北京郵電大學

Queen Mary University of London

For examiners' use only

1-10	
11	
12	
Total	

BBC4924

Joint Programme Examinations 2022/23

BBC4924 Physics C

Paper A

Time allowed 1 hours

Answer ALL questions

Complete the information below about yourself very carefully.

QM student number										
BUPT student number										
Class number										

NOT allowed: electronic calculators and electronic dictionaries.

INSTRUCTIONS

1. **You must NOT take answer books, used or unused, from the examination room.**
2. Write only with a black or blue pen **and in English**.
3. Do all rough work in the answer book – **do not tear out any pages**.
4. If you use Supplementary Answer Books, tie them to the end of this book.
5. Write clearly and legibly.
6. **Read the instructions on the inside cover.**

Examiners

Dr. Gang Song

Filename: 2223_BBC4924_M No answer book required

Instructions

Before the start of the examination

1) Place your BUPT and QM student cards on the corner of your desk so that your picture is visible.

2) Put all bags, coats and other belongings at the back/front of the room. All small items in your pockets, including wallets, mobile phones and other electronic devices must be **placed in your bag in advance**. **Possession of mobile phones, electronic devices and unauthorised materials is an offence.**

3) Please ensure your mobile phone is switched off and that no alarm will sound during the exam. **A mobile phone causing a disruption is also an assessment offence.**

4) Do not turn over your question paper or begin writing until told to do.

During the examination

1) You must not communicate with or copy from another student.

2) If you require any assistance or wish to leave the examination room for any reason, please raise your hand to attract the attention of the invigilator.

3) If you finish the examination early you may leave, but not in the first 30 minutes or the last 10 minutes.

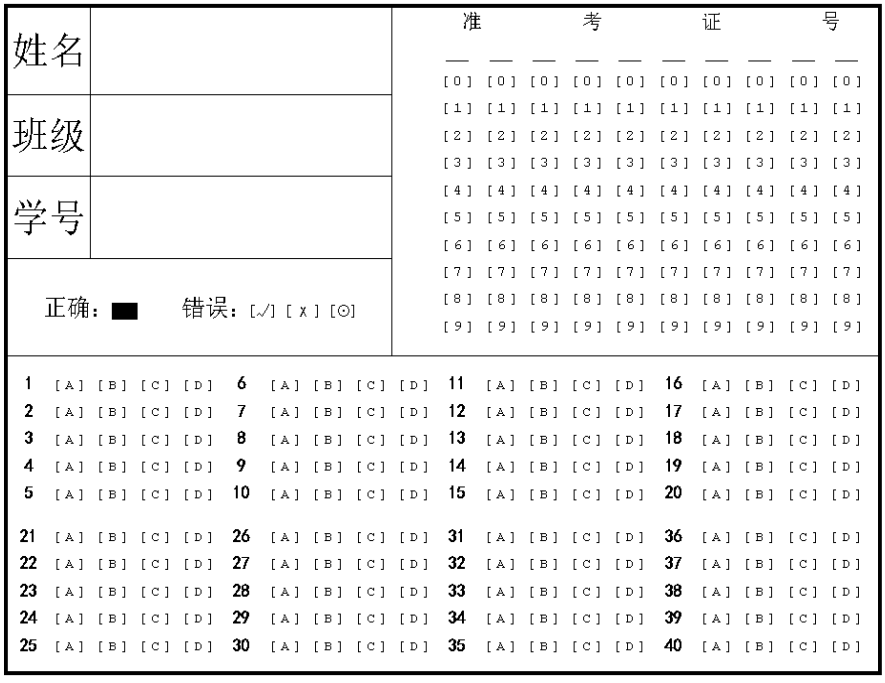
4) For 1 hour examinations you may **not** leave temporarily.

5) For examinations longer than 1 hours you **may** leave temporarily but not in the first 1 hours or the last 30 minutes.

At the end of the examination

1) You must stop writing immediately – **if you continue writing after being told to stop, that is an assessment offence.**

2) Remain in your seat until you are told you may leave.

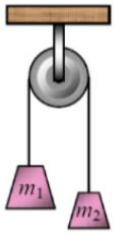


Part I Multiple Choice (5%, each multiple-choice question has a choice of multiple answers, **only one** of which is correct, 5 marks for each question.)

1. An object is moving in the *x* direction with velocity *v*(*t*), and *dv*/*dt* is nonzero constant. With *v*=0 when *t*=0, then for *t*>0 the quantity *vdv*/*dt* is 【 】

(A)Negative. (B)Zero. (C)Positive. (D) Not determined from the information given.

2. Two masses, m_1 and m_2 ($m_1 > m_2$), hang over an ideal pulley and the system is free to move. The magnitude of the tension in the cord is 【 】



(A)$m_1 g$. (B) $\frac{2m_1 m_2}{m_1 + m_2} g$.

