國立高雄大學105學年度第1學期
理學院應用物理學基礎能力會考試題

系級：　　學號：　　姓名：

Multiple-choice questions (one answer)共 32 題，每題 2.5 分，共 80 分

1. A jet touches down at velocity 310 km/h. Find the constant acceleration required to stop the aircraft 1000 m down the runway.
   (A) -3.71m/s^2
   (B) 2.52 m/s^2
   (C) -2.32 m/s^2
   (D) 1.87 m/s^2
2. A plane flies east at 210 km/h for 3.0 h, then turns around and flies west at 170 km/h for 2.0 h, find the planes average speed for the trip.
   (A) 203 km/h
   (B) 194 km/h
   (C) 205 km/h
   (D) 331 km/h
3. Moon orbits Earth in 27.3 days, with orbital radius 384,000 km. What is the central acceleration of the Moon in its orbit?
   (A) 2. 32 x 10^{-3} m/s^2
   (B) 1.88x 10^{-3} m/s^2
   (C) 4.14 x 10^{-3} m/s^2
   (D) 2.72 x 10 $^{-3}$m/s^2
4. A ball 0.5 kg moving with a velocity 10 m/s hits a wall and sticks on it. If the acting time for the ball is 0.1s. What is the acting force on the wall by the ball?
   (A) 20N
   (B) 30N
   (C) 40N
   (D) 50N
5. Two forces act on a 24 kg cart, resulting in acceleration a = -5.17 m/s$^2\hat{x}$+2.5 m/s$^2\hat{y}$. If one force is (32N, -48N). Find the second force.
   (A) (-88N, 99N)
   (B) (-122.2N, -23N)
   (C) (-156.1N, 108N)
   (D) (-166N, 99.1N)
6. At time t =0 s, a 0.23 kg air track glider is moving rightward at 2.0 m/s. At t = 4.0 s, it's going leftward at 1.2 m/s. Determine the magnitude of the constant force that acted on the glider during this interval.
   (A) 0.323 N　(B) 0.184 N
   (C) 0.225 N　(D) 1.324 N

7. A 230 g air track glider is connected to a string handing over a frictionless pulley. A 100g mass hands from the other end of the string. What is the acceleration of each?
   (A) 2.97 m/s^2
   (B) 3.23 m/s^2
   (C) 4.52 m/s^2
   (D) 5.22 m/s^2
8. A man weights 65 kg standing on a weight scale in an elevator and the elevator is moving upward with the acceleration 2.25 m/s^2. What is the weight showing on the scale?
   (A) 88.2
   (B) 90.1
   (C) 101.3
   (D) 205.5
9. The position of an object as a function of time is given by $\vec{r}(t) = (2t + t^2)\hat{\imath} + (t - 3t^2)\hat{\jmath}$. Find the object's acceleration vector.
   (A) $\hat{\imath} + 7\hat{\jmath}$
   (B) $2\hat{\imath} - 6\hat{\jmath}$
   (C) $5\hat{\imath} + 8\hat{\jmath}$
   (D) $5\hat{\imath} - 3\hat{\jmath}$
10. A object moves in a circle of radius *r* at constant speed *v*, corresponding to a period *T*. Find its acceleration.
   (A) $4\pi^2 r/T^2$
   (B) $8\pi^2 rT$
   (C) $2\pi^2/T^3$
   (D) $6\pi r^2/T$
11. If you can throw a stone straight up to height *h*, what's the maximum horizontal distance you could throw it over level ground?
   (A) *h*/2
   (B) *h*
   (C) 2*h*
   (D) 3*h*
12. Find the work done by a force $\vec{F} = -2\hat{\imath} + 5\hat{\jmath}$ N as it acts on an object moving from the origin to the point $3\hat{\imath} + 4\hat{\jmath}$ m.
   (A) 6 J
   (B) 14 J
   (C) 20 J
   (D) 26 J

