Name：_____

Student ID：_____

Grade_____ Class_____

Dalian University of Technology

Course： College Physics **Paper type：** C **Test form：** Close- book

Department: DUT-RU Joint Institute **Date：** / / Paper includes 13 pages

	Ⅰ	Ⅱ	Total score
Total score	60	40	100
Actual score			

Score	

Ⅰ Multiple-Choice questions: *(3 points per each question)*

1. Use the *rules* for significant figures to find the answer to the *addition* problem (11.4 + 13.2 + 27.03):

A) 51.63 B) 51.6

C) 51 D) 52

2. Suppose that quantity **A** has dimension of *length* and quantity **B** has dimension of *time*. Determine which of the following arithmetic operations could be physically meaningful:

A) $A = B$ B) $A - B$

C) A/B D) $A + B$

3. What is the correct power of 10 for the kilo- prefix?

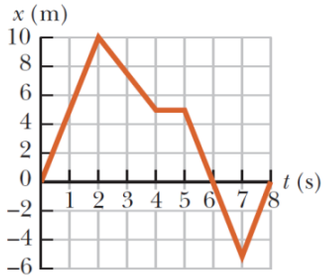
A) 10^3 B) 10^9

C) 10^6 D) 10^{12}

4. What should be the directions of the velocity and acceleration vectors (in respect to each other) so that a moving object could come to a *complete stop* after a while?

A) same directions
B) perpendicular directions
C) opposite directions
D) no correct answer in A-B-C

5. A graph of position versus time for a certain particle moving along the *x*-axis is shown in the figure. Find the average velocity in the time interval from 0 s to 4.00 s.



A) 0 m/s
B) 4.00 m/s
C) 2.50 m/s
D) 1.25 m/s

6. The correct expression for the period of rotation in case of a *uniform circular motion* is (**ω** is the angular velocity and ***R*** is the radius):

A) $T = \dfrac{2\pi R}{\omega}$
B) $T = \dfrac{2\pi}{\omega}$
C) $T = \dfrac{2\pi}{R}$
D) $T = \dfrac{2\pi}{\omega R}$

7. What is the correct expression for the centrifugal force of inertia?

A) $m\omega^2\vec{\rho}$
B) $m[\vec{v}' \times \omega]$
C) $m\rho^2\vec{\omega}$
D) no correct answer in A-B-C

8. What is the correct relation between the *work* ***W*** and the *force* ***F*** which does the work in case of a 1-D motion?

A) $W = \int_{x_i}^{x_f} F(x)dx$
B) $W = \dfrac{dF(x)}{dx}$
C) $W = \dfrac{d^2F(x)}{dx^2}$
D) no correct answer in A-B-C

9. Two *point charges* attract each other with an electric force of magnitude ***F***. If one charge is *reduced to one half* its original value and the *distance* between the charges is *doubled*, what is the resulting magnitude of the *electric force* between them?

A) ***F*** / 2

B) ***F*** / 4

C) ***F*** / 8

D) ***F*** / 16

10. The correct expression for the potential produced by a *point charged particles* is:

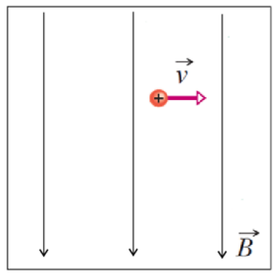
A) $V = \frac{1}{4\pi\varepsilon_0}\frac{q^2}{r^2}$

B) $V = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$

C) $V = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$

D) $V = \frac{1}{4\pi\varepsilon_0}\frac{q^2}{r}$

11. What is the direction of the *magnetic* force acting on a point *positive* charge?



A) ← (left)

B) → (right)

C) ⊙ (towards you)

D) ⊗ (into the page)

12. What is the correct expression for the magnetic energy stored inside the inductor?

A) $U_B = \frac{1}{2}\frac{1}{Li^2}$

B) $U_B = \frac{1}{2}\frac{L}{i^2}$

C) $U_B = \frac{1}{2}Li^2$

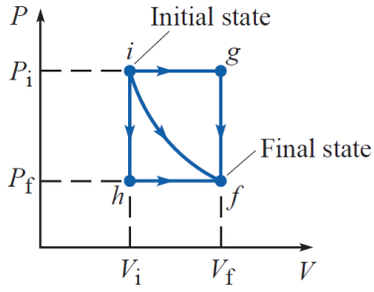
D) $U_B = \frac{1}{2}\frac{i^2}{L}$

13. The temperature of boiling of water is 100°C. What is this value equal to in Kelvin temperature scale? (the answer is rounded to integers)

A) 273 K B) 373 K

C) –100 K D) 0 K

14. The *PV* diagram illustrates several paths to get from an initial to a final state (both points *i* and *f* belong to the same *isotherm*). For which path the change in the internal energy has the *greatest* value?



