UESTC Student ID_____ UOG Student ID_____ Course Title_____ Lecturer_____

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# Glasgow College, UESTC

## Physics I —Semester 2, 2017 - 2018

## Final Exam

**10:00-12:00, 10th July, 2018**

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**<u>Notice:</u> Please make sure that both your UESTC and UoG Student IDs are written on the top of every sheet. This examination is closed-book. The use of a calculator is allowed, but the use of a cell phone is not permitted. All scratch paper must be adequately labeled. Unless indicated otherwise, answers must be derived or explained clearly. Please write within the space given below on the answer sheets.**

**All questions are compulsory. There are 7 questions and a maximum of 100 marks in total.**

**The following table is for grader only:**

| Question | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total | grader |
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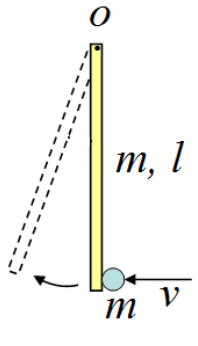
**Question 1 Multiple-choice Questions (3×6=18 points)**

**Choose the <u>ONE alternative</u> that best complete the statement or answer the questions.**

**(  ) 1. A hanged uniform thin rod (*m, l*) initially stays at rest, and then it is collided at its end by a particle, which has a mass *m* and a horizontal velocity *v*. If the collision is elastic, how does the <u>particle</u> move after collision?**




**A) Keep moving in the original direction with a less speed.**

**B) Stop moving at the moment.**

**C) Rebound back to the opposite direction.**

**D) Stick on the rod and move with it.**

**(  ) 2. A block–spring system vibrating on a frictionless, horizontal surface with amplitude of 6.0 cm has energy of 12 J. If the block is replaced by one who's mass is twice the mass of the original block and the amplitude of the motion is again 6.0 cm, what is the energy of the system?**

**A) 48J;  B) 24J;  C) 12J;  D) 6J;  E) none of those answers.**

**(  ) 3. Which of the following statements is <u>not necessarily true</u> regarding mechanical waves?**

**A) They are formed by some source of disturbance.**

**B) They are sinusoidal in nature.**

**C) They carry energy.**

**D) They require a medium through which to propagate.**

**E) The wave speed depends on the properties of the medium in which they travel.**

**(  ) 4. Sound from a loudspeaker is measured to be 60dB at a distance of 3m. What is the sound level measured at a distance 6m?**

**A) 15dB;  B) 30dB;  C) 50dB;  D) 54dB;  E) 57dB.**

**( ) 5. What combination of optical phenomena causes the bright colored patterns sometimes seen on wet streets covered with a layer of oil? Choose the best answer.**

**A) Diffraction and polarization.**

**B) Interference and diffraction.**

**C) Polarization and reflection.**

**D) Refraction and diffraction.**

**E) Reflection and interference.**

**( ) 6. Two spaceships move with same speed 0.80c relative to the Earth, but in opposite directions. What is the speed of one ship relative to the other?**

**A) 0; B) 0.80c; C) 0.976c; D) 0.994c; E) 1.60c.**

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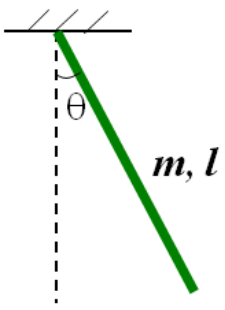
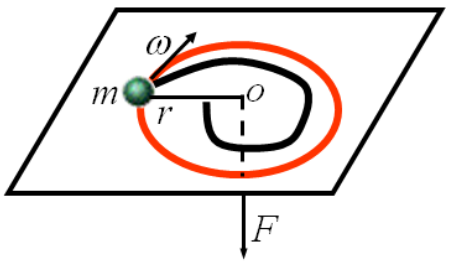
## Question 2 Fill-in Questions (4×5=20 points)

**1. A small ball (mass *m*) connected by a rope is moving on frictionless table circularly with uniform $\omega$ and *r*. Then one pulls the rope slowly through the center. When the radius of circular motion changes from *r* to *r*/3, the work done on the ball is _____.**



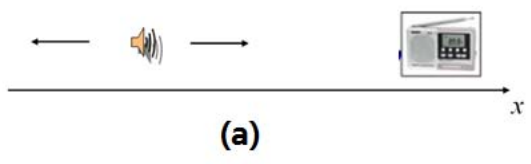

**2. A uniform thin rod can pivot about its end. If we treat the device as a physical pendulum, its period *T* equals_____.**

