Unit 6 - Week 4

Course outline

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Assessment 4

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-10-14, 23:59 IST.

1) You are given the following Langevin type stochastic differential equation $dx(t)-f(x)dt+g(x)dW(t)$. The corresponding Fokker Planck equation for the probability density will take the form: *1 point*

- $\frac{\partial p(x,t)}{\partial t} = -\frac{\partial}{\partial x}[f(x)p(x,t)]+\frac{1}{2}\frac{\partial^2}{\partial x^2}[g(x)^2 p(x,t)]$
- $\frac{\partial p(x,t)}{\partial t} = -\frac{\partial}{\partial x}[f(x)p(x,t)]+\frac{\partial^2}{\partial x^2}[g(x)p(x,t)]$
- $\frac{\partial p(x,t)}{\partial t} = -\frac{\partial}{\partial x}[f(x)p(x,t)]+\frac{1}{2}\frac{\partial^2}{\partial x^2}[g(x)p(x,t)]$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{\partial p(x,t)}{\partial t} = -\frac{\partial}{\partial x}[f(x)p(x,t)]+\frac{1}{2}\frac{\partial^2}{\partial x^2}[g(x)^2 p(x,t)]$

2) Given that $\hat{q}|q\rangle = q|q\rangle$ and $|q,t\rangle = e^{-iHt}|q\rangle$, which of the following holds: *1 point*

- $\hat{q}(t)|q\rangle = q|q,t\rangle$
- $\hat{q}(t)|q,t\rangle = q|q,t\rangle$
- $\hat{q}(t)|q\rangle = p|q,t\rangle$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\hat{q}(t)|q,t\rangle = q|q,t\rangle$

3) $\int dq|q\rangle\langle q|$ where the integration is over a complete set of $q-states$ equals: *1 point*

- $\hat{I}$ (the identity operator)
- 0
- ∞
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\hat{I}$ (the identity operator)

4) The expression $\langle q',t'|q'',t''\rangle$ represents: *1 point*

- The probability of a quantum system in state $|q',t'\rangle$ to move to state $|q'',t''\rangle$
- The transition amplitude of a quantum system in state $|q',t'\rangle$ to move to state $|q'',t''\rangle$
- The transition amplitude of a quantum system in state $|q'',t''\rangle$ to move to state $|q',t'\rangle$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
The transition amplitude of a quantum system in state $|q'',t''\rangle$ to move to state $|q',t'\rangle$

5) The Lagrangian of a particle moving in a potential $V(q)$ is given by: *1 point*

- $L(q,\dot{q}) = \frac{1}{2}m\dot{q}^2 + V(q)$
- $L(q,\dot{q}) = \frac{1}{2}m\dot{q}^2$
- $L(q,\dot{q}) = \frac{1}{2}m\dot{q}^2 - V(q)$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$L(q,\dot{q}) = \frac{1}{2}m\dot{q}^2 - V(q)$

6) You are given that $|p_i\rangle$ is an eigenstate of the momentum operator $\hat{p}$ for a single non-relativistic free particle with the Hamiltonian $\hat{H} = \frac{\hat{p}^2}{2m}$. The expression $\langle p_i|\hat{H}(\hat{p},\hat{q})|q_i\rangle$ evaluates to (Use the inner product $\langle q|p\rangle = e^{ipq/\hbar}$): *1 point*

- $\exp\left(-\frac{i}{\hbar}p_i q_i\right)$
- $\frac{p_i^2}{2m}\exp(p_i q_i)$
- $\frac{p_i^2}{2m}$
- $\frac{p_i^2}{2m}\exp\left(-\frac{i}{\hbar}p_i q_i\right)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{p_i^2}{2m}\exp\left(-\frac{i}{\hbar}p_i q_i\right)$

7) $\int \frac{e^{ikx}}{a^2-x^2}\delta(x)dx$ evaluates to: *1 point*

- 1
- 0
- e^{ika}
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
None of the above

8) The Lagrangian of a harmonic oscillator is: $L = \frac{1}{2}m\dot{q}^2 - \frac{1}{2}kq^2$. The corresponding Euler Lagarnge equation is: *1 point*

- $m\dot{q} - kq = 0$
- $m\ddot{q} + kq = 0$
- $m\ddot{q} - kq = 0$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$m\ddot{q} + kq = 0$

9) $\int_{-\infty}^{+\infty}(4x^2-1)\delta'(x-3)dx$ is equal to: *1 point*

- -24
- 3
- 12
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
-24

10) The probability density function of a Gaussian distribution is $p(x) = \frac{1}{\sqrt{2\pi}}e^{-\frac{1}{2}x^2}$. Its characteristic function is: *1 point*

- $C_x(t) = \frac{1}{2}t^2$
- $C_x(t) = e^{\frac{1}{2}t^2}$
- $C_x(t) = e^{-\frac{1}{2}t^2}$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$C_x(t) = e^{-\frac{1}{2}t^2}$