PHY201 List of eExam Questions in the Bank

Latex formatted questions may not properly render

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Q3 The equation $$H=\sum_{k=1}^{n}p_{k}\dot{q}_{k}{-}L\left (q_{k},\dot{q}_{k}, t \right)$$ gives the classical Hamiltonian function for a system of particles, each of mass $$m_{k}$$ and described by the generalized coordinates $$q_{k}$$. For a system of particles in a coservative field, theHamiltonian function given represents of the system

Q4 $$ \frac{d}{dt}\left (\frac{\partial {L}}{\partial {\dot{q_{k}}}} \right) =\frac{\partial L}{\partial q_{k}}$$ represent the _'s equations of motion for a conservative system subject to, at worst, only holonomic constraints

Q5 In the application of the variational principle to a physical system, the quantity $$L$$ in the equation $$L=T-V$$ is called the

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Q12 If the displacement of a simple harmonic oscillator as a function of time I given as $$x=Acos\left (\omega{t}+\phi \right)$$, the quantity $$phi$$ is called the constant

Q13 $$\triangledown\times\left (\triangledown\phi \right)$$= . Note $$\phi $$ is the potential in a conservative force field.

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Q40 If the work done in moving a particle from place to place in a force field is independent of the path followed by the particle, then the force field is said to be

Q41 A damped oscillation driven by external periodic impulses whose frequecy is the same as the natural frequency of the oscillator

Q42 If the resistance to a simple harmonic oscillation is very strong, the motion is said to be heavily

Q43 In reality, the amplitude of a simple harmonic oscillator gradually decreases in the presence of dissipative forces. Such motion is said to be

Q44 In an LC circuit, the quantity $\frac{1}{\sqrt{LC}}$ represents

Q45 The displacement of a simple harmonic oscillator is given as $x=Acos\left(\omega{t}{+}\phi\right)$. The quantity $\left(\omega{t}{+}\phi\right)$ is the of the oscillation. (symbols have their usual meaning)

Q46 The term mormal mode frequency is associated with oscillation

Q47 The inertial factor in the spring mass system is $$m$$. The inertial factor in the LC circiut is

Q48 Any motion that repeats itself at a regular intervals of time is said to be

Q49 The equation $$\left(\frac{du}{d\theta}\right)^{2}+U^{2}=\frac{2m}{L^{2}}\left(E-V\right)$$ is the statement of conservation of

Q50 For an oscillating system, if the restoring force obeys Hooke's law for small displacement from equilibrium position, the the motion is

Q51 A damped oscillation driven by external periodic impulses whose frequecy is the same as the natural frequency of the oscillator is said to -----------

be heavily damped
free
resonate
be critically damped

Q52 The equation of motion of a simple harmonic oscillator is $$\frac{d^{2}x}{dt^{2}}+16x=0$$. Solve this equation subject to the initial conditions that at $$t=0$$, $$x=4 cm$$ and $$\frac{dx}{dt}=0$$.

$$x(t)=3cos2t$$
$$x(t)=4cos4t$$
$$x(t)=2cost$$
$$x(t)=\sqrt{2}cos\left(2t{-}\pi/3\right)$$

Q53 Which of the following is NOT a valid solution of the equation of a simple harmonic oscillator ? The symbols have their usual meaning.

$$x=acos\left(\omega{t}+\phi\right)$$
$$x=asin\left(\omega{t}-\phi\right)$$
$$x=acos\left(\omega{t}{-}\phi\right)$$
$$x=asin\left(\omega{-}\phi{t}\right)$$

Q54 The equation of a simple harmonic motion is given as $$\frac{d^{2}{x}}{dt^{2}}+\omega^{2}{x}=0$$ where the symbols have their usual meaning. The dimension of the quatity $$\omega^{2}$$ is

$$ L^{-1}$$
$$M$$
$$T^{-2}$$
$$LT^{-2}$$

Q55 Write down the correct relation for the component of the acceleration in the $$\hat{r}$$ direction in the plane polar coordinate system

$$r\ddot{\theta}+2\dot{r}\ddot{\theta}$$
$$\ddot{r}{+}r\ddot{{\theta}^{2}}$$
$$r\ddot{\theta}{-}2\dot{r}\ddot{\theta}$$
$$\ddot{r}{-}r\dot{{\theta}^{2}}$$

Q56 In the plane polar coordinate system, which of the following correctly

gives the component of acceleration in the $$\hat{\theta}$$ direction?
$$r\ddot{\theta}+2\dot{r}\ddot{\theta}$$
$$\ddot{r}{+}r\ddot{{\theta}^{2}}$$
$$r\ddot{\theta}{-}2\dot{r}\ddot{\theta}$$
$$\ddot{r}{-}r\ddot{{\theta}^{2}}$$

Q57 In the plane polar coordinate system, which of the following correctly gives the component of velocity in the $$\hat{\theta}$$ direction?
$$\dot{r}$$
$$\dot{\theta}$$
$$r\dot{\theta}$$
$$r\dot{r}$$

