

Physics, 2016 EC, natural science, entrance exam

Grade 12 · Physics · 2016 E.C.

Time allowed: 120 minutes

Questions: 48

Total marks: 48

Name _____ Grade _____ ID No. _____ Date _____

1. Lenz's law states that the direction of the induced current in a loop is in such a way that the current (1)
 - A. is in opposite direction to that of the applied magnetic field that is causing it.
 - B. creates a magnetic field that reinforces the change in magnetic flux through the loop.
 - C. is in the same direction as that of the applied magnetic field that is causing it.
 - D. creates a magnetic field that opposes the change in magnetic flux through the loop.
2. Which one of the following statements is correct about the resistance of a conducting wire? The resistance of the wire is (1)
 - A. directly proportional to the square of its length.
 - B. directly proportional to the square of its cross-sectional area.
 - C. inversely proportional to its cross-sectional area.
 - D. inversely proportional to its length.
3. Consider an ideal transformer having N_p and N_s turns, and voltages V_p and V_s in its primary and secondary coils, respectively. Which one of the following is the correct ideal transformer equation? (1)
 - A. $V_p = (N_p / N_s)^2 V_s$
 - B. $N_s / N_p = (V_s / V_p)^2$
 - C. $V_s / V_p = N_p / N_s$
 - D. $V_s / V_p = N_s / N_p$
4. Which one of the following statements is correct about the electrical conductivity of materials? Materials in which all the (1)
 - A. outer most shell electrons are tightly bound to its parent atom are conductors.
 - B. outer most shell electrons are free to move within the material are semiconductors.
 - C. inner and outer most shell electrons are free to move within the material are conductors.
 - D. inner and outer most shell electrons are tightly bound to its parent atom are insulators.
5. Which one of the following statements distinguishes precision from accuracy? (1)
 - A. Precision indicates how close a measured value is to the true value, whereas accuracy refers to the closeness of repeatedly measured values to each other.
 - B. Accuracy measures how exact a value is whereas precision indicates how close a measured value is to the true value.
 - C. Precision is a measure of the closeness of repeatedly measured values to each other, whereas accuracy is related to the number of significant figures.
 - D. Precision is a measure of the closeness of repeatedly measured values to each other, whereas accuracy refers to the closeness of measured values to the true value.

6. Which of the following statements about the nature electromagnetic waves is correct? Electromagnetic waves are transverse waves produced when (1)
- electric and magnetic fields are oscillating perpendicular to each other.
 - charges are placed at rest in an electric and magnetic fields that are perpendicular to each other.
 - electric and magnetic fields are oscillating parallel to each other.
 - charges are placed at rest in an electric and magnetic fields that are parallel to each other.
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7. A concave mirror has a radius of curvature of 30.0 cm . It is positioned so that the upright image of an object is 2.0 times the size of the object. How far is the object from the mirror? (1)
- 10.0 cm
 - 15.0 cm
 - 22.5 cm
 - 7.5 cm
-
8. Which one of the following is correct about the four basic forces in nature? (1)
- Electromagnetic force is the weakest of all the forces in nature.
 - Gravitational force is attractive force that acts on the scale of the atomic nucleus.
 - Strong nuclear force is short-range force that holds protons and neutrons together inside a nucleus.
 - Weak nuclear force keeps the electrons in their orbit around a nucleus.
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9. Which of the following is correct about impulse? (1)
- The direction of the impulse is in the same direction to change in the momentum of the object.
 - During momentum change final momentum of an object is along the impulse on the object.
 - Impulse due to a force exerted for a short time is equal to impulse due to the same force exerted for a long time.
 - The impulse is smaller than change of momentum which caused by the applied force.
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10. Which of the following pair of vectors is collinear? (1)
- $C = i + j$ and $D = i - j$
 - $A = 2i + 3j$ and $B = -4i + 6j$
 - $E = -i + j$ and $F = 3i - 3j$
 - $G = 2i + 3j$ and $F = 3i + 2j$
-
11. A ball is thrown vertically upward with 12 m/s from the ground. Its speed when the ball is 4.0 m above the ground is (1)
- 8 m/s.
 - 15 m/s.
 - 10 m/s
 - 12 m/s
-
12. An object is projected at angle θ from the horizontal with initial velocity v_0 . Which one of the following expressions represents the relationship between maximum height, $h_{\max}$, and range of the projectile, R ? (1)
- $R = h_{\max}(\tan\theta)/2$
 - $R = 4h_{\max}(\tan\theta)$
 - $R = (2h_{\max})/(\tan\theta)$
 - $R = (4h_{\max})/(\tan\theta)$
-
13. A 0.5 kg block moving with an initial speed of 5.0 m/s slides 2.5 m on a A rough horizontal surface before coming to rest. The coefficient of kinetic friction is (1)
- 0.5
 - 0.3
 - 0.1
 - 0.4
-
14. A 0.2 kg ball is kicked from the ground at 16 m/s in a direction making an angle θ above the horizontal. Neglecting air resistance, the magnitude of velocity of the ball when it is 3.0 m from the ground is (1)
- 7 m/s.
 - 2 m/s.
 - 14 m/s.
 - 16 m/s.

