



2020–2021 AUT Admission Test Physics (Sample)

< **Multiple choice Questions** > There is only one correct answer per each question. Mark your answer choice on the OMR answer sheet. For each correct answer, you will get 4 points. No penalty point is applied to an incorrect answer.

1. Bob's ball follows the trajectory $y = 20t - 5t^2$, while Jim's ball follows $y = 10 - 5t^2$. They meet when $t = 0.5$ s.

Answer) ① 0.5 s

2. The tension is needed to withstand the centripetal force given by mv^2/r . Therefore the maximum speed is $\sqrt{20 \times 0.8/4} = 2$ m/s.

Answer) ① 2 m/s

3. From the law of energy conservation, we have $\frac{2}{2}5^2 = \frac{2}{2}v^2 + \frac{1800}{2}0.1^2$, which gives $v = 4$ m/s.

Answer) ④ 4 m/s

4. The pendulum's period is given by $T = 2\pi\sqrt{\frac{L}{g}}$. T is doubled by quadrupling L.

Answer) ③ quadrupling the length L

5. When the initial speed of the bullet is v , the law of momentum conservation gives $mv - MV = (m + M) \times 0 = 0$. Therefore $v = MV/m$.

Answer) ④ MV/m

6. At the position where the angle between the tangent to the slope and the horizontal direction is θ , the local gravitational acceleration is $g \sin \theta$. The angle θ decreases monotonically only for C.

Answer) ③ C

7. Let the accelerations of the three blocks from the left to the right be a_1, a_2, a_3 . From Newton's law, we have $T_1 = ma_1$, $T_2 - T_1 = ma_2$, $T - T_2 = ma_3$. Since $a_1 = a_2 = a_3$, we obtain $T = 3ma$, $T_2 = 2ma$, $T_3 = ma$. Therefore $T_1 = 10$ N, $T_2 = 20$ N.

Answer) ③ $T_1 = 10$ N, $T_2 = 20$ N

8. The angular momentum is conserved in the planetary motion. From this, it follows that the speed of the planet is larger when it is closer to the Sun.

Answer) ⑤ A Same



2020–2021 AUT Admission Test Physics (Sample)

9. The spring constant is $k=10/4$ N/cm. Two springs exert identical forces, therefore $2kx=5x=10$ and $x=2$ cm.

Answer) ② 2 cm

10. Let the speeds of sound, the ambulance and the car be v, v_s, v_o respectively. The observed frequency is changed to $1000 \frac{v-v_o}{v+v_s} = 800$. Since $v_s = v_o$, $v_s/v = 1/9$.

Answer) ① 1/9

11. $v = \lambda f = 20$ m/sec

Answer) ④ 20 m/sec

12. If the final temperature is x , then $200 \times (100 - x) = 50 \times (x - 30)$. Therefore $x = 86^\circ\text{C}$.

Answer) ④ 86°C

13. When the car is accelerating in the forward direction, there exists an effective gravitational force in the backward direction inside the car. Since helium is lighter than the air, the buoyant force makes the balloon move forward.

Answer) ② forward

14. Total internal reflection occurs when the light is incident from a material with higher refractive index n_1 to the one with lower refractive index n_2 , and the incident angle satisfies $\sin\theta > \frac{n_2}{n_1} = 0.5$. Therefore $\theta > 30^\circ$.

Answer) ① the solid 30°

15. The energy of a photon is proportional to the frequency. Blue light has the highest frequency among the five colors.

Answer) ① Blue

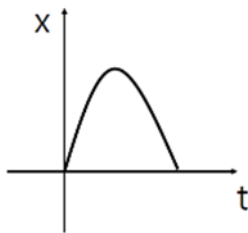


2020–2021 AUT Admission Test Physics (Sample)

16. Electrons are transferred from the fur to the rubber rod. Therefore the piece of fur becomes lighter, while the rubber rod becomes heavier.

Answer) ⑤ The piece of fur becomes lighter, while the rubber rod becomes heavier

17. The particle experiences a constant acceleration in the negative x direction. When the initial velocity is in the positive x direction, the time dependence of x is a parabolic function of t as shown in ⑤.



Answer) ⑤

18. Since the Coulomb force is inversely proportional to the square of the distance between the charges, the force is decreased to $20/4=5$ N.

Answer) ⑤ 5 N

19. If the resistance of each light bulb is R and the emf is V, then the total resistance for three bulbs is $R/3$ and the total current is $3V/R$. The current of V/R flows in each bulb. When one of the bulbs burns out, the total resistance becomes $R/2$ and the total current becomes $2V/R$. However, the current flowing in each bulb remains to be V/R . Therefore the light intensity of the other two bulbs will remain the same.

Answer) ⑤ The light intensity of the other two bulbs will remain the same.

20. The effective resistance of the three resistors connected in parallel is $\left(\frac{1}{3} + \frac{1}{2} + \frac{1}{2}\right)^{-1} = \frac{3}{4} \Omega$. The voltage difference applied to them is 3 V. Therefore the current flowing in the 3Ω resistor is $3/3=1$ A.

Answer) ③ 1 A



2020–2021 AUT Admission Test Physics (Sample)

21. Three capacitors connected in series, $8\ \mu\text{F}$, $12\ \mu\text{F}$ and $24\ \mu\text{F}$, have an effective capacitance $\left(\frac{1}{8} + \frac{1}{12} + \frac{1}{24}\right)^{-1} = 4\ \mu\text{F}$. This is connected to a $4\ \mu\text{F}$ capacitor in parallel, therefore the effective capacitance is $8\ \mu\text{F}$. Finally, one has three capacitors connected in series, $8\ \mu\text{F}$, $8\ \mu\text{F}$ and $4\ \mu\text{F}$, the effective capacitance of which is $\left(\frac{1}{8} + \frac{1}{8} + \frac{1}{4}\right)^{-1} = 2\ \mu\text{F}$.

Answer) ② $2\ \mu\text{F}$

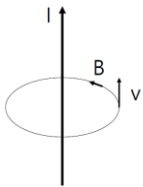
22. The total energy consumed is $10 \times 60 \times 50 = 30000\ \text{Wh} = 30\ \text{kWh}$. The price is $30 \times 0.5 = 15$ dollars.

Answer) ⑤ 15 dollars

23. The force between the wires per unit length is given by $\frac{\mu_0 I_1 I_2}{2\pi r}$. Therefore when r, I_1, I_2 are doubled, the force increases by a factor of 2.

Answer) ② increases by a factor of 2

24. The directions of the magnetic field created by the current and the particle are depicted in the figure below. The Lorentz force $\mathbf{F} = q\mathbf{v} \times \mathbf{B}$ is directed radially inward toward the wire.



Answer) ③ radially inward toward the wire

25. From the nuclear reaction equation, the atomic number and the mass number of the missing particle are 2 and 4 respectively. Therefore it is an α particle.

Answer) ② α particle