Q58 if $$\hat{r}$$, $$\hat{\theta}$$ are the functions of $$\theta$$ in the plane polar coordinate system, which of the following is Not a correct relation among $$\theta$$, $$\hat{r}$$, and $$\hat{\theta}$$?
$$\hat{r}=\hat{x}cos\theta{-}\hat{y}sin\theta$$ $$
$$\hat{r}=\hat{x}cos\theta{+}\hat{y}sin\theta$$ $$
$$\hat{\theta}={-}\hat{x}sin\theta{+}\hat{y}cos\theta $$
$$\hat{\theta}=\hat{y}cos\theta{-}\hat{x}sin\theta $$ $$

Q59 In the plane polar coordinates, which of the following relations is NOT correct?
$$x=rcos\theta $$
$$\theta=sin^{-1}\frac{y}{\left (x^{2}+y^{2} \right)^{1/2}}$$
$$\theta=cos^{-1}\frac{x}{\left (x^{2}+y^{2} \right)^{1/2}}$$
$$\theta=rsinx$$

Q60 A particl is subjected to a force $$F=\left (2xy+z^{2} \right) \hat{i}+x\hat{j}+2xz\hat{k}$$ in a conservative field. Find the potential function.
$$2xyz$$
$${-}\left (x^{2}y+z^{2}x \right)$$
$$2x^{2}yz^{2}$$
$${-}\left (xy^{2}+zx^{2} \right)$$

Q61 Given that the hamiltonian function for the motion of a one-dimensional harmonic oscillator is $$H=\frac{1}{2m}p^{2}+\frac{k}{2}x^{2}$$, which of the following is the correct set of hamiltonian equation of motion for the system?
$$ \frac{p}{m}=\ddot{x}$$, $$kx={-}\ddot{p}$$
$$ \frac{p}{m}=\dot{x}$$, $$kx={-}\dot{p}$$
$$ \frac{x}{m}=\dot{p}$$, $$kp={-}\dot{x}$$
$$ \frac{x}{m}=\dot{p}$$, $$kx={-}\ddot{x}$$

Q62 Which of the following is the correct Hamiltonian function for the motion of a particle in a central field?
$$H=\frac{1}{2}\left (p^{2}_{\theta}+\frac{p^{2}_{r}}{\theta^{2}} +V\left (\theta \right) \right)$$
$$H=\frac{1}{2}\left (p^{2}_{\theta}+\frac{p^{2}_{r}}{\theta^{2}} +V\left (r \right)\right)$$
$$H=\frac{1}{2}\left (p^{2}_{\theta}{-}\frac{p^{2}_{r}}{\theta^{2}} +V\left (r \right)\right)

$$
$$H=\frac{1}{2}\left (p^{2}_{r}+\frac{p^{2}_{\theta}}{r^{2}} +V\left (r \right)\right)$$

Q63 Which of these is the correct set up of the Lagrangian for a simple pendulum?

$$L\left (\theta,\ddot{\theta} \right)=\frac{1}{2}ml^{2}\ddot{\theta}^{2}+mglcos\theta$$
$$L\left (\theta,\dot{\theta} \right)=\frac{1}{2}ml^{2}\ddot{\theta}^{2}+mglsin\theta$$
$$L\left (\theta,\dot{\theta} \right)=\frac{1}{2}ml^{2}\dot{\theta}^{2}+mglcos\theta$$
$$L\left (\dot{\theta},\ddot{\theta} \right)=\frac{1}{2}ml^{2}\ddot{\theta}^{2}-mglcos\theta$$

Q64 Which of the following is NOT a correct canonical equation of Hamilton? (Symbols have their usual meaning)

$$\frac{\partial{H}}{\partial{p_{\alpha}}}=\dot{p_{\alpha}}$$
$$\frac{\partial{H}}{\partial{p_{\alpha}}}=\dot{q_{\alpha}}$$
$$\frac{\partial{H}}{\partial{q_{\alpha}}}={-}\dot{p_{\alpha}}$$
$$\frac{\partial{H}}{\partial{t}}={-}\frac{\partial{L}}{\partial{t}}$$

Q65 The equations $$\begin{matrix} \dot{x_{1}}=\sum_{k=1}^{3N}\frac{\partial{x}_{1}}{\partial{q_{k}}}{+}\frac{\partial{x_{1}}}{\partial{t}},\\ .\\ .\\ .\\ \\\dot{x_{N}}=\sum_{k=1}^{3N}\frac{\partial{x}_{N}}{\partial{q_{k}}}{+}\frac{\partial{x_{N}}}{\partial{t}} \end{matrix}$$ represent the cartesian velocity components expressed in terms of

generalised coordinates and velocities
generalised forces and acceleration
generalised forces and torques
generalised forces and momenta