A) path ***if*** B) path ***ihf***

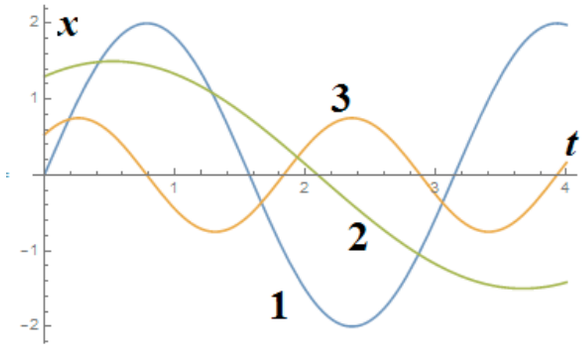
C) path ***igf*** D) there is NO change in the internal energy along all paths

15. An ideal gas has the volume V_0 and pressure p_0. If during the *constant temperature* process the volume of the gas is increased *four* times, the new pressure is:

A) $p_0 / 4$ B) $2\ p_0$

C) $p_0 / 2$ D) $4\ p_0$

16. Figure shows the $x(t)$ curves for three experiments involving a particular spring-box system oscillating in *simple harmonic motion*. Rank the curves according to the system's *amplitude*, greatest first.



A) 1–2–3

B) 2–1–3

C) 1–3–2

D) 3–1–2

17. Which type of waves can be produced by means of a *spring*?:

A) longitudinal	B) transversal
C) both longitudinal and transversal	D) no correct answer in A-B-C

18. The image of an object formed by a thin *diverging* lens

A) is always real	B) is always virtual
C) can be both real and virtual	D) no correct answer in A-B-C

19. A *converging* lens has a focal length of 0.5 m. If p is the *object* distance and q is the *image* distance, what is the correct form of the thin-lens equation for this case?

A) $p + q = 0.5$

B) $p + q = -0.5$

C) $\frac{1}{p} + \frac{1}{q} = 2$

D) $\frac{1}{p} + \frac{1}{q} = -2$

20. The relativistic (Lorentz) factor of a moving object (v is the speed of motion) is a *dimensionless* quantity in the theory of relativity which can be written as follows:

A) $\gamma = \frac{1}{\sqrt{1 - (v/c)^2}}$

B) $\gamma = \frac{1}{\sqrt{v^2 + c^2}}$

C) $\gamma = \frac{1}{\sqrt{v^2 - c^2}}$

D) no correct answer in A-B-C

Score	

Ⅱ **Problems** *(5 points per each problem)*

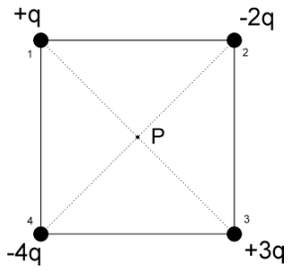
1. A particle's acceleration along an *x*-axis is $a = 2.0t$, with t in seconds and a in meters per second squared. At $t = 3.0$ s, its velocity is +12 m/s. What is its velocity at t = 1.0 s?

Solution:

2. At $t = 0$, force $\vec{F} = -2\vec{i} + 3\vec{j}$ N begins to act on a 2 kg particle which is initially at rest. What is the particle's <u>speed</u> (i.e. magnitude of the velocity) when its displacement from the initial point is $\vec{d} = 3\vec{i} + 5\vec{j}$ m?

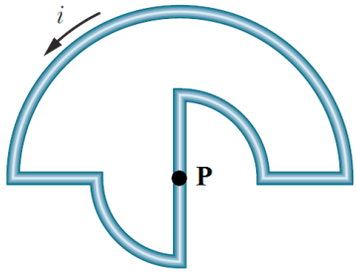
Solution:

3. Four particles carrying charges $+q$, $-2q$, $+3q$ and $-4q$ (with q = 1.00 nC) are kept at the vertices of a square of side 6.00 cm. Determine the net potential due to these charged particles at the centre of the square.



Solution:

4. Figure shows a closed loop with current i = 2.00 A. The loop consists of a half-circle of radius 4.00 m, two quarter-circles each of radius 2.00 m, and three radial straight wires. What is the magnitude of the net magnetic field at the common center of the circular sections (i.e., at P point)?



Solution:

5. An *ideal* monatomic gas expands *adiabatically* from 1.25 m^3 to 2.50 m^3. If the initial pressure is 1.00×10^5 Pa and initial temperature is 477 K, find (a) the final pressure of the gas, (b) the change in the internal energy of the gas. The adiabatic index of an ideal monatomic gas $\gamma = 5/3$.

Solution:

6. A 50 g piece of ice at –10°C is mixed with 100 g of water at 85°C What is the resulting temperature of the drink? Specific heat capacitance of ice is 2.22 kJ/(kg K), specific heat capacitance of water is 4.20 kJ/(kg K); heat of fusion of ice is 333 kJ/kg.

Solution:

7. The period of *simple harmonic oscillations* of an object in an ideal *spring-mass* system is 1.5 s and the amplitude is 15 cm. What is the speed of the object when it passes the equilibrium point?

Solution:

8. An object is located 15.0 cm to the left of a *converging* lens having a focal length 10.0 cm. Determine (a) the location and (b) the magnification of the image.

Solution: