考題皆為單選題，請在答案卡上作答。

共25題，每題4分，答錯不倒扣。

1. Which physical quantity is observed with the same result for all inertial reference frames? (A) The force; (B) The work; (C) The kinetic energy; (D) All; (E) None.

2. Which is not correct to apply Newton's 3rd law? (A) All measurements should be made in an inertial reference frame; (B) The interacting particles can not be accelerating; (C) No virtual force (e.g., the Coriolis force) is involved; (D) All; (E) None.

3. A ball of mass m moves in a vertical circle at the end of a string. By how much is the tension at the bottom greater than that at the top? (A) **0**; (B) **2** mg; (C) **4** mg; (D) **6**mg; (E) None.

4. If the energy needed to send an object (initially at rest on the earth's surface) to a maximum height H is a half of that for sending it into an orbit at the same height, what would be the value of H in terms of R_E (the radius of the earth)? Ignore the earth's rotation. (A) **1/4**; (B) **1/3**; (C) **1/2**; (D) **2/3**; (E) None.

5. Which pair of vectors is not always in parallel? (A) Velocity & linear momentum; (B) Angular velocity & angular momentum; (C) Net force & acceleration; (D) All; (E) None.

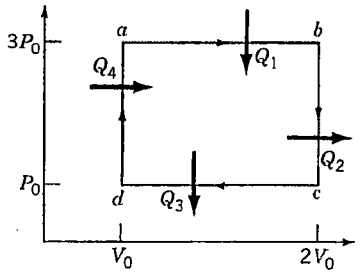
6. What is the moment of inertia I for a uniform ring of radius R and mass M about an axis (perpendicular to the plane of ring) at its rim? (A) **0.5** MR^2; (B) MR^2; (C) **1.5** MR^2; (D) **2** MR^2; (E) None.

7. A rope of mass M and length L hangs vertically. What is the time T needed for a pulse to travel from the bottom end to the support? (A) **0.5** $(L/g)^{0.5}$; (B) $(L/g)^{0.5}$; (C) **2** $(L/g)^{0.5}$; (D) **2** (L/g); (E) None.

8. Which statement is not correct for the "shear modulus"? (A) It has the same dimension as the "pressure"; (B) It involves the application of two parallel forces of opposite directions along the same line; (C) It can not be defined for an ideal fluid; (D) All; (E) None.

9. Which statement is correct?
(A) "Heat" is the energy of the random motion; (B) Neither "heat" nor "work" belongs to a system; (C) A "heat reservoir" possesses a lot of heat; (D) All; (E) None.

10. One mole of an ideal monatomic gas is taken around the reversible cycle shown in Figure.1 (on the right). What is the efficiency of this "heat engine"?
(A) **4/21**; (B) **5/14**; (C) **6/11**; (D) **7/34**; (E) None.



11. A point charge Q is placed at one corner of a Gaussian surface in the form of a cube of side L. What is the total "electric flux" through this Gaussian surface in terms of Q/ε_0?
(A) **0**; (B) **1/8**; (C) **3/4**; (D) **5/6**; (E) None.

12. Which is <u>not</u> correct for the dielectric constant (κ) of a substance? (A) It is a measure of the response of its charges to an external electric field; (B) The capacitance of a capacitor can be enhanced by a factor of κ when filling with this substance; (C) $\kappa = 0$ for an ideal conductor; (D) All; (E) None.

13. A conductor has a surface charge density σ C/m^2. The force per unit area on the surface is (A) 0; (B) $\sigma^2/2\varepsilon_0$ N/m^2; (C) σ^2/ε_0 N/m^2; (D) $2\sigma^2/\varepsilon_0$ N/m^2; (E) None.

14. The "Hall potential difference" of a Hall device depends on (A) the local magnetic field; (B) the current; (C) the sign and concentration of charge carriers; (D) All; (E) None.

15. A particle of mass m and charge q is in a circular orbit (of radius R) normal to an external field B. What is proportional to the magnetic field created at the center of its orbit by the charge? (A) m; (B) q; (C) R; (D) B; (E) None.

16. Which is <u>not</u> among applications of the "eddy current"? (A) The braking system of a train; (B) Mutual attraction of metals; (C) Induction cooking; (D) Propulsion of trains; (E) None.

17. Which is <u>not</u> an appropriate pair of analogy between mechanical and electrical quantities of the oscillating systems? (A) $x \leftrightarrow Q$; (B) $v \leftrightarrow I$; (C) $m \leftrightarrow C$; (D) $F \leftrightarrow V$; (E) None.

18. The image by a convex mirror is always (A) erect; (B) reduced; (C) virtual; (D) All; (E) None.

19. A better resolution for the two headlights of a car in a picture can be achieved by reducing (A) the separation of the headlights; (B) the wavelength of light; (C) the aperture diameter of the camera lens; (D) All; (E) None.

20. A laser beam of intensity S and cross-sectional area A is completely absorbed by a particle of mass m for a period Δt. What is the change in speed of the particle? (A) $SA\Delta t/mc$; (B) $SA\Delta t/m$; (C) SA/mc; (D) $SA\Delta t/c$; (E) None.

21. Which statement is <u>not</u> correct for the lines of force (i.e., the "field lines")? (A) They never cross; (B) The field strength is constant along them; (C) The total number of them is proportional to the source charge; (D) Their density is proportional to the field strength; (E) None.

22. Which statement is <u>not</u> correct according to the "theory of special relativity"? (A) Whether two events at different locations are simultaneous depends on the frame; (B) The relative velocity of two objects <u>never</u> precede the speed of light; (C) The "effect" may appear to occur earlier than its "cause" as observed in some frames; (D) All; (E) None.

23. Which behavior in the "photoelectric effect" can also be explained by the wave theory of light? (A) There is a "threshold frequency" for the incident light; (B) The "stopping potential" is <u>not</u> dependent on the intensity of light; (C) The "photocurrent" is proportional to the intensity of light; (D) All. (E) None.

24. Which issue in the spectrum of hydrogen atoms can <u>not</u> be solved by the Bohr model? (A) The existence of separated series of lines; (B) The relative intensity of each line; (C) The wavelength of each line; (D) All; (E) None.

25. Which statement is correct for a "blackbody"? (A) It is a perfect absorber and emitter of radiation; (B) It can be realized by "a tiny hole on the wall of a cavity"; (C) A higher temperature will result in a shorter peak wavelength in its radiation spectrum; (D) All; (E) None.