

**NATIONAL EDUCATIONAL ASSESMENT AND EXAMINATIONS AGENCY (NEAEA)
ETHIOPIAN UNIVERSITY ENTRANCE EXAMINATION (EUEE)
PHYSICS EXAMINATION 2006**

BOOKLET CODE: 00

NUMBER OF ITEMS:

SUBJECT CODE: 00

TIME ALLOWED: 00

Constant	Symbol	Value
Acceleration due to gravity	g	10m/s²
Permittivity of vacuum	ϵ_0	8.85 X 10⁻¹²F/m
Faraday's constant	F	96500Cml⁻¹
Charge of an electron	e	1.6 x 10⁻¹⁹Coulomb
Universal gravitational constant	G	6.67 x 10⁻¹⁹Coulomb
Pi	π	3.14159
Density of water	ρ	1000kg/m³
Atmospheric pressure	P	101.3kPa
Planck's constant	h	6.63 x 10⁻³⁴Js
Electron mass	m_e	9.11 x 10⁻³¹
Sin 30° = cos 60° = 0.5		
Sin 37° = cos 53° = 0.6		
Sin 45° = cos 45° = 0.707		
Sin 53° = cos 37° = 0.8		
Sin 60° = cos 30° = 0.866		
1/√2 = 0.707		

1. The distance between two point charges is doubled. What will happen to the force of interaction between the charges?

- A) The force will be doubled.
- B) The force will be reduced by half.
- C) The force will be reduced by a factor of $\frac{1}{4}$.
- D) The force will not be affected.

2. What does the slope of a velocity time graph represent?

- A) distance
- B) acceleration
- C) displacement

D) speed

3. Moving 2.5×10^{-6} coulomb of charge from point A to point B in an electric field requires 6.3×10^{-4} joule of work. The potential difference between points A and B is approximately

A) 4.0×10^{-3} V

B) 2.5×10^{-2} V

C) 1.6×10^{-19} V

D) 1.0×10^{-14} V

4. A transverse sinusoidal wave is traveling on a string. Which statement is correct about a point on the string?

A) The point moves in the same direction as the wave.

B) The point moves in simple harmonic motion with a different frequency than that of the wave.

C) The point moves in simple harmonic motion with the same angular frequency as the wave.

D) The point moves in uniform circular motion with a different angular speed than the wave.

5. Two non zero vectors D and E have precisely equal magnitudes. For the magnitude of $D + E$ to be 3 times larger than the magnitude of $D - E$, what must be the angle between D and E ?

A) 30°

B) 37°

C) 53°

D) 60°

6. Which statement is correct about the pressure under a fluid in a container?

A) It depends on the volume of the fluid.

B) It depends on the density of the fluid.

C) It depends on the shape of the container.

D) It is independent of the depth of the fluid.

7. A capacitor made of parallel plates is charged by connecting it to a battery. The distance between the plates is much less than the surface area of each plate. After fully charged if the plates are disconnected from the battery and then pulled apart a little, what will happen to the total stored energy, the electric field, and the potential difference between the plates?

A) The electric field between the plates increase.

B) The potential difference between the plates remain the same.

C) The total energy stored in the capacitor increase.

D) The electric field, the potential difference and the stored energy remain the same.

8. Which one of the following statements is true about the motion of a particle in a circular path?

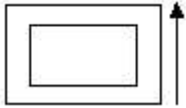
A) The centripetal acceleration is constant if the particle's speed is constant.

B) The tangential acceleration can be perpendicular to the velocity vector of the particle.

C) The centripetal acceleration is always in the direction perpendicular to the velocity vector of the particle.

D) The acceleration is always perpendicular to the velocity vector of the particle.

9. Two rectangular loops of wire lie in the plane of this paper as shown in the figure below, if the current I in the outer loop is counter clockwise and increases with time, which one of the following statements is correct about the current induced in the inner loop?



- A) A current is induced in the inner loop in the clockwise direction.
- B) A current is induced in the inner loop in the counter wise direction.
- C) The induced current in the inner loop creates a magnetic field inside the area bounded by the inner loop in the same direction of the magnetic field that the outer loop produces in this same area.
- D) It is zero.

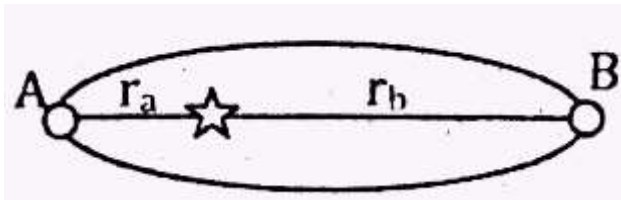
10. Two men, A and B, are loading identical boxes onto a truck. A lifts his box starting up from the ground to the bed of the truck, whereas B slides his box up a rough ramp to the truck, which statement is correct about the change in the potential energy on the box earth system?

- A) A and B change the potential energy by the same amount.
- B) A changes more potential energy than B.
- C) B changes more potential energy than A.
- D) None of those statements is necessarily true because the force of friction and the angle of the incline is unknown.

