#### **Answer Form**

# Theoretical problem No. 2

### DOPPLER LASER COOLING AND OPTICAL MOLASSES

## PART I: BASICS OF LASER COOLING

## 1. Absorption.

		0.2
1b		0.2
1c		0.2
2. 8	Spontaneous emission in the $-x$ direction.	
2a		0.2
2a		0.2
2a		0.2
2a 2b		0.2

2c		0.2
2d		0.2
3. S	pontaneous emission in the $+x$ direction.	
3a		0.2
3b		0.2
3c		0.2
3d		0.2
1 1	varage emission after absorption	
<b>4.</b> A	verage emission after absorption.	
4a		0.2

		0.2
4c		0.2
40		0.2
4d		0.2
5. E	Energy and momentum transfer.	
5a		0.2
		0.2
		0.2
		0.2
5a		
5a 5b	Energy and momentum transfer by a laser beam along the +x direction	0.2
5a 5b	Energy and momentum transfer by a laser beam along the +x direction	0.2
5a 5b	Energy and momentum transfer by a laser beam along the $\pm x$ direction	0.2 n.

6b			0.3
PART II: I MOLASSI		THE FUNDAMENTALS OF	OPTICAL
7. Force or	the atomic beam by	the lasers.	
7a			1.5
3. Low vel	ocity limit.		
	ocity limit.		1.5
8a	ocity limit.		
8a Ba	ocity limit.		0.25

		0.25
8d		0.25
8e		0.25
9. Opti	ical molasses	
9. Opti	ical molasses	
		1.5
9a 9a		1.5
		1.5
		1.5
		1.5
		1.5
		1.5
9a		
		0.5
9a		
9a		
9a		