

**Answer Form**  
**Theoretical problem No. 2**

**DOPPLER LASER COOLING AND OPTICAL MOLASSES**

**PART I: BASICS OF LASER COOLING**

**1. Absorption.**

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

2a		0.2
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2b		0.2
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2c		0.2
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2d		0.2
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**3. Spontaneous emission in the  $+x$  direction.**

3a		0.2
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3b		0.2
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3c		0.2
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3d		0.2
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**4. Average emission after absorption.**

4a		0.2
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4b		0.2
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4c		0.2
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4d		0.2
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**5. Energy and momentum transfer.**

5a		0.2
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5b		0.2
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**6. Energy and momentum transfer by a laser beam along the  $+x$  direction.**

6a		0.3
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6b		0.3
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**PART II: DISSIPATION AND THE FUNDAMENTALS OF OPTICAL MOLASSES**

**7. Force on the atomic beam by the lasers.**

7a		1.5
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**8. Low velocity limit.**

8a		1.5
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8b		0.25
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8c		0.25
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8d		0.25
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8e		0.25
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## 9. Optical molasses

9a		1.5
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9b		0.5
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