Q66 If a system of particles is described by a set of generalised coordinates $$q_{1},...,q_{3N}$$, then $$\dot{q_{k}}$$ for $$k=1,2,…,3N$$ is called the ----------- associated with the coordinates

specifie torque
generalised velocity
angular acceleration
generalised force

Q67 Which of these is an example of a system of particles subject to constraints?

a single particle
3N free particles
rigid object
N free particles

Q68 The generalised force associted with angular quantities is

potential
energy
power
a torque

Q69 In spherical coordinates, which of the following relations is NOT correct?

$$x=rcos\theta{cos\phi}$$
$$x=rsin\theta{cos\phi}$$
$$y=rsin\theta{sin\phi}$$
$$z=rcos\theta$$

Q70 Two masses m_{1} and m_{2} connectected by a spring are sliding on a frictionless plane. How many degrees of freedom has the system?

2
4
1
3

Q71 With polar coordinats $\left (r,\phi \right)$ as generalised coordinates, the generalised velocities are $\left (\dot{r},\dot{\phi} \right)$, while the velocity vector is ----------

$$\ddot{r}\hat{r}{+}2r\dot{\phi}\hat{\phi}$$
$$\dot{r}\hat{r}{+}r\dot{\phi}\hat{\phi}$$
$$\dot{r}\hat{r}{-}r\dot{\phi}\hat{\phi}$$
$$\ddot{r}\hat{r}{-}2r\dot{\phi}\hat{\phi}$$

Q72 How many degrees of freedom has a particle that moves along a straight line?

3
2
1
0

Q73 Constraints that can be representd as functions of space and time are said to be -----------

holonomic
orthogonal
inertial
invariant

Q74 A set of coordinate axes with respect to which the position and orientation of an object can be measured is called the -----------

constraint
degree of freedom
orthogonality
frame of reference

Q75 Consider two capacitively coupled circuits shown in the figure. How many normal modes are we supposed to have in the system?

1
2
3
0

Q76 The equation of motion of a simple pendulum is given as $$\ddot{\theta}{+}\omega^{2}\theta=0$$. The equation of motion of a simple pendulum is given as $$\ddot{\theta}{+}\omega^{2}\theta=0$$. $$\omega^{2}= ------$$

$$g$$
$$\sqrt{\frac{g}{l}}$$
$$\frac{g}{l}$$
$$\sqrt{\frac{l}{g}}$$

Q77 The differential equation for the orbit of motion in an inverse square law force field is

$$\frac{du}{d{\theta}}+u=\frac{k}{mh^{2}}$$
$$\frac{d^{2}u}{d{\theta}^{2}}+u=\frac{k}{mh}$$
$$\frac{d^{2}u}{d{\theta}^{2}}+u=0$$
$$\frac{d^{2}u}{d{\theta}^{2}}+u=\frac{k}{mh^{2}}$$

Q78 The equation of motion of a damped oscillator is given as m\ddot{x}{+}\gamma\dot{x}+kx=0$$. $$\gamma$$ is called the damping coefficient. Which of the following is the correct unit of the damping coeffient?

$$kgs^{-1}$$
$$ms^{-1}$$
$$kgm^{-1}$$
$$s^{-2}$$

Q79 All bodies at the same place in a gravitational field experience

same acceleration
different acceleration
zero acceleration
twice the acceleration as that on the surface of the source of the field

Q80 Which of the following is a correct example of a coupled oscillator?

an oscillating torsional pendulum
oscillating atoms in a solid
an acoustic oscillator
an oscillating simple pendulum

Q81 Given that $$\vec{F}=f{r}\vec{r}$$, where $$\vec{F}$$ is the central force, $$f{r}\vec{r}$$ is a function of the radial distance from the origin and $$\vec{r}$$ is the unit vector directed radially outward from the origin, which of the following is correct?

f(r) < 0 implies that the $$\vec{F}$$ is repulsive
f(r)> 0 implies that the $$\vec{F}$$ is attractive
$$\vec{r}\times\vec{F} < 0$$
$$\vec{r}\times\vec{F}=0$$

Q82 Which of the following is NOT a central force?

gravitational force
frictional force

electrostatic force
intermolecular force

Q83 A force which acts on a particle in such a way that there is interconversion between kinetic and potential energies is said to be ______
centripetal
inertial
conservative
kinematic

Q84 What is the torque produced by a force of $$2\vec{i}-3\vec{j}+\vec{k}$$ N on a particle at radial distance of $$4\vec{i]+\vec[j}-2\vec{k}$$ m from the origin a three dimensional coordinate system?
$$12\vec{i}{-}8\vec{j}+7\vec{k}$$ Nm
$$5\vec{i}+3\vec{j}{-}4\vec{k}$$ Nm
$$\vec{i}+8-2\vec{j}{-}\vec{k}$$ Nm
$$5\vec{i}+8\vec{j}+14\vec{k}$$ Nm

