

1. 10.4821 Seconds

Microsoft Whiteboard

N.S HW-1

Jumper 1

$V(t) = \frac{mg}{c} (1 - e^{-\frac{c}{m}t})$
 1. Masses - 70 kg
 2. Gravity - 9.81
 3. Drag coefficient - 15 kg
 4. $e^{-2.71628}$
 $V(0) = \frac{70(9.81)}{15} (1 - e^{-\frac{15}{70}t})$
 $= 44.992$

Solution

$V(t) = \frac{mg}{c} (1 - e^{-\frac{c}{m}t})$
 $= \frac{80(9.81)}{15} (1 - e^{-\frac{15}{80}t}) = 44.992$
 $= \frac{52.32 (1 - e^{-0.1875t})}{52.32} = 44.992$
 $= 1 - e^{-0.1875t} = 0.8599$
 $+ e^{-0.1875t} = 0.8599$
 $= 0.1401 = e^{-0.1875t}$
 $\ln(0.1401) = \ln(e^{-0.1875t})$
 $-1.9654 = -0.1875t$
 $\frac{-1.9654}{-0.1875} = \frac{-0.1875t}{-0.1875}$
 $= 10.4821 \text{ seconds}$

16%

2.

Min	Volume
0	63.8791
0.25	62.3335
0.5	60.8130
0.75	59.3173
1.00	57.8462

$2.5 - 2.4193 = 0.08 \text{ mm/min}$

min	Volume
0	63.8791
0.25	62.3335
0.5	60.8130
0.75	59.3173
1.00	57.8462

$V(t) = V(t_1) + (KA)t_2$
 $V(t_1) = \frac{4}{3}\pi r^2 = 65.4498$
 $K = 0.08$
 $A = 4\pi r^2 = 78.5398$
 $V(t_2) = 65.4498 + (0.08 \cdot 78.5398)0.25 = 63.8791$
 $V(t_2) = V(t_1) + (KA)t_2$
 $K = 0.08$
 $A = 77.2791$
 $V(t_2) = 65.4498 + (0.08 \cdot 77.2791)0.25 = 62.3335$

3. $Q_1 = 1.2$
 $Q_2 = 0.7$
 $Q_3 = 0.5$
 $Q_4 = 0.2$
 $Q_5 = 0.3$
 $Q_6 = 0.2$
 $Q_7 = 0.1$
 $Q_8 = 0.3$
 $Q_9 = 0.5$
 $Q_{10} = 1.2$



$$Q_1 = Q_3 + Q_2 = 1.2$$

$$Q_2 = 0.7$$

$$Q_3 = 0.5$$

$$Q_4 = Q_3 - Q_5 = 0.2$$

$$Q_5 = Q_6 + Q_7 = 0.3$$

$$Q_6 = Q_8 - Q_7 = 0.2$$

$$Q_7 = 0.1$$

$$Q_8 = 0.3$$

$$Q_9 = Q_4 + Q_8 = 0.5$$

$$Q_{10} = Q_2 + Q_9 = 1.2$$

4.

Min	Temp
0	68.1000
2	66.2722
4	64.5139
6	62.8223
8	61.1951
10	59.6297
12	58.1237
14	56.6750

16	55.2814
18	53.9407
20	52.6509

```

problem_four.py > main
1  def main():
2      past_temp = 70
3      current_temp = past_temp
4      k = 0.019
5      ambient_temperature = 20
6      change_in_time = 2
7      for i in range(0, 21, 2):
8          derivative = -k * (current_temp - ambient_temperature)
9          current_temp = past_temp + (derivative * change_in_time)
10         print(current_temp)
11         past_temp = current_temp
12
13     if __name__ == "__main__":
14         main()

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

PS D:\School\CS3320\HW\HW-1> & C:/Users/cody1/AppData/Local/Programs/Python/Python39/python.exe d:/School/CS3320/HW/HW-1/problem_four.py

Traceback (most recent call last):

File "d:\School\CS3320\HW\HW-1\problem_four.py", line 13, in <module>

main()

File "d:\School\CS3320\HW\HW-1\problem_four.py", line 7, in main

derivative = -k * (current_temp - ambient_temperature)

UnboundLocalError: local variable 'current_temp' referenced before assignment

PS D:\School\CS3320\HW\HW-1> & C:/Users/cody1/AppData/Local/Programs/Python/Python39/python.exe d:/School/CS3320/HW/HW-1/problem_four.py

68.1

66.2722

64.5138564

62.822329856799996

61.1950813222416

59.62966823199642

58.123740839180556

56.675038687291696

55.28138721717461

53.94069450292198

52.65094811181094

PS D:\School\CS3320\HW\HW-1>

5. $4/3r^3(p_s - p_f) + p_f r h^2 - p_f / 3h^3$

Volume above water =

$$V_a = \int_0^h A(h) dh = \int_0^h \pi (r^2 - (r-h)^2) dh$$

$$V_a = \pi \int_0^h (2rh - h^2) dh = \pi \left(rh^2 - \frac{1}{3}h^3 \right) = \frac{\pi h^2}{3} (2r - h)$$

Force balance = $p_s g \left(\frac{4}{3} \pi r^3 \right) - p_f g \left(\frac{4}{3} \pi r^3 - \frac{\pi h^2}{3} (2r - h) \right)$