第廿七届全国华文独中数理学识比赛　物理科

1. 物体做一维简谐运动，它的周期$T = 2\pi\sqrt{\frac{m}{k}}$，则动能最大值时的频率为：

An object is vibrating in one dimension with period $T = 2\pi\sqrt{\frac{m}{k}}$ then the maximum kinetic energy is:

(a) $\frac{1}{2T}$　(b) $\frac{3}{2T}$　(c) $\frac{1}{T}$　(d) $\frac{2}{T}$　(e) $\frac{1}{3T}$

2. 在平面上两个质量相等的球做碰撞，碰撞后它们之间离开的最大夹角可以为：
Two balls of equal mass colliding on a plane. The maximum angle between the balls after collision can be:

(a) 90°　(b) 180°　(c) 108°　(d) 135°　(e) 以上皆非　none of the above

3. 静止的球由高度h向下掉，如果球弹起时损耗掉 10%的能量，则第一次弹起后球的最高点高度h_1为：
A ball falls down with zero velocity at a height h, when the ball bounces up from the floor with 10% of energy lost. Then the maximum height after the first bounce is:

(a) $h/2$　(b) $0.9h$　(c) $0.99h$　(d) $\sqrt{3}h/2$　(e) $0.1h$

4. 行星绕太阳的轨道为椭圆，这些轨道的总能量为：
All planets are moving around the sun in elliptical orbit. The energy of these orbits are:

(a) 0　(b) 正值 positive　(c) 负值 negative　(d) 虚数 complex value
(e) 以上皆非 none of the above

5. 把一个球以初速v_0从地面往上抛，则球由最高点回到地面的时间t为

A ball is thrown up from the ground with initial speed v_0, the time to take it from at the highest point back to the ground is:

(a) $v_0/2g$　(b) $2g/v_0$　(c) $\sqrt{g/v_0}$　(d) $\sqrt{v_0/g}$　(e) v_0/g

6. 三个相等的电荷 q 分别放在等边三角形(边长为l)的三个顶点上，则三角形的中心点上的电位为：(k 为常数)

Three particles of the same charge are located on the vertices of equilateral triangle of side d. The electrical potential at the center is: (k is a constant)

(a) $3kq^2/d$　(b) $3kq/d$　(c) $2\sqrt{3}kq^2/d$　(d) $3\sqrt{3}kq/d$

(e) 以上皆非 none of the above

7. 一个圆形电流环中(半径为 a)，载有电流 I，则圆心上的磁场$\vec{B}$的大小为：(μ_0为常数)

A current ring of radius d carries the electric current I.
The magnetic field at the ring's center is: (μ_0 is a constant)

(a) $\mu_0 I/2\pi d$　(b) $\mu_0 I/4\pi d$　(c) 0　(d) $\mu_0 Id$　(e) $\mu_0 d/I$

8. 电荷 q (质量为 m) 在均匀电场$\vec{E}=E_0\hat{x}$中运动，则它的速度$\vec{v}$为：

A charge q (Mass m) is moving in the uniform electric field $\vec{E}=E_0\hat{x}$. It velocity $\vec{v}$ is :

(a) 常向量 a fixed vector　(b) $\vec{v}=\vec{v}_0+(qE_0t/m)\,\hat{x}$　(c) $\vec{v}=(qE_0t/m)\,\hat{x}$

(d) $\vec{v}=\left(qE_0t^2/m\right)\hat{x}$　(e) 以上皆非 none of the above

9. 一条长直导线上有电流 I，如果在它的旁边有一正电荷 q 以速度 v 沿著电流的方向运动，则电荷所受的力的方向为：

A long straight conducting wire carries current I. If a positive charge q is moving with speed v parallel to the direction of the current then the direction of the magnetic force on q is :

(a) 平行电流方向　parallel to the current
(b) 指向导线　pointing toward the wire
(c) 离开导线　pointing away from the wire
(d) 不决定　can not be decided
(e) 反平行电流　Anti-Parallel to the current

10. 一块形如橄榄球的金属上有电荷 Q，则以下对金属表面附近的电场的叙述哪一个为正确？

A piece of metal of the shape of Rugby football contains charge Q, which of the following statements is correct for the electric field E close to the surface of the conductor:

(a) 电场大小与位置无关　　E is position independent

(b) 电场皆平行於表面　　E is always parallel to surface

(c) 比较尖的两端电场最小　　the sharp ends of the foot ball has the weakest E

(d) 比较尖的两端电场最大　　the sharp ends has the maximum E

(e) 电场与 Q 成反比　　E is inversely proportional to Q.

11. 一个金属实心(半径为 a)上有电荷 Q，则以下叙述何者为不正确：

A solid conducting sphere of radius a has charge Q, which of the following statement is incorrect:

(a) 球内电场 $\vec{E}=0$　　the electric field inside the sphere $\vec{E}=0$

(b) 球心的电位为 $V=kQ/a$　　the potential V at the center is $V=kQ/a$

(c) 在球内 $r=a/2$ 的电位为 $V=2kQ/a$　　V at $r=a/2$ is $V=2kQ/a$

(d) 球内任一点的电位都相等　　the potential is constant inside the sphere

(e) 球面上的电场 $r=a$ 与球面垂直

the electric field at $r=a$ is always perpendicular to the surface.