Q85 The work done by the force $$2\vec{i}-3\vec{j}+\vec{k}$$ N to move a particle through a displacement of $$4\vec{i]+\vec[j}-2\vec{k}$$ m is ------ J.
2
4
3
7

Q86 The angle between the vectors $$6\vec{i}+5\vec{j}+4\vec{k}$$ and $$\vec{i}+2\vec{j}+3\vec{k}$$ is
$$31.5^{o}$$
$$60.0^{o}$$
$$30.0^{o}$$
$$42.5^{o}$$

Q87 For what values of q are the two vectors $$\vec{i}+\vec{j}+q\vec{k}$$ and $$\vec{b}=q\vec{i}{-}2\vec{j}+2q\vec{k}$$ parllel to each other?
0,1
0,-2
1,1
1,-2

Q88 Given that $$\vec{a}=5\vec{i}-2\vec{j}+3\vec{k}$$; $$\vec{b}=3\vec{i}+\vec{j}-2\vec{k}$$; $$\vec{c}= \vec{i}-3\vec{j}+4\vec{k}$$; evaluate the vector triple product of $$\vec{a}$$, $$\vec{b}$$ and $$\vec{c}$$.
$$109\vec{i}+7\vec{j}-22\vec{k}$$
$$13\vec{i}+7\vec{j}$$
$$17\vec{i}{-}\vec{k}$$
$$121\vec{i}{-}12\vec{j}+5\vec{k}$$

Q89 In spherical coordinates, which of the following relations is NOT correct?
$$x=rcos\theta{cos\phi}$$

$$x=rsin\theta{cos\phi}$$
$$y=rsin\theta{sin\phi}$$
$$z=rcos\theta$$

Q90 Given that $$\vec{a}=5\vec{i}-2\vec{j}+3\vec{k}$$; $$\vec{b}=3\vec{i}+\vec{j}-2\vec{k}$$; $$\vec{c}= \vec{i}-3\vec{j}+4\vec{k}$$; evaluate the scalar triple product of $$\vec{a}$$, $$\vec{b}$$ and $$\vec{c}$$.

12
-16
-12
16

Q91 If a vector function is given as $$\vec{F}=xy^{2}\vec{i}-2yz\vec{j}+xyz\vec{k}$$, $$\triangledown\times{F}$$ at the point P(1,-1,2) from the origin of $$\vec{F}$$

$$2(\vec{J}+\vec{K})$$
$$3\vec{J}-{-}4\vec{K}$$
$$4\vec{J}+3\vec{K}$$
$$\vec{J}+\vec{k}$$

Q92 Which of these is the correct set up of the Lagrangian for a simple pendulum?

$$L\left (\theta,\ddot{\theta} \right)=\frac{1}{2}ml^{2}\ddot{\theta}^{2}+mglcos\theta$$
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$$H=\frac{1}{2}\left (p^{2}_{\theta}+\frac{p^{2}_{r}}{\theta^{2}} +V\left (\theta \right) \right)$$
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$$H=\frac{1}{2}\left (p^{2}_{r}+\frac{p^{2}_{\theta}}{r^{2}} +V\left (r \right)\right)$$

Q95 If a scalar field function is given as $$\phi=x^{2}y^{2}+x^{3}yz-yz^{2}$$, determine $$\triangledown\phi$$ at point P(1.-1,2) from the origin of $$\phi$$.

$$3\vec{i}-4\vec{j}+3\vec{k}$$
$$-4\vec{i}+4\vec{j}-3\vec{k}$$

$$-4\vec{i}-3\vec{j}+4\vec{k}$$
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measure of the outward flow of the vector from its source
rotational capacity of the vector about its source
perpendicularity of the vector to its dirction of motion
angular sweep the vector makes about its origin

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$$A^{2}+B^{2}{-}2ABcos\theta$$
$$A^{2}{-}B^{2}{+}2ABsin\theta$$
$$A{-}B{+}ABcos\theta$$
$${+}B{-}ABsin\theta$$

Q98 Which of the following is correct
$$\hat{i}\cdot{\hat{j}}=1$$
$$\hat{i}\cdot{\hat{i}}=1$$
$$\hat{i}\times{\hat{j}}={-}\hat{k}$$
$$\hat{k}\times{\hat{j}}=\hat{i}$$

Q99 The dot or scalar product of a force and a displacement vectors defines
work
power
moment
momentum

Q100 The central force problem is important in explaining the motion of
gases
high energy perticles
celetial bodies
neucleons

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Q138 The statement $$T+V=E(constant)$$, where T is the kinetic energy and V the potential energy is known as the theorem

Q139 If $$\triangledown\times\vec{F}=0$$, then $$\vec{F}$$ is

Q140 If the work done in moving a particle from place to place in a force field is independent of the path followed by the particle, then the force field is said to be

Q141 A damped oscillation driven by external periodic impulses whose frequecy is the same as the natural frequency of the oscillator

