PHY401A: Weekly Quizzes (Odd semester: 2022-23)

Total points: 5x10= 50 Date: Tuesday Time: 13h15-13h25

Quiz no. 4 (more than one answer may be correct)

16. What will be the generalized momentum for the Lagrangian $L = \frac{1}{2}\dot{q}^2 - \frac{1}{2}q^2 + q\dot{q}$

(a) $\ddot{q}$
(b) $q + \dot{q}$
(c) $\dot{q}$
(d) $\dot{q}^2$

17. If the bob of a sperical pendulum is allowed to move only on the surface of the southern hemisphere of a three dimensional sphere, how many cyclic coordinates would the corresponding Lagrangian have when expressed in terms of spherical polar coordinates?

(a) 3
(b) 2
(c) 1
(d) 0

18. In Cartesian coordinates, $\mathbf{v} = \dot{x}\ \hat{i} + \dot{y}\ \hat{j} + \dot{z}\ \hat{k}$ denotes the particle velocity. For a non-constant vector field $\mathbf{M}(\mathbf{v}, t)$, which of the following expressions is(are) always equivalent to $(\mathbf{M} \cdot \nabla_{\mathbf{v}})\mathbf{v}$?

(a) $\mathbf{v}\,(\nabla_{\mathbf{v}} \cdot \mathbf{M})$
(b) $\mathbf{0}$
(c) $\mathbf{M}$
(d) $\nabla_{\mathbf{v}}\,(\mathbf{v} \cdot \mathbf{M}) - \mathbf{v} \times (\nabla_{\mathbf{v}} \times \mathbf{M})$

19. What will be the energy function for a Lagrangian $L = \frac{1}{2}(\dot{x} - \dot{y})^2 - \frac{1}{6}xy$

(a) $\frac{1}{2}(\dot{x} - \dot{y})^2 + \frac{1}{6}xy$
(b) $\frac{1}{2}(\dot{x} + \dot{y})^2 - \frac{1}{6}xy$
(c) $\frac{1}{2}\dot{x}\dot{y} + \frac{1}{6}xy$
(d) $\frac{1}{2}(\dot{x}^2 + \dot{y}^2) + \frac{1}{6}xy$

20. For a mechanical system consisting of both conservative (derived from a scalar potential) and non-conservative (not derived from any scalar potential) forces, which of the following statement(s) is(are) true?

(a) There is no Lagrangian which satisfies an Euler-Lagrange equation for the system
(b) All Lagrangians must have a velocity dependent potential
(c) In some cases, the non-conservative force can be derived from Rayleigh dissipation function
(d) The Lagrangian of the system is exactly the same as that of an analogous system without the non-conservative force

No Rough Work is Allowed on this Page