The Gold Rings Question

Project Maths 2011 Paper 1 Q. 5

SEc SetA   Stock: 147g of 9-carat gold
2011 P.1   85g of 18-carat gold
Q.5   Value = Value of gold content @ €36 per gram.

c = Carat Rating
m_g = mass of gold in material
m_t = total mass of material

$$C = 24 \frac{m_g}{m_t}$$

$$\frac{C m_t}{24} = m_g$$

a)   What is the value of the stock?

Value = Value of gold.

⇒ Mass of gold is:

$$\frac{9(147)}{24} + \frac{18(85)}{24} = 118 \cdot 875 \ g$$

Value of gold

$$= 118 \cdot 875 \,(36) = €4279 \cdot 50$$

SEc SetA   Stock: $147g$ of 9-carat gold
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-3 ①

b) To make a 21 gram 15-carat pendent. How much of the 9-carat and 18 carat stock should be used?

let m_9 = mass of 9-carat used
     m_{18} = mass of 18-carat used

$$m_9 + m_{18} = 21 \quad ①$$

$$\frac{3 \cancel{9} \, m_9}{24} + \frac{6 \cancel{18} \, m_{18}}{24} = \frac{5 \cancel{15} (21)}{24}$$

$$\Rightarrow \quad 3 m_9 + 6 m_{18} = 105 \quad ②$$
$$\underline{-3 m_9 - 3 m_{18} = -63}$$

$$3 m_{18} = 42$$
$$m_{18} = \boxed{14 \, g}$$

$$m_9 = 21 - 14 = \boxed{7 \, g}$$

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gold alloy = gold + copper + silver. In old Stock Ratio copper to silver = 1:1. The jeweller has pure silver to add to any mixture. He wants an item that:
• is $48g$ • 15-carat gold • twice as much silver as copper.

2011
Q6
P.1
(c)

Stock: $147g$ of 9-carat gold
       $85g$ of 18-carat gold

$$c = 24 \frac{m_g}{m_t}$$

$$\frac{c m_t}{24} = m_g$$

(i) How many grams of copper will this item contain?

Mass of gold?

$$m_g = \frac{15(48)}{24} = 30 \, g$$

mass alloys? $= 48 - 30 = 18 \, g$

Ratio $2:1 = 12:6$

$$\Rightarrow \boxed{6g \text{ of copper}}$$

gold alloy = gold + copper + silver. In old stock Ratio copper to silver = 1:1.
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   • Is 48g   • 15-carat gold   • twice as much silver as copper.

2011
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(C)

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        85g of 18-carat gold

$C = 24 \dfrac{M_g}{M_t}$

$\dfrac{C M_t}{24} = m_g$

$-$ ①

ii) How many grams of each type of stock should be used?

In part (i) ⇒ 6g of silver added.
⇒ mass of old stock = 48 − 6 = 42 g

⇒ $M_9 + M_{18} = 42$ ①

$\dfrac{\cancel{9}^{3} M_9}{24} + \dfrac{\cancel{18}^{2} (m_{18})}{24} = \dfrac{\cancel{15}^{5} (48)^{16}}{24}$

$m_9 + 2 m_{18} = 80$ ②
$- m_9 - m_{18} = -42$
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⇒ $m_{18} = 36 g$

$M_9 = 42 - 36 = 4g = m_9$

5 g 14-carat gold rings − Cost = €135 + gold cost.
      Sales ⤳ 20 rings per month @ €200
              every €20 more ⇒ 1 less sale

Profit = Value Sales − Costs

$C = 24 \dfrac{M_g}{M_t}$

$\dfrac{C M_t}{24} = m_g$

gold = €36 per g.

(i) Price = $(200 + 20x)$; Profit?

Value of Sales = Price × no. Sales
               = $(200 + 20x)(20 − x)$

Costs? = $(20 − x)\left(135 + 36\left(\dfrac{14(5)}{24}\right)\right)$
       = $240 (20 − x)$

Profit = $(200 + 20x)(20 − x) − 240 (20 − x)$
       = $(20 − x)(200 − 240 + 20x)$
       = $(20 − x)(20x − 40)$
       = $20(20 − x)(x − 2)$

5 g   14-carat gold rings — Cost = €135 + gold cost.

  Sales ↦ 20 rings per month @ €200
       every €20 more ⇒ 1 less sale

Price = 200 + 20x

no. Sales = 20 – x

Profit = 20(20–x)(x–2)

Price

(ii) Find selling price for which Profit ≥ €1600

$$\Rightarrow \quad 20(20-x)(x-2) \geq 1600$$
$$(20-x)(x-2) \geq 80$$
$$20x - 40 - x^2 + 2x \geq 80$$
$$-x^2 + 22x - 120 \geq 0$$
$$x^2 - 22x + 120 \leq 0$$

If $x^2 - 22x + 120 = 0$
$$(x-12)(x-10) = 0$$
$$x = 12 \text{ or } 10$$

check is x inside/outside?

$x = 0 \Rightarrow 0^2 - 22(0) + 120 = 120 \neq 0$

⇒ not outside !   ⇒ $10 \leq x \leq 12$

$x = 10 \Rightarrow$ Price $= 200 + 20(10) = 400$
$x = 12 \Rightarrow$ Price $= 200 + 20(12) = 440$

Price between €400 and €440

x	Price	No. Sales	Value of Sales	Cost of Sales	Profit
0	200	20	4000	4800	-800
1	220	19	4180	4560	-380
2	240	18	4320	4320	0
3	260	17	4420	4080	340
4	280	16	4480	3840	640
5	300	15	4500	3600	900
6	320	14	4480	3360	1120
7	340	13	4420	3120	1300
8	360	12	4320	2880	1440
9	380	11	4180	2640	1540
10	400	10	4000	2400	1600
11	420	9	3780	2160	1620
12	440	8	3520	1920	1600
13	460	7	3220	1680	1540
14	480	6	2880	1440	1440
15	500	5	2500	1200	1300
16	520	4	2080	960	1120
17	540	3	1620	720	900
18	560	2	1120	480	640
19	580	1	580	240	340