Q142 If the resistance to a simple harmonic oscillation is very strong, the motion is said to be heavily

Q143 In reality, the amplitude of a simple harmonic oscillator gradually decreases in the presence of dissipative forces. Such motion is said to be

Q144 In an LC circuit, the quantity $$\frac{1}{\sqrt{LC}}$$ represents

Q145 The displacement of a simple harmonic oscillator is given as $$x=Acos\left(\omega{t}{+}\phi\right)$$. The quantity $$\left(\omega{t}{+}\phi\right)$$ is the of the oscillation. (symbols have their usual meaning)

Q146 The term mormal mode frequency is associated with oscillation

Q147 The inertial factor in the spring mass system is $$m$$. The inertial factor in the LC circiut is

Q148 Any motion that repeats itself at a regular intervals of time is said to be

Q149 The equation $$\left(\frac{du}{d\theta}\right)^{2}+U^{2}=\frac{2m}{L^{2}}\left(E-V\right)$$ is the statement of conservation of

Q150 For an oscillating system, if the restoring force obeys Hooke's law for small displacement from equilibrium position, the the motion is

Q151 A damped oscillation driven by external periodic impulses whose frequecy is the same as the natural frequency of the oscillator is said to -----------

be heavily damped

free

resonate
be critically damped

Q152 The equation of motion of a simple harmonic oscillator is $$\frac{d^{2}x}{dt^{2}}+16x=0$$. Solve this equation subject to the initial conditions that at $$t=0$$, $$x=4 cm$$ and $$\frac{dx}{dt}=0$$.

$$x(t)=3cos2t$$

$$x(t)=4cos4t$$

$$x(t)=2cost$$

$$x(t)=\sqrt{2}cos\left(2t{-}\pi/3\right)$$

Q153 Which of the following is NOT a valid solution of the equation of a simple harmonic oscillator ? The symbols have their usual meaning.

$$x=acos\left(\omega{t}+\phi\right)$$

$$x=asin\left(\omega{t}-\phi\right)$$

$$x=acos\left(\omega{t}{-}\phi\right)$$

$$x=asin\left(\omega{-}\phi{t}\right)$$

Q154 The equation of a simple harmonic motion is given as $$\frac{d^{2}{x}}{dt^{2}}+\omega^{2}{x}=0$$ where the symbols have their usual meaning. The dimension of the quatity $$\omega^{2}$$ is

$$ L^{-1}$$

$$M$$

$$T^{-2}$$

$$LT^{-2}$$

Q155 Write down the correct relation for the component of the acceleration in the $$\hat{r}$$ direction in the plane polar coordinate system

$$r\ddot{\theta}+2\dot{r}\ddot{\theta}$$

$$\ddot{r}{+}r\ddot{{\theta}^{2}}$$

$$r\ddot{\theta}{-}2\dot{r}\ddot{\theta}$$

$$\ddot{r}{-}r\dot{{\theta}^{2}}$$

Q156 In the plane polar coordinate system, which of the following correctly gives the component of acceleration in the $$\hat{\theta}$$ direction?

$$r\ddot{\theta}+2\dot{r}\ddot{\theta}$$

$$\ddot{r}{+}r\ddot{{\theta}^{2}}$$

$$r\ddot{\theta}{-}2\dot{r}\ddot{\theta}$$

$$\ddot{r}{-}r\ddot{{\theta}^{2}}$$

Q157 In the plane polar coordinate system, which of the following correctly gives the component of velocity in the $$\hat{\theta}$$ direction?

$$\dot{r}$$

$$\dot{\theta}$$

$$r\dot{\theta}$$

$$r\dot{r}$$

Q158 if $$\hat{r}$$, $$\hat{\theta}$$ are the functions of $$\theta$$ in the plane polar coordinate system, which of the following is Not a correct relation among

$$\theta$$, $$\hat{r}$$, and $$\hat{\theta}$$?

$$\hat{r}=\hat{x}cos\theta{-}\hat{y}sin\theta$$ $$

$$\hat{r}=\hat{x}cos\theta{+}\hat{y}sin\theta$$ $$

$$\hat{\theta}={-}\hat{x}sin\theta{+}\hat{y}cos\theta $$

$$\hat{\theta}=\hat{y}cos\theta{-}\hat{x}sin\theta $$ $$

Q159 In the plane polar coordinates, which of the following relations is NOT correct?

$$x=rcos\theta $$

$$\theta=sin^{-1}\frac{y}{\left (x^{2}+y^{2} \right)^{1/2}}$$

$$\theta=cos^{-1}\frac{x}{\left (x^{2}+y^{2} \right)^{1/2}}$$

$$\theta=rsinx$$

Q160 A particl is subjected to a force $$F=\left (2xy+z^{2} \right) \hat{i}+x\hat{j}+2xz\hat{k}$$ in a conservative field. Find the potential function.

