

Physics, 2015 EC, natural science, entrance exam

Grade 12 · Physics · 2015 E.C.

Time allowed: 120 minutes

Questions: 30

Total marks: 30

Name _____ Grade _____ ID No. _____ Date _____

1. An object is placed 25.0 cm in front of a concave mirror having focal length of 10.0cm. The magnification of the mirror is (1)
 - A. 2.5
 - B. 16.7
 - C. 0.67
 - D. 1.5
2. Which of the following statements distinguishes between random and systematic errors? (1)
 - A. Systematic error can be minimized by taking several readings and averaging; whereas random error cannot be minimized.
 - B. Systematic error makes measured values to be always above or always the true value; whereas random error causes measured vales to be sometimes above and sometimes below the true value.
 - C. Random error makes measured values to be always above or always below the true value; whereas systematic error causes measured values to be sometimes above and sometimes below the true value.
 - D. Random error is biased, whereas systematic error does not show bias.
3. The unit vector the direction $A = 3i + 4j$ is (1)
 - A. $(3/5)i + (4/5)j$
 - B. $2i - j$
 - C. $(3/2)i - (4/2)j$
 - D. $i + j$
4. Which of the following pair of vectors are collinear? (1)
 - A. $2i - 3j$ and $-4i - j$
 - B. $i + j$ and $-i + j$
 - C. $2i + 3j$ and $-4i + 6j$
 - D. $2i + 3j$ and $-4i - 6j$
5. For an object moving in straight line, (1)
 - A. If the displacement changes by equal amount in equal time interval, the displacement-time graph is horizontal line.
 - B. The area of the region under the displacement-time graph and the slope of velocity-time graph are, respectively, the acceleration and displacement of the object.
 - C. If the velocity increases by equal amount in equal time interval, the velocity -time graph is straight line with positive slope and the acceleration-time graph is horizontal.
 - D. The slope of displacement-time graph and the area of the region under acceleration-time graph are, respectively, the acceleration and velocity of the object
6. Which of the following is true about satellite motion? (1)
 - A. A satellite moving closer to the Earth takes longer time to complete one revolution than a satellite farther from the Earth.
 - B. For two satellites moving around the Earth at equal orbital radius, a heavier satellite has larger speed than a lighter one.
 - C. For equal orbital radius, a satellite moving around the Earth has smaller speed than a satellite moving about moon.
 - D. A satellite closer to Earth is faster than a satellite farther from the As Earth.