15. The angular speed of a disk rotating about its axis increases by 2000 rad/s in a time interval of 3.0 s . If the moment of inertia of the disk is 0.6 kg m^2 , what is the average torque on the disk? (1)
- A. 670 Nm B. 1200 Nm
C. 6000 Nm D. 400 Nm
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16. What do you call the sound wave that is heard after reflection from a hard surface? (1)
- A. Loudness B. Timber
C. Echo D. pitch
-
17. The angular momentum of a rotating object is defined as the product of its (1)
- A. mass and the angular velocity.
B. moment of inertia and the square of the angular velocity.
C. moment of inertia and angular velocity.
D. mass and one-half of the square of the angular velocity.
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18. Which one of the following waves is identified as longitudinal wave? (1)
- A. Deep water wave B. Wave on a vibrating string
C. Sound wave D. S-wave of Earthquake
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19. Which of the following statements is correct about the components of the velocity of a ball projected up at an angle of θ with the horizontal? Neglecting the air resistance, (1)
- A. the vertical component of the velocity remains constant throughout its journey.
B. the vertical component of velocity increases while the horizontal component of velocity decreases.
C. the horizontal component of the velocity remains constant throughout its journey.
D. the horizontal velocity of the ball is equal to zero at the maximum
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20. Which one of the following statements is correct about the electric field due to a charged spherical solid conductor? (1)
- A. It is zero inside the sphere.
B. It is non-zero constant outside the sphere.
C. It is non-zero constant inside the sphere.
D. It is parallel to the surface of the sphere.
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21. A metal wire made of coefficient of linear expansion α is heated so that its temperature is changed by ΔT . If the length of the wire before heating is L_0 , which one of the following expressions is correct for the final length of the wire after heating? (1)
- A. $L_0 \propto \Delta T$ B. $(L_0)/(1 + \alpha \Delta T)$
C. $L_0(1 + \alpha \Delta T)$ D. $(L_0)/(1 - \alpha \Delta T)$
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22. What amount of heat energy is required to completely melt 200 g of ice at 0°C ? (Take specific latent heat of melting for ice, $L_f = 3.3 \times 10^5 \text{ J/kg}$) (1)
- A. $1.65 \times 10^7 \text{ J}$ B. Zero
C. $6.60 \times 10^4 \text{ J}$ D. $1.65 \times 10^3 \text{ J}$
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23. The orbital speed of a satellite at a height of 780 km from the surface of the earth is $7,465 \text{ m/s}$. what is the period of the satellite? (1)
- A. $6.04 \times 10^2 \text{ s}$ B. $6.04 \times 10^3 \text{ s}$
C. $6.60 \times 10^3 \text{ s}$ D. $6.60 \times 10^2 \text{ s}$

24. The charge of 20.0μ is stored on the capacitor when a potential difference between its two parallel plates is 200.0 V, what is the capacitance of the capacitor? (1)

A. $1.0 \times 10^{-6} \text{ F}$ B. $10.0 \times 10^{-6} \text{ F}$
C. $0.1 \times 10^{-6} \text{ F}$ D. $4.0 \times 10^{-6} \text{ F}$

25. An air filled parallel plate capacitor is connected to a potential difference 'V' to store electric charge. If the area of the plates is A and the separation between the plates is 'd', then the electrical energy stored on the capacitor is (1)

A. $\frac{1}{2}(\epsilon_0 dV^2)/A$ B. $(\epsilon_0 AV^2)/d$
C. $(\epsilon_0 dV^2)/A$ D. $(1/2)(\epsilon_0 AV^2)/d$

26. When a force F is applied to a wire of length 'L' fixed at one end, the wire extends by x. The tensile strain of the wire is (1)

A. the extension divided by the length L.
B. the length L divided by the extension x
C. the applied force F divided by the extension.
D. the product of the force F and then extension x .