$$2xyz$$

$${-}\left (x^{2}y+z^{2}x \right)$$

$$2x^{2}yz^{2}$$

$${-}\left (xy^{2}+zx^{2} \right)$$

Q161 Given that the hamiltonian function for the motion of a one-dimensional harmonic oscillator is $$H=\frac{1}{2m}p^{2}+\frac{k}{2}x^{2}$$, which of the following is the correct set of hamiltonian equation of motion for the system?

$$ \frac{p}{m}=\ddot{x}$$, $$kx={-}\ddot{p}$$

$$ \frac{p}{m}=\dot{x}$$, $$kx={-}\dot{p}$$

$$ \frac{x}{m}=\dot{p}$$, $$kp={-}\dot{x}$$

$$ \frac{x}{m}=\dot{p}$$, $$kx={-}\ddot{x}$$

Q162 Which of the following is the correct Hamiltonian function for the motion of a particle in a central field?

$$H=\frac{1}{2}\left (p^{2}_{\theta}+\frac{p^{2}_{r}}{\theta^{2}} +V\left (\theta \right) \right)$$

$$H=\frac{1}{2}\left (p^{2}_{\theta}+\frac{p^{2}_{r}}{\theta^{2}} +V\left (r \right)\right)$$

$$H=\frac{1}{2}\left (p^{2}_{\theta}{-}\frac{p^{2}_{r}}{\theta^{2}} +V\left (r \right)\right) $$

$$H=\frac{1}{2}\left (p^{2}_{r}+\frac{p^{2}_{\theta}}{r^{2}} +V\left (r \right)\right)$$

Q163 Which of these is the correct set up of the Lagrangian for a simple pendulum?

$$L\left (\theta,\ddot{\theta} \right)=\frac{1}{2}ml^{2}\ddot{\theta}^{2}+mglcos\theta$$

$$L\left (\theta,\dot{\theta} \right)=\frac{1}{2}ml^{2}\ddot{\theta}^{2}+mglsin\theta$$

$$L\left (\theta,\dot{\theta} \right)=\frac{1}{2}ml^{2}\dot{\theta}^{2}+mglcos\theta$$

$$L\left (\dot{\theta},\ddot{\theta} \right)=\frac{1}{2}ml^{2}\ddot{\theta}^{2}-mglcos\theta$$

Q164 Which of the following is NOT a correct canonical equation of Hamilton? (Symbols have their usual meaning)

$$\frac{\partial{H}}{\partial{p_{\alpha}}}=\dot{p_{\alpha}}$$

$$\frac{\partial{H}}{\partial{p_{\alpha}}}=\dot{q_{\alpha}}$$

$$\frac{\partial{H}}{\partial{q_{\alpha}}}={-}\dot{p_{\alpha}}$$
$$\frac{\partial{H}}{\partial{t}}={-}\frac{\partial{L}}{\partial{t}}$$

Q165 The equations $$\begin{matrix} \dot{x_{1}}=\sum_{k=1}^{3N}\frac{\partial{x}_{1}}{\partial{q_{k}}}{+}\frac{\partial{x_{1}}}{\partial{t}},\\ .\\ .\\ .\\ \\\dot{x_{N}}=\sum_{k=1}^{3N}\frac{\partial{x}_{N}}{\partial{q_{k}}}{+}\frac{\partial{x_{N}}}{\partial{t}} \end{matrix}$$ represent the cartesian velocity components expressed in terms of

generalised coordinates and velocities
generalised forces and acceleration
generalised forces and torques
generalised forces and momenta

Q166 If a system of particles is described by a set of generalised coordinates $$q_{1},...,q_{3N}$$, then $$\dot{q_{k}}$$ for $$k=1,2,…,3N$$ is called the ----------- associated with the coordinates

specifie torque
generalised velocity
angular acceleration
generalised force

Q167 Which of these is an example of a system of particles subject to constraints?

a single particle
3N free particles
rigid object
N free particles

Q168 The generalised force associted with angular quantities is

potential
energy
power
a torque

Q169 In spherical coordinates, which of the following relations is NOT correct?

$$x=rcos\theta{cos\phi}$$
$$x=rsin\theta{cos\phi}$$
$$y=rsin\theta{sin\phi}$$
$$z=rcos\theta$$

Q170 Two masses $$m_{1}$$ and $$m_{2}$$ connectected by a spring are sliding on a frictionless plane. How many degrees of freedom has the system?

2
4
1
3

Q171 With polar coordinats $$\left (r,\phi \right)$$ as generalised coordinates,

the generalised velocities are $$\left (\dot{r},\dot{\phi} \right)$$, while the velocity vector is ----------

$$\ddot{r}\hat{r}{+}2r\dot{\phi}\hat{\phi}$$
$$\dot{r}\hat{r}{+}r\dot{\phi}\hat{\phi}$$
$$\dot{r}\hat{r}{-}r\dot{\phi}\hat{\phi}$$
$$\ddot{r}\hat{r}{-}2r\dot{\phi}\hat{\phi}$$

Q172 How many degrees of freedom has a particle that moves along a straight line?