12. 如果刹车所需要的摩擦力都一样，如果初速 v_0 所需要的刹车距离为 d_0，则当初速度变为 $2v_0$ 时所需要的刹车距离为：

Assuming the frictional force for stopping the car is the same and the stopping distance is d_0 when the initial speed is v_0, then as initial speed increases to $2v_0$ the corresponding stopping distance will be:

(a) $2d_0$　(b) $4d_0$　(c) $3d_0$　(d) $5d_0$　(e) 以上皆非 none of the above

13. 一个物体在平面上运动，而且其加速度为常向量，则以下叙述哪一个为正确：
An object is moving on a plane with its acceleration being a constant vector, which of the following statement is correct:

(a) 运动轨距为双曲线　Its trajectory is the hyperbola
(b) 没有位能　it has no potential energy
(c) 总能量不变　the total energy remains unchanged
(d) 位能随时间增加　Potential energy is increasing with time
(e) 动能随时间增加　kinetic energy is increasing with time

14. 电子伏特是描写：
Electron volt describes

(a) 电压　electric potential　(b) 电流　current
(c) 动量　momentum　(d) 能量　energy
(e) 以上皆非　none of the above

15. 太阳所放出的光与热的来源正确原因为:
The light and heat produced by the sun is due to:

(a) 燃烧表面的氢气　The burning of hydrogen
(b) 化学反应　chemical reaction
(c) 原子核分裂　nuclear fission
(d) 氢原子核的融合过程　nuclear fusion
(e) 以上皆非　none of the above

16. 原子被激发时所放出的光都是一些不连续的光谱，它的正确原因为：
The light produced by exciting atom manifests as discrete spectral lines. The correct statement for such phenomenon is:

(a) 原子中的电子做周期性运动　the electrons inside the atom is moving periodically
(b) 电子做不规则运动　the electron motion is random
(c) 电子之间有碰撞　there are collision among electrons
(d) 原子的能量为某些特定值　the allowed energy of the atom is discrete
(e) 以上皆非　none of the above

17. 波耳的氢原子模型中导致不连续的原子能阶的新观念为：
Bohr's hydrogen atom model implies the energy levels are discrete, he has used the following new concept:

(a) 库仑力　Coulomb force
(b) 电子有大小　the electron has finite size
(c) 角动量不守恒　angular momentum is not conserved
(d) 角动量量子化　angular momentum is quantized
(e) 动量不守恒　momentum is not conserved.

18. 以下有关光子的叙述何者为不正确：
Which of the following statement about the photon is incorrect:

(a) 电荷为零　Electric charge =0
(b) 质量为零　mass=0
(c) 光子没有动量　photon has no momentum
(d) 光子能量 $E = hf$　energy E=hf
(e) 光子有角动量　photon has angular momentum

19. 以下有关理想气体比热 C 的性质何者为正确？(R 为理想气体常数)
For the specific heat C of ideal gas which statement is correct (R is the ideal gas constant):

(a) $C \propto R^2$　(b) $C \propto R^3$　(c) $C \propto R$　(d) $C \propto \sqrt{R}$　(e) 以上皆非 none of the above

20. 如果维持气体的压力 P 不变来加热，则气体的体积 V 为(T 为温度):
If heating up gas with fixed pressure P, then its volume V (T being its temperature) will:

(a) 不变　remain unchanged
(b) 减少　decrease
(c) 增加　increase
(d) 反比於 T^2　be inversely proportional to T^2
(e) 正比於 $\sqrt{T}$　be proportional to $\sqrt{T}$

21. 辐射是物体散热的一个途径，则辐射的强度 I 与物体表面温度 T 的关系为:
Radiation is one way to loose heat. The intensity of radiation is related to the temperature T as:

(a) $I \propto T^3$　(b) $I \propto T^2$　(c) $I \propto \sqrt{T}$　(d) $I \propto T^4$　(e) $I \propto T^{3/2}$.

22. 可见光的波长大约为:
The order of magnitude for visible light wavelength is:

(a) $10^{-3}m$　(b) $10^{-6}m$　(c) $10^{-8}m$　(d) $10^{-1}m$　(e) $10^{-5}m$.

23. 以下的声波性质何者为不正确：
Which statement is incorrect for sound wave:

(a) 声波为纵波	It is longitudinal wave
(b) 声波的波速在固体中比空气慢	the speed of sound is slower in solid than in the air
(c) 声波没有偏振	sound wave is non polarized
(d) 波长与频率成反比	wavelength is inversely proportional to frequency
(e) 声波传递能量	sound wave transmits energy

24. 质量为 m 的物体与地球的距离为 r，则它的重力位能为：(M 为地球质量)
An object of mass m is located away from the earth with distance r, its gravitational potential energy is: (M is the mass of the earth)

(a) mgr　(b) GMm/r　(c) $-GMm/r$　(d) $-GM/r$　(e) GM/r

25. 以下哪一项是描述驻波: (λ 为波长， f 为频率)
Which expression in below is correct for standing wave: (λ is the wave length, f is the frequency and a is constant length)

(a) $A\sin(2\pi x/\lambda - 2\pi ft)$　(b) $A\sin(2\pi x/a)\cos(2\pi ft)$　(c) $A\sin(\pi x/\lambda - 2\pi ft)$
(d) $A\cos(2\pi\lambda/x + 2\pi ft)$　(e) 以上皆非 none of the above