27. Which one of the following factors does NOT affect the moment of inertia of an object? (1)

A. The axis about which the object is rotating
B. The size of the object
C. The angular speed of the object
D. The mass of the object

28. Which of the following describes the difference between static and dynamic equilibrium? In static equilibrium, (1)

A. an object is at rest, whereas in dynamic equilibrium, the object moves with constant velocity.
B. an object moves with constant acceleration, whereas in dynamic equilibrium, the object is at rest.
C. acceleration is zero, whereas in dynamic equilibrium the acceleration increases uniformly.
D. an object moves with constant velocity, whereas in dynamic equilibrium an object is at rest.

29. About an axis of rotation perpendicular to a plane of a couple, the forces in a couple produce (1)

A. no torque. B. non-zero resultant force.
C. torques in opposite direction. D. torques in the same direction.

30. Which one of the following statements describes the difference between heat and temperature? (1)

A. Heat is a transfer of energy due to temperature difference, whereas temperature is a measure of the average kinetic energy.
B. Heat is measured with a thermometer in Kelvin, whereas temperature is measured with a Calorimeter in Joule.
C. Heat is a measure of the average kinetic energy, whereas temperature is a flow of energy from hotter to colder object.
D. Heat is an energy that flows spontaneously from colder to hotter object, whereas temperature is the degree of hotness and coldness.

31. Which one of the following statements does NOT describe the relationship of physics with biology? (1)

A. Physics and biology are interrelated to each other in the study of vision and color detection.
B. Physics and biology used to study how air vibrates in vocal cords.
C. Both physics and biology are mainly concerned in the interaction of large number of particles.
D. Newtonian mechanics and biology are used to explain why cheetah is fastest animal.

32. Which one of the following is a correct relation of physics with medicine? (1)
- A. Modern medical imaging instrument are developed with knowledge of medicine and later used by physics.
 - B. Medicine is a branch of physics dealing with nuclear reaction.
 - C. Physics is a branch of medicine that sets standards during medical diagnosis.
 - D. A discipline called medical physics deals with principles of physics in medical diagnosis.
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33. A glass tube of radius 30 mm is inserted in a bowl which contains methyl iodide of density $2.28 \text{ kg}^3 \text{ m}^3$. If the contact angle of the methyl iodide in the tube is 30° and the surface tension is 0.26 N/m , how much height does the methyl iodide rises through the tube? (1)
- A. 0.52 m
 - B. 6.6 m
 - C. 0.66 m
 - D. 0.066 m
-
34. Three resistors are connected between points a and b as shown in the figure below. The effective resistance of the circuit is (1)
-  Question Diagram
- A. 1.0Ω
 - B. 11.0Ω
 - C. $1.0\text{K}\Omega$
 - D. $11.0\text{K}\Omega$
-
35. In an experiment to determine the direction of the magnetic field around a long straight current-carrying wire, a student placed a small compass at point P, as shown in the diagram. If the direction of the current in the wire is directed out-of the page, then the magnetic needle of the compass will point (1)
-  Question Diagram
- A. to the right.
 - B. to the left.
 - C. downward.
 - D. upward.
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36. A small ball of mass m tied to a rope of length l is moving along a vertical B circle about a point O as shown in the figure. If A, B, C, and D are points on the path, then which one of the following is correct about the force exert on the ball at these points? (1)
-  Question Diagram
- A. At point C , the radial force and the tension on the rope are in opposite direction.
 - B. At point D , the radial force is equal to the tension on the rope.
 - C. At point A, the radial force is in opposite direction to the gravitational force on a ball.
 - D. At point B, the radial force is equal to the gravitational force on the ball.
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37. The velocity-time graph of an object moving along a straight line toward east is described by the figure shown below. What is the total displacement moved by the object? (1)
-  Question Diagram
- A. 600 m East
 - B. 375 m East
 - C. 525 m East
 - D. 450 m East

- 38.** A 200 N force is required to be applied at one end of a 1 m long lever, 80 cm from its fulcrum, in order to lift a load of 600 N placed at the other end as shown in the figure below. (1)

What is the efficiency of the lever?