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7. According to the work- energy theorem, (1)
- A. work done by tension on an object tied to a string and moving a horizontal circle is negative.
 - B. work done by gravity on an object downward is negative.
 - C. work done by gravity on an object thrown upward and moving upward is negative.
 - D. work done by gravitational force on a satellite moving around the earth in a circular is positive
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8. A young double slit experiment consists of two narrow slits separated by 0.06 mm and 1.2m away from a screen. (1)
If the slits are illuminated with a light of wavelength 563nm, the location of the fourth bright fringe on the screen is
- A. 0.0394cm
 - B. 0.45cm
 - C. 3.94cm
 - D. 4.5cm
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9. The electric potential at a distance of 2 cm from $-1.6 \times 10^{-9}\text{C}$ point charge is (1)
- A. -14.4 v
 - B. 720 v
 - C. 4.4 v
 - D. -720 v
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10. Consider a long and tightly wound solenoid carrying current I , having length L and N turns of winding. If n is the number of turns per unit length, which of the following describes the magnetic field produced by the solenoid? (1)
- A. The magnetic field inside the solenoid is zero, whereas the field outside is perpendicular to the length of the solenoid.
 - B. The magnetic field inside the solenoid is constant and is parallel to the solenoid's axis, whereas the field outside is negligible.
 - C. The magnetic field inside the solenoid is uniform and perpendicular to the axis of the solenoid.
 - D. The magnetic field outside the solenoid is as strong as the field inside it.
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11. According to the law of electromagnetic induction, (1)
- A. the magnitude of emf induced in a circuit is directly proportional to the rate of change the magnetic flux crossing any surface bounded by the circuit.
 - B. a changing magnetic field parallel to the plane of a circuit induces an emf in it.
 - C. a constant magnetic flux crossing the surface of a circuit induced an emf in the circuit.
 - D. an emf is induced in a circuit when a constant magnetic field crosses its surface.
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12. According to the Heisenberg's uncertainty principle, (1)
- A. the larger the position uncertainty, the larger the momentum uncertainty.
 - B. if the uncertainty in position decreases, the momentum uncertainty decreases, too.
 - C. the more precisely we measure the position of a particle; we become less precise of its momentum and vice versa.
 - D. we can measure both the position and momentum of a particle simultaneously with unlimited precision.
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13. The graph of nuclear binding energy per nucleon (BE/A) versus mass number (A) has its peak near an atomic weight $A = 56$. Which of the following statements is true about the graph? (1)
- A. Uranium ($A = 235$), which has larger binding energy than iron ($A = 56$), is more stable than iron.
 - B. Nucleus with larger number of neutron is more stable than nucleus of the same atom with smaller number of neutron.
 - C. For heavier nuclei ($A > 56$), the binding energy per nucleon decreases with the increase of mass number; implying that heavier atoms can increase their stability by increasing their proton's number.
 - D. For smaller atoms ($A < 56$), the binding energy per nucleon generally increases with the increase of mass number; indicating that lighter atoms can increase stability through nuclear fission.

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14. Which of the following statements is NOT correct about reflection and refraction of sound waves and their applications? (1)
- A. In pre-natal scanning, reflection and refraction of sound allows doctors to monitor the progress of a developing baby.
 - B. Reflection of sound (echo) is formed when sound enters a medium of varying densities.
 - C. Reflection and refraction of sound are used to detect flaws in metals and to help people park their cars.
 - D. Refraction of sound is the change in its direction as it travels through a medium having different densities.
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15. A torque τ rotates an object of mass m and moment of inertia I through an angle θ . The work done on the object by the torque is (1)
- A. $I\theta$
 - B. $m\theta$
 - C. $\tau\theta$
 - D. τI
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16. One of the following statements is a correct description of the charging processes? (1)
- A. During charging a neutral object by induction using a negatively charged rod, charge flows from the rod to the object
 - B. When a neutral metallic sphere is charged by induction using a negatively charged rod, the sphere acquires a net negative charge.
 - C. When a positively charged object is momentarily brought into contact with a neutral metallic sphere, the sphere acquires a net positive charge.
 - D. When a plastic rod is rubbed with wool, the two objects acquire a net charge of the same region.
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17. A parallel plate capacitor is charged with a battery. The battery is then disconnected, and a dielectric material is inserted between the plates of the capacitor. Which of the following is correct about the effect of the dielectric? (1)
- A. The potential difference between the plates remains the energy stored increases.
 - B. The charge on the plates decreases and the energy stored increases
 - C. The electric field between the plates and the energy stored decrease.
 - D. the capacitance remains the same and the electric field between the plates increases.
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18. Which one of the following statements is correct about the resistance of a conductor with a circular cross-section? (1)
- A. At a given temperature, the resistance of copper and silver wires of the same length and diameter is the same.
 - B. The resistance of the conductor increases as its length increases and its diameter decreases.
 - C. The resistance of the conductor increases as its length and diameter increases.
 - D. The resistance of the conductor decreases as it is heated.
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19. The primary coil of a transformer has 250 turns and its secondary coil consists of 1500 turns. If 220V is applied to its primary coil, the voltage induced in the secondary coil, respectively, are (1)
- A. 1320V and 6
 - B. 1330V and 6
 - C. 1220V and 60
 - D. 1320V and 60
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20. A diode is an electronic component that (1)
- A. is useful to convert a DC voltage to AC voltage.
 - B. allows electric current to pass through it in one direction.
 - C. allows the flow of current when its p-type region is connected to the negative terminal of a cell.
 - D. allows current to pass through it either from cathode to anode or from anode to cathode.