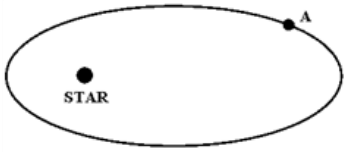
13. It takes about 22.5 kJ to melt an ice cube. A typical microwave oven produces 900 W of microwave power. How long will it take a typical microwave to melt the ice cube?
(A) 25 s
(B) 30 s
(C) 35 s
(D) 40 s

14. How much energy can be stored in a spring with $k = 440$ N/m if the maximum allowed stretch is 10 cm?
(A) 1.4 J
(B) 2.2 J
(C) 3.6 J
(D) 4.4 J

15. A 1500-kg car enters a passing zone and accelerate from 15 to 25 m/s. How much work is done on the car?
(A) 200 kJ
(B) 250 kJ
(C) 300 kJ
(D) 350 kJ

16. A mass *m* is dropped from height *h* above the top of a spring of constant *k* mounted vertically on the floor. What is the spring's maximum compression?
(A) mg/kh
(B) $(k/mg)\left(2+\sqrt{1+2mg/kh}\right)$
(C) $\sqrt{1+3kh/mg}$
(D) $(mg/k)\left(1+\sqrt{1+2kh/mg}\right)$

17. The figure below shows a planet traveling in a counterclockwise direction on an elliptical path around a star located at one focus of the ellipse. When the planet is at point A,
(A) its speed is constant.
(B) its speed is increasing.
(C) its speed is decreasing.
(D) its speed is a maximum.



18. Two stars of masses *M* and 6*M* are separated by a distance *D*. Determine the distance (measured from *M*) to a point at which the net gravitational force on a third mass would be zero.
(A) 0.41 *D*
(B) 0.33 *D*
(C) 0.37 *D*
(D) 0.29 *D*

19. A spaceship of mass m_1 circles a planet (mass = m_2) in an orbit of radius r. How much energy is required to transfer the spaceship to a circular orbit of radius 3R?
(A) $Gm_1m_2/(2r)$
(B) $Gm_1m_2/(3r)$
(C) $Gm_1m_2/(4r)$
(D) $Gm_1m_2/(6r)$

20. An asteroid revolves around the Sun with a perihelion 0.5 AU and an aphelion of 7.5 AU. What is its period of revolution?
(A) 4 years.
(B) 8 years.
(C) 16 years.
(D) 32 years.

21. The coefficient of static friction for the tires of a race car is 0.950 and the coefficient of kinetic friction is 0.800. The car is on a level circular track of 50.0 m radius on a planet where g=2.45m/s^2 compared to Earth's g=9.8m/s^2. The maximum safe speed on the track on the planet is ____ times as large as the maximum safe speed on Earth.
(A) 0.250
(B) 0.500
(C) 1.00
(D) 2.00

22. A car enters a level, unbanked semi-circular hairpin turn of 300 m radius at a speed of 40 m/s. The coefficient of friction between the tires and the road is μ = 0.25. If the car maintains a constant speed of 40 m/s, it will
(A) attempt to dig into the road surface.
(B) tend to veer toward the center of the semicircle.
(C) arrive safely at the end of the semicircle.
(D) tend to veer toward the outside of the circle.

23. A 1.8-kg block is released from rest at the top of a rough 30° inclined plane. As the block slides down the incline, its acceleration is 3.0 m/s^2 down the incline. Determine the magnitude of the force of friction acting on the block.
(A) 4.2 N
(B) 3.0 N
(C) 3.4 N
(D) 3.8 N

24. The frictional force of the floor on a large suitcase is least when the suitcase is
(A) pushed by a force parallel to the floor.
(B) dragged by a force parallel to the floor.
(C) pulled by a force directed at an angle θ above the floor.
(D) pushed by a force directed at an angle θ into the floor.

25. The momentum of an object at a given instant is independent of its:
(A) speed.
(B) acceleration.
(C) mass.
(D) velocity.

26. The direction of the impulse on a struck baseball
(A) depends on how fast the ball was thrown.
(B) is in the direction of the force of gravity.
(C) depends on how hard the ball is struck.
(D) is in the direction of the ball's change in velocity.