A. 25% B. 75%

C. 17% D. 83%

39. A substance with a mass of 2 kg has a volume of $2.5 \times 10^{-3} \text{ m}^3$. What is the relative density of the substance? (1)

A. 80 B. 0.8

C. 8.0 D. 1.25

40. The gauge pressure at a point in a fluid at rest is defined as (1)

A. the actual pressure at a given point relative to absolute vacuum.

B. the sum of absolute pressure and atmospheric pressure.

C. the pressure difference between the absolute pressure and the atmospheric pressure.

D. the atmospheric pressure difference between sea level and the local area at which the fluid exists.

41. How do we use manometer to measure pressure of a given gas? We use it in such a way that (1)

A. the principle of the hydrostatic equilibrium is considered to measure the pressure of unknown gas.

B. the pressure at the surface of open end manometer is the same as the gas pressure in closed tube.

C. the gauge pressure equals the atmospheric pressure.

D. the gauge pressure in a fluid in the open end equals the gas pressure in closed tube.

42. Consider two balls A and B are projected with the same velocity, v_0 at angle θ_1 and θ_2 , respectively, $0 < \theta_1 < 45^\circ$ and $45^\circ < \theta_2 < 90^\circ$. Which one of the following statements is correct about the motion of the balls? (1)

A. The range of ball A is smaller than its maximum height.

B. Ball A takes longer time than ball B to reach its maximum height.

C. Both balls have equal speed at their respective maximum height.

D. The two balls cover equal ranges when $\theta_1 + \theta_2 = 90^\circ$

43. A car initially traveling at speed of 20 m/s undergoes a constant deceleration of magnitude 1.5 m/s^2 . If the radius of each tire is 0.3 m, how many revolutions does each tire make, without slipping, before the car comes to rest? (1)

A. 444.4 rev B. 44.44 rev

C. 70.77 rev D. 133.33 rev

44. A constant tangential force is applied on a rim of uniform solid disk of mass 50 kg and radius $r = 0.5 \text{ m}$. If the angular speed of the disk changes by 1 rev/s within 2.0 s, what is the magnitude of the torque produced by the force? (moment of inertia of disk $I = \frac{mr^2}{2}$) (1)

A. 19.6 Nm B. 3.125 Nm

C. 39.3 Nm D. 8.25 Nm

45. A loop of 0.1 m wide in diameter is placed in xy-plane in uniform magnetic field of 0.6 T that is perpendicular to the plane of the loop. What is the net magnetic flux through the coil? (1)

A. $1.9 \times 10^{-2} \text{ Wb}$ B. $4.7 \times 10^{-3} \text{ Wb}$

C. $5.6 \times 10^{-2} \text{ Wb}$ D. $9.4 \times 10^{-2} \text{ Wb}$

- 46.** A 12 V voltage source is connected across the primary coil of a transformer having 600 turns. If the secondary coil of a transformer has 1000 turns, what voltage appears across the secondary coil? (1)
- A. 72.0 V B. 12.0 V
C. 7.2 V D. 20.0 V

- 47.** The following table shows the density of different objects at 20°C. (1)

Based on the information given in the table, if we identify substances that sink and float with respect to other substance,

 Question Diagram

- A. bone, iron and seawater will sink in water.
B. water, gasoline and ice will sink into seawater.
C. gasoline, ice and blood floats on the surface of water.
D. gold, blood and copper floats in gasoline.
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- 48.** Which one of the following statements differentiates emitter, collector and base of a transistor? (1)
- A. The collector region is heavily doped as compared with emitter and base.
B. The emitter region is heavily doped as compared with base and collector.
C. The three parts; emitter, base and collector are equally doped.
D. The base region is heavily doped as compared with emitter and collector.

— END OF EXAMINATION —