(C)0 (D) Not determined from the information given

3. If the net force acting on a body is constant, what can we conclude about its momentum? 【 】

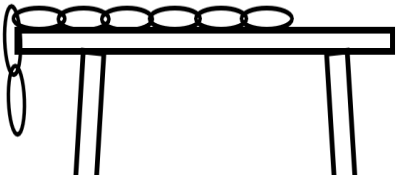
(A) The magnitude and/or the direction of its momentum may change.

(B) The magnitude of its momentum remains fixed, but its direction may change.

(C) The direction of its momentum remains fixed, but its magnitude may change.

(D) Its momentum remains fixed in both magnitude and direction.

4. A chain is held on a frictionless table with one-fourth of its length hanging over the edge, as shown in figure. The chain has a length *L* and a mass *m*. When all the chain leaves the table, the work done by the weight is 【 】



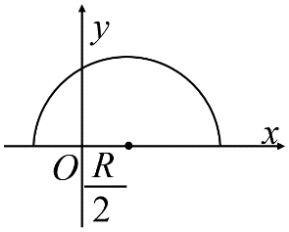
(A) 15*mgL*/32 (B) *mgL* (C) 3*mgL*/4 (D) 7*mgL*/8

5. A particle moves with position given by $\vec{r} = 3t\vec{i} + 4\vec{j}$, where $\vec{r}$ is measured in meters when *t* is measured in seconds. For each of the following, consider only *t*>0. The magnitude of the angular momentum of this particle about the origin is 【 】

(A) increasing in time. (B) constant in time. (C) decreasing in time. (D) undefined.

6. Find the center of mass of the uniform halfsphere with the radius of *R*.

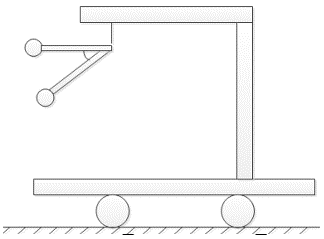
(A) (*R*/2,*R*/π) (B) (*R*/2,*R*/2) (C) (*R*/2,3*R*/8) (D) (*R*/2,0) 【 】



7. A boat moves in the sea with a velocity v_0. When the engine of the boat stops, there is an acceleration $a=-kv^2$ (k is a positive constant and v is the speed). Find the relation between the distance x and the speed v. 【 】

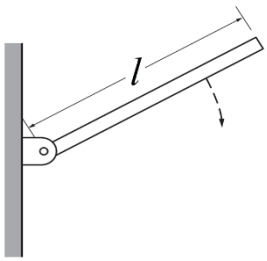
(A) $v = kxv_0$ (B) $v = v_0 e^{-kx}$ (C) $v = kv_0$ (D) $v_0 = ve^{kx}$

8. A car with mass *M* is setting on the frictionless ground. A particle ball with mass *m* is released from horizontal position with rest. The length of the string is *R*. What is the car's speed when the ball is rotating through 60 degrees relative to the car?



(A) $-\dfrac{mR}{2(M+m)}$ (B) $-\dfrac{R}{2}$ (C) $-\dfrac{MR}{M+m}$ (D) $-R$

9. A uniform thin plank of mass *M* and length *l* is pivoted at one end (no friction on the pivot). The plank is released at 60° from the vertical, as shown. When the plank is horizontal, the magnitude of the force on the pivot is



【 】

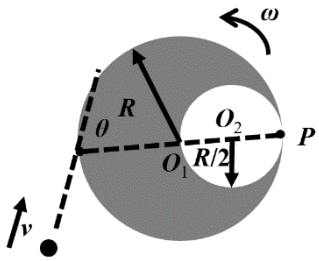
(A) $\dfrac{1}{4}Mg$ (B) $\dfrac{\sqrt{7}}{4}Mg$ (C) $\dfrac{\sqrt{13}}{4}Mg$ (D) $\dfrac{\sqrt{10}}{4}Mg$

10. A 2.0-kg block starts from rest on the positive *x* axis 3.0m from the origin and thereafter has a constant acceleration given by $\vec{a} = 4\vec{i} - 3\vec{j}$ (m/s^2). At the end of 2s its angular momentum about the origin is 【 】

(A) -36kgm^2/s (B) -18kgm^2/s (C) -72kgm^2/s (D) -48kgm^2/s

Part III Problems (50%)

11. (25 marks) There is a circle hole with the radius of $R/2$ in a disk with mass of M and radius R. The disk rotates about the P-axis in a horizontal plane with the angular velocity of ω. A ball with mass of m and the speed of v is thrown along the path shown and sticks to the end of the disk.（$I_{Disk} = \frac{1}{2} m_{Disk} R_{Disk}^2$ ）



(a) Find the rotational inertia respect to P-axis.

(b) Find the rotational kinetic energy of both the disk and the ball after sticking.

12. (25 marks) A point with mass 3kg moves in x-y plane with the position vector $\vec{r} = 3t^2\vec{i} + t^3\vec{j}$.

(a) Find the average force from t_1=3s to t_2=5s.

(b) Find the work done by the force on the point from t_1=2s to t_2=6s.

(c) Find the torque with respect to the point (15, 4).

(d) Find the angular momentum with respect to the point (3,2).

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