3
2
1
0

Q173 Constraints that can be representd as functions of space and time are said to be -----------

holonomic
orthogonal
inertial
invariant

Q174 A set of coordinate axes with respect to which the position and orientation of an object can be measured is called the -----------

constraint
degree of freedom
orthogonality
frame of reference

Q175 Consider two capacitively coupled circuits shown in the figure. How many normal modes are we supposed to have in the system?

1
2
3
0

Q176 The equation of motion of a simple pendulum is given as $$\ddot{\theta}{+}\omega^{2}\theta=0$$. The equation of motion of a simple pendulum is given as $$\ddot{\theta}{+}\omega^{2}\theta=0$$. $$\omega^{2}= ------$$

$$g$$
$$\sqrt{\frac{g}{l}}$$
$$\frac{g}{l}$$
$$\sqrt{\frac{l}{g}}$$

Q177 The differential equation for the orbit of motion in an inverse square law force field is

$$\frac{du}{d{\theta}}+u=\frac{k}{mh^{2}}$$
$$\frac{d^{2}u}{d{\theta}^{2}}+u=\frac{k}{mh}$$
$$\frac{d^{2}u}{d{\theta}^{2}}+u=0$$

$$\frac{d^{2}u}{d{\theta}^{2}}+u=\frac{k}{mh^{2}}$$

Q178 The equation of motion of a damped oscillator is given as m\ddot{x}{+}\gamma\dot{x}+kx=0$$. $$\gamma$$ is called the damping coefficient. Which of the following is the correct unit of the damping coeffient?
$$kgs^{-1}$$
$$ms^{-1}$$
$$kgm^{-1}$$
$$s^{-2}$$

Q179 All bodies at the same place in a gravitational field experience
same acceleration
different acceleration
zero acceleration
twice the acceleration as that on the surface of the source of the field

Q180 Which of the following is a correct example of a coupled oscillator?
an oscillating torsional pendulum
oscillating atoms in a solid
an acoustic oscillator
an oscillating simple pendulum

Q181 Given that $$\vec{F}=f{r}\vec{r}$$, where $$\vec{F}$$ is the central force, $$f{r}\vec{r}$$ is a function of the radial distance from the origin and $$\vec{r}$$ is the unit vector directed radially outward from the origin, which of the following is correct?
f(r) < 0 implies that the $$\vec{F}$$ is repulsive
f(r)> 0 implies that the $$\vec{F}$$ is attractive
$$\vec{r}\times\vec{F} < 0$$
$$\vec{r}\times\vec{F}=0$$

Q182 Which of the following is NOT a central force?
gravitational force
frictional force
electrostatic force
intermolecular force

Q183 A force which acts on a particle in such a way that there is interconversion between kinetic and potential energies is said to be ______
centripetal
inertial
conservative
kinematic

Q184 What is the torque produced by a force of $$2\vec{i}-3\vec{j}+\vec{k}$$ N on a particle at radial distance of $$4\vec{i]+\vec[j]-2\vec{k}$$ m from the origin a three dimensional coordinate system?
$$12\vec{i}{-}8\vec{j}+7\vec{k}$$ Nm
$$5\vec{i}+3\vec{j}{-}4\vec{k}$$ Nm

$$\vec{i}+8-2\vec{j}{-}\vec{k}$$ Nm
$$5\vec{i}+8\vec{j}+14\vec{k}$$ Nm

Q185 The work done by the force $$2\vec{i}-3\vec{j}+\vec{k}$$ N to move a particle through a displacement of $$4\vec{i]+\vec[j}-2\vec{k}$$ m is ------ J.
2
4
3
7

Q186 The angle between the vectors $$6\vec{i}+5\vec{j}+4\vec{k}$$ and $$\vec{i}+2\vec{j}+3\vec{k}$$ is
$$31.5^{o}$$
$$60.0^{o}$$
$$30.0^{o}$$
$$42.5^{o}$$

Q187 For what values of q are the two vectors $$\vec{i}+\vec{j}+q\vec{k}$$ and $$\vec{b}=q\vec{i}{-}2\vec{j}+2q\vec{k}$$ parllel to each other?
0,1
0,-2
1,1
1,-2

Q188 Given that $$\vec{a}=5\vec{i}-2\vec{j}+3\vec{k}$$; $$\vec{b}=3\vec{i}+\vec{j}-2\vec{k}$$; $$\vec{c}= \vec{i}-3\vec{j}+4\vec{k}$$; evaluate the vector triple product of $$\vec{a}$$, $$\vec{b}$$ and $$\vec{c}$$.
$$109\vec{i}+7\vec{j}-22\vec{k}$$
$$13\vec{i}+7\vec{j}$$
$$17\vec{i}{-}\vec{k}$$
$$121\vec{i}{-}12\vec{j}+5\vec{k}$$