27. An inelastic collision is one in which:
(A) neither kinetic energy nor momentum is conserved.
(B) the total impulse is equal to the change in kinetic energy.
(C) momentum is conserved but kinetic energy is not conserved.
(D) momentum is not conserved but kinetic energy is conserved.

28. A 3 g bullet is fired horizontally into a 10 kg block of wood suspended by a rope from the ceiling. The block swings in an arc, rising 3 mm above its lowest position. The velocity of the bullet was:
(A) 8.0×10^2 m/s
(B) 24.0 m/s
(C) 8.0 m/s
(D) unknown since the heat generated in the collision was not given

29. If the momentum of a system is to be conserved, which must be true of the net external force acting on the system?
(A) increasing.
(B) decreasing.
(C) nonzero but constant.
(D) zero.

30. The momentum of a system of particles is changing at the rate of $0.71\ t + 1.2\ t^2$, in kg·m/s. The net force at $t = 2.0$ s
(A) is 5.5 N (B) cannot be determined without knowing the momentum at $t = 0$
(C) is 3.1 N (D) cannot be determined without knowing the masses of the particles

31. In a one-dimensional collision,
(A) one of the objects must remain at rest after the collision.
(B) all motion, both before and after the collision, must be along the same line.
(C) a moving object strikes a stationary object, after which the objects move in arbitrary directions.
(D) the objects must be moving along the same line before the collision, but may be moving in arbitrary directions after the collision.

32. A rocket exhausts fuel with a velocity of 1500 m/s, relative to the rocket. It starts from rest in outer space with fuel comprising 80 per cent of the total mass. When all the fuel has been exhausted its speed is:
(A) 880 m/s
(B) 400 m/s
(C) 2400 m/s
(D) 1200 m/s

Multiple-choice questions (multiple answers)共 8 題，每題 2.5 分，全對才給分，共 20 分

1. A train passes through a station at a constant velocity 11 m/s. On a parallel track sits another train at rest. At the moment the first train passes, the second train begins to accelerate at 1.5 m/s^2. When and where do the train meet again?
(A)12.5 s
(B) 14.67 s
(C) 161.3 m
(D) 123.2 m

2. Three blocks of mass m1, m2, m3 are sequentially connected and touching on a frictionless horizontal surface and a 36 N horizontal force is applied. Find the acceleration of the blocks and the net force between m1 and m2.
(A) 12 m/s^2
(B) 24 m/s^2
(C) 16 N
(D) 18 N

3. A particle moves along the *x*-axis under the influence of a force $F(x) = 2x^2 - 8x$. Find the local extrema of the potential energy.
(A) $x = 0$
(B) $x = 2$
(C) $x = \sqrt{6}$
(D) $x = 4$

4. What is the unit of energy?
   (A) joule.
   (B) newton.
   (C) newton-meter.
   (D) kilogram-meter/second.

5. A satellite is in a circular Earth orbit of radius r. The area A enclosed by the orbit depends on r^2 because $A = \pi r^2$. Determine how the following properties of the satellite depending on r are right:
   (A) period is proportional to $r^{1.5}$
   (B) kinetic energy period is proportional to r^{-1}
   (C) angular momentum period is proportional to $r^{0.5}$
   (D) speed period is proportional to $r^{-0.5}$

6. A student of weight 667 N rides a steadily rotating Ferris wheel (the student sits upright). At the highest point, the magnitude of the normal force $\vec{F}_N$ on the student from the seat is 556 N. Which of the following are right?
   (A) The student feels "heavy" there.
   (B) The magnitude of $\vec{F}_N$ at the lowest point is 778N. If the wheel's speed is doubled.
   (C) the magnitude F_N at the highest is 223 N.
   (D) the magnitude F_N at lowest point is 1.11 kN.

7. Whenever an object strikes a stationary object of equal mass:
   (A) momentum is necessarily conserved.
   (B) energy is not necessarily conserved.
   (C) the collision must be elastic.
   (D) the first object must stop.

8. The following descriptions concern impulse, momentum and force. Which are correct?
   (A) Impulse is not an intrinsic property of object.
   (B) Momentum is an intrinsic property of object.
   (C) They are all vectors.
   (D) Impulse is proportional to momentum.