	\$2,093.75	\$160,800.00	\$163,853.75	
1000	\$16.50	\$480.00	\$4,125.00	\$158,400.00	\$163,005.00	
335	\$17.10	\$1,432.84	\$1,432.13	\$164,160.00	\$167,024.96	Vendor 2
400	\$16.85	\$1,200.00	\$1,685.00	\$161,760.00	\$164,645.00	
800	\$16.60	\$600.00	\$3,320.00	\$159,360.00	\$163,280.00	
1200	\$16.25	\$400.00	\$4,875.00	\$156,000.00	\$161,275.00	BEST

Annual Demand	9600
Setup cost/order	50
Holding cost/unit	0.5

(e) Other considerations include the perishability of the chemical and whether there is adequate space in the controlled environment to handle 1,200 pounds of the chemical at one time.

Question 12.37 This problem is an EOQ production Order Quantity model.

Given Annual demand, $D = 8{,}000$
Daily production rate, $p = 200$
Setup cost, $S = 120$
Holding cost, $H = 50$
Production quantity, $Q = 400$

(a) Daily demand, $d = D/250 = 8{,}000/250 = 32$

(b) Number of days in production run $= Q/p = 400/200 = 2$

(c) Number of production runs per year $= D/Q = 8{,}000/400 = 20$

Annual setup cost $= 20(\$120) = \$2{,}400$

(d) Maximum inventory level $= Q(1 - d/p) = 400(1 - 32/200) = 336$

Average inventory = Maximum/2 = 336/2 = 168

(e) Total holding cost + Total setup cost

$= (168)50 + 20(120) = \$8{,}400 + \$2{,}400 = \$10{,}800.00$

(f) $Q = \sqrt{\dfrac{2DS}{H\left(1 - \dfrac{d}{p}\right)}} = \sqrt{\dfrac{2(8{,}000)120}{50\left(1 - \dfrac{32}{200}\right)}} = 213.81$

Total holding cost + Total setup cost = 4,490 + 4,490 = \$8,980

Savings = \$10,800 – \$8,980 = \$1,820