21. A student throws a ball vertically upward with a speed of 20m/s. The maximum height reached by the ball and its velocity 30s after it was thrown are, respectively (1)

A. 20m and 30m/s upward. B. 15m and 10m/s downward.
C. 105m and 50m/s upward. D. 20m and 10m/s downward.

22. Which one of the following statements describes the difference between different types of friction? (1)

A. For an object at rest on a horizontal surface, static friction increases with the increase of the applied force and reaches a maximum value just before sliding occurs.
B. Limiting friction is the minimum value of static friction that keeps an object stationary.
C. If there is a constant force applied to a stationary object on a horizontal surface, the static friction becomes equal to the limiting friction.
D. Limiting and kinetic frictions exist at the same time between two surfaces sliding over each other.

23. The apparent weight of a 60kg student standing inside a lift is (1)

A. 600N when the lift accelerates with acceleration equal to gravitational acceleration.
B. 600N when the lift accelerates upward with 2m/s^2
C. 480N when the lift accelerates downward with 2m/s^2
D. 720N when the lift is at rest.

24. Which of the following statements describe the use of energy resources? (1)

A. Solar energy produced by photovoltaic cells is free of greenhouse gases and has a very low running cost
B. Hydroelectric power generates a large amount of energy using small dam with little environmental impact and cheap initial cost of construction.
C. Geothermal energy is the most accessible, environmental friendly and inexpensive source of energy.
D. Wind energy, which is due to the pressure difference in space as the result of uneven sun heat, is a consistent and economical source of energy.

25. According to the law of floatation, an object must displace a volume of fluid (1)

A. equal to the weight of undispersed fluid.
B. equal to its apparent weight.
C. less than its own weight.
D. equals to its own weight.

26. Which one of the following statements describes the unusual behavior of expansion of water? (1)

A. The density of water at 0°C is less than its density at 4°C , since water molecules move further apart and form a second hydrogen bond with other water molecules.
B. As a temperature of water increases above 4°C , its density increases since water molecules move further apart to form a second hydrogen bond with other molecules.
C. At 0°C , water has larger density and smaller volume than its density and volume at 4°C .
D. As a temperature of water increases from 0°C to 4°C , its density increases since one molecule of water forms one hydrogen bond with another molecule.

27. An FM radio signal is transmitted from a radio station at a frequency of 1.5×10^8 Hz. If the wavelength of the radio wave is 2.00m, the speed of the FM signal is (1)

A. 6.00×10^8 m/s B. 1.33×10^8 m/s
C. 3×10^8 m/s D. 0.75×10^8 m/s

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- 28.** Which one of the following statements is correct about transformation of mechanical energy into other forms and the law of conservation of total energy? (1)
- A. Due to dissipative force, the mechanical energy of a wooden block sliding on a rough horizontal surface is not conserved.
 - B. Mechanical energy of a wooden block sliding on a rough horizontal surface is conserved.
 - C. Neglecting air resistance, an object moving vertically downward gains potential energy and loses an equal amount of kinetic energy.
 - D. Neglecting air resistance, an object moving vertically upward gains kinetic energy and loses an equal amount of gravitational potential energy
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- 29.** A wheel rotating at angular speed of 20 rev/s is brought to rest after 40 rev under a constant angular acceleration. The angular acceleration of a point on the wheel is (1)
- A. 5 rev/s²
 - B. -5 rev/s²
 - C. -0.5 rev/s²
 - D. 0.25 rev/s²
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- 30.** Tensile stress is the (1)
- A. parallel component of the applied force divided by the cross sectional area of an object.
 - B. ratio of change in length of an object to the original length
 - C. perpendicular component of the applied force divided the cross sectional area of an object.
 - D. ratio of original to the change in length of the object.

— END OF EXAMINATION —