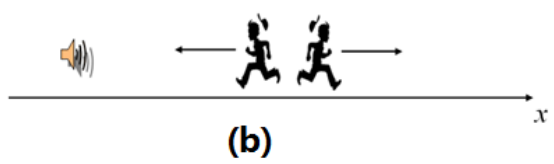
**3. A traveling wave is shown by y=0.1cos(6x + 80t + π/3) (SI). Then its wavelength is _____, wave velocity is _____.**

**4. In an experiment of Doppler Effect, the detected frequency is greater than the emitted frequency.**

**(a) If the observer stays at rest and sound source moves, what is the moving direction of sound source? _____**

**(b) If the observer moves and sound source stays at rest, what is the moving direction of observer? _____**




**5. List three methods which can be used to obtain linear polarized light from unpolarized natural light.**

**_____,**

**_____,**

**_____.**

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**Question 3 (12 points)**

**A 50g mass is hanging on a spring of $k$=80N/m vertically. It moves with an initial velocity $v_0$=1.6m/s and initial displacement $x_0$=0.03m from the equilibrium position. (a) Determine the motional equation; (b) Consider the existence of air friction, the motion becomes a damped oscillation. What is the difference between damped oscillation and no damping oscillation (simple harmonic motion)?**


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**Question4 (16 points)**

**Suppose two linear waves of equal amplitude and frequency have a phase difference $\phi$ as they travel in the same medium. They can be represented by $y_1 = A\cos(\omega t - kx),\ y_2 = A\sin(\omega t - kx + \phi)$.**

**(a) If $y$ is the superposition of these two waves, write out the wave function $y(x,t)$.**

**(b) Does $y(x,t)$ represent a standing wave? If not, find another wave $y_3$ which can make a standing wave with $y_1$.**

**(c) What is the minimum distance between two nodes of standing wave in case (b)?**

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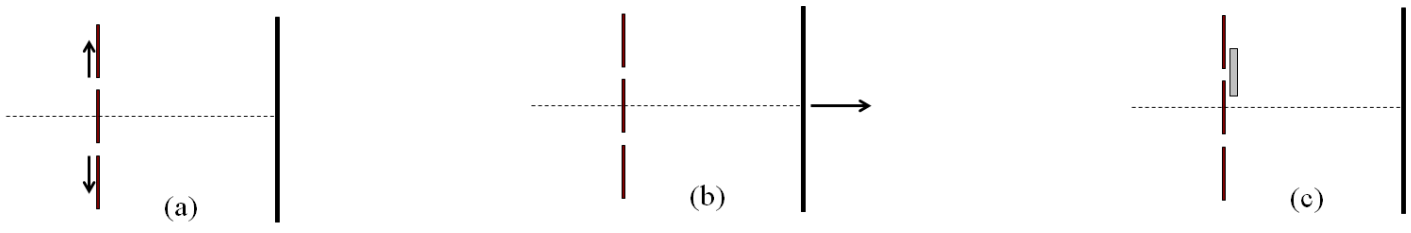
**Question5 (12 points)**

**In the double-slit interference experiment, initially the distance between two slits is *d*, and the screen is *L* away from the slits. We can change the experiment condition to see what happens to the interference pattern. Describe the phenomena if: (a) two slits moves further apart; (b) the screen moves further apart; (c) a very thin piece of glass (~1μm) is placed in front of one slit.**

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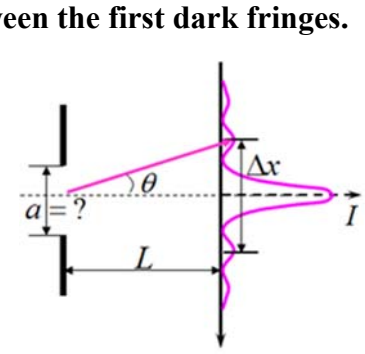
**Question6 (10 points)**

**Monochromatic light (λ=450nm) falls on a slit, the fringes are shown on a screen 4.0m away. If the distance between the first bright fringes on either side of the central maximum is 15mm, determine (a) the width of slit; (b) the distance between the first dark fringes.**

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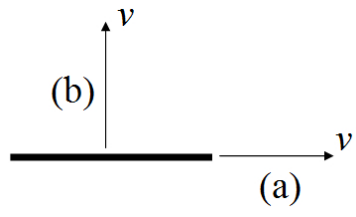
**Question7 (12 points)**

**A uniform thin rod has a mass *m* and length *L* when it is at rest. When it is moving with *v*=0.6c, Determine (a) the linear density (mass per unit length) if it moves along its direction; (b) linear density if it moves perpendicular to its direction; (c) its kinetic energy;**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