Q189 In spherical coordinates, which of the following relations is NOT correct?
$$x=rcos\theta{cos\phi}$$
$$x=rsin\theta{cos\phi}$$
$$y=rsin\theta{sin\phi}$$
$$z=rcos\theta$$

Q190 Given that $$\vec{a}=5\vec{i}-2\vec{j}+3\vec{k}$$; $$\vec{b}=3\vec{i}+\vec{j}-2\vec{k}$$; $$\vec{c}= \vec{i}-3\vec{j}+4\vec{k}$$; evaluate the scalar triple product of $$\vec{a}$$, $$\vec{b}$$ and $$\vec{c}$$.
12
-16
-12
16

Q191 If a vector function is given as $$\vec{F}=xy^{2}\vec{i}-2yz\vec{j}+xyz\vec{k}$$, $$\triangledown\times{F}$$ at the point P(1,-1,2) from the origin of $$\vec{F}$$

$$2(\vec{J}+\vec{K})$$
$$3\vec{J}-{-}4\vec{K}$$
$$4\vec{J}+3\vec{K}$$
$$\vec{J}+\vec{k}$$

Q192 Which of these is the correct set up of the Lagrangian for a simple pendulum?
$$L\left (\theta,\ddot{\theta} \right)=\frac{1}{2}ml^{2}\ddot{\theta}^{2}+mglcos\theta$$
$$L\left (\theta,\dot{\theta} \right)=\frac{1}{2}ml^{2}\ddot{\theta}^{2}+mglsin\theta$$
$$L\left (\theta,\dot{\theta} \right)=\frac{1}{2}ml^{2}\dot{\theta}^{2}+mglcos\theta$$
$$L\left (\dot{\theta},\ddot{\theta} \right)=\frac{1}{2}ml^{2}\ddot{\theta}^{2}-mglcos\theta$$

Q193 Given that the hamiltonian function for the motion of a one-dimensional harmonic oscillator is $$H=\frac{1}{2m}p^{2}+\frac{k}{2}x^{2}$$, which of the following is the correct set of hamiltonian equation of motion for the system?
$$ \frac{p}{m}=\ddot{x}$$, $$kx={-}\ddot{p}$$
$$ \frac{p}{m}=\dot{x}$$, $$kx={-}\dot{p}$$
$$ \frac{x}{m}=\dot{p}$$, $$kp={-}\dot{x}$$
$$ \frac{x}{m}=\dot{p}$$, $$kx={-}\ddot{x}$$

Q194 Which of the following is the correct Hamiltonian function for the motion of a particle in a central field?
$$H=\frac{1}{2}\left (p^{2}_{\theta}+\frac{p^{2}_{r}}{\theta^{2}} +V\left (\theta \right) \right)$$
$$H=\frac{1}{2}\left (p^{2}_{\theta}+\frac{p^{2}_{r}}{\theta^{2}} +V\left (r \right)\right)$$
$$H=\frac{1}{2}\left (p^{2}_{\theta}{-}\frac{p^{2}_{r}}{\theta^{2}} +V\left (r \right)\right)$$
$$H=\frac{1}{2}\left (p^{2}_{r}+\frac{p^{2}_{\theta}}{r^{2}} +V\left (r \right)\right)$$

Q195 If a scalar field function is given as $$\phi=x^{2}y^{2}+x^{3}yz-yz^{2}$$, determine $$\triangledown\phi$$ at point P(1.-1,2) from the origin of $$\phi$$.
$$3\vec{i}-4\vec{j}+3\vec{k}$$
$$-4\vec{i}+4\vec{j}-3\vec{k}$$
$$-4\vec{i}-3\vec{j}+4\vec{k}$$
$$-4\vec{i}-4\vec{j}+3\vec{k}$$

Q196 The physical significance of the divegence of a vector is the
measure of the outward flow of the vector from its source
rotational capacity of the vector about its source
perpendicularity of the vector to its dirction of motion
angular sweep the vector makes about its origin

Q197 Given that $$\vec{C}=\vec{A{-}\vec{B}}$$, what is $$\vec{C}\cdot\vec{C}$$?
$$A^{2}+B^{2}{-}2ABcos\theta$$
$$A^{2}{-}B^{2}{+}2ABsin\theta$$
$$A{-}B{+}ABcos\theta$$
$${+}B{-}ABsin\theta$$

Q198 Which of the following is correct

$$\hat{i}\cdot{\hat{j}}=1$$

$$\hat{i}\cdot{\hat{i}}=1$$

$$\hat{i}\times{\hat{j}}={-}\hat{k}$$

$$\hat{k}\times{\hat{j}}=\hat{i}$$

Q199 The dot or scalar product of a force and a displacement vectors defines

work
power
moment
momentum

Q200 The central force problem is important in explaining the motion of

gases
high energy perticles
celetial bodies
neucleons