11. Two projectiles are fired from ground level at equal speed but different angles. One is fired at an angle of 30 degrees and the other at 60 degrees. The projectile to hit the ground first will be the one fired at (neglect air resistance)

- A) 60 degrees
- B) 30 degrees
- C) both hit at the same time
- D) cannot be determined from the given condition.

12. A planet of mass m is circling a star in an elliptical orbital as shown below. Its velocity at point A is $60,000\text{m/s}$ and $r_b = 8r_a$ what is its velocity at point B?



- A) $7,500\text{m/s}$
- B) $8,571\text{m/s}$
- C) $60,000\text{m/s}$
- D) $788,000\text{m/s}$

13. A small radio receiver uses a battery that delivers a constant current of 25mA for 3 hours. Calculate the total charge delivered by the battery.

- A) 1080000C

- B) 270000
- C) 540C
- D) 270C

14. A cup of coffee at a temperature of 80°C is placed on table in a 20°C room. What happens to the thermal energy and molecular motion of the coffee when it is left on the table?

- A) The thermal energy decreases and the molecules move more slowly.
- B) The thermal energy increases and the molecules move more slowly.
- C) The thermal energy decreases and the molecules move faster.
- D) The thermal energy increases and the molecules move faster.

15. The vector $2\hat{i} + \hat{j} + \hat{k}$ is perpendicular to $\hat{i} + 4\hat{j} + \lambda$ if λ is equal to

- A) -2
- B) -1
- C) 2
- D) 3

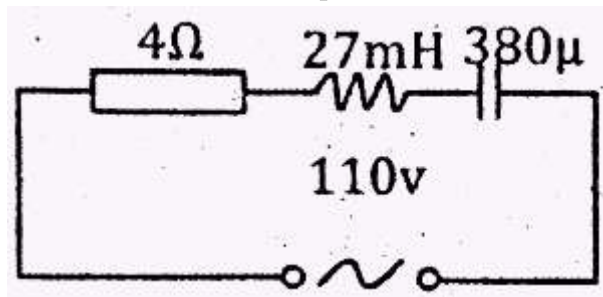
16. A garden hose has an inside diameter of 16cm. the hose can fill a 10 litter bucket in 20 seconds. If the diameter of the nozzle is reduced to 8 cm

- A) Water exists with a speed twice the speed inside the hose.
- B) A 10 litter bucket can be filled in 10 seconds.
- C) A 20 litter bucket can be filled in 40 seconds.
- D) Water exists with a speed half the speed inside the hose.

17. A mass suspended from the end of a spring vibrates up and down 20 times in 36s. What are the frequency and period of the vibration?

- A) 0.55Hz, 1.8S
- B) 0.67Hz, 1.5S
- C) 0.0012Hz, 864S
- D) 864Hz, 0.0012S

18. Determine the total impedance for the circuit shown below



- A) 0Ω
- B) 4Ω
- C) 27Ω

D) 31Ω

19. A hoop of mass M and radius R is at rest at the top of an incline plane of height h . the hoop rolls down the plane without slipping. When the hoop reaches bottom, its angular momentum about its center of mass is:

A) Mgh

B) $MR\sqrt{2gh}$

C) $MR\sqrt{\frac{gh}{2}}$

D) $MR\sqrt{gh}$

20. What is the resistance of a copper cable if it has a cross sectional area of 1cm^2 and a length of 2km ? The resistivity of copper is $2 \times 10^{-8}\Omega\text{m}$.

A) 0.0004Ω

B) 0.004Ω

C) 0.04Ω

D) 0.4Ω

21. When a load of 500kg is hanging from a steel wire of length 3m and cross sectional area 0.20cm^2 , the wire stretches beyond its no load length. If the Young's modulus for the wire made of steel is $Y = 2 \times 10^{11} \text{ Pa}$, what is the change in length of the wire beyond its no load length?

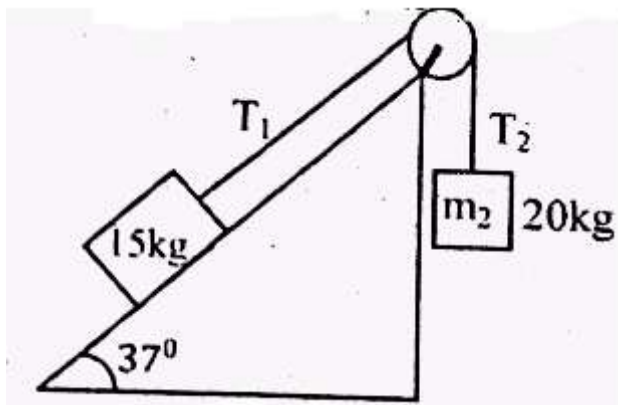
A) 3.75mm

B) 2.75mm

C) 1.75mm

D) 0.75

22. As shown in Figure below, two blocks are connected by a string of negligible mass passing over a pulley of radius $r = 0.2\text{m}$ and moment of inertia I . The block on the frictionless incline is moving with a constant acceleration $a = 2.0\text{m/s}^2$ up along the incline. What is the moment of inertia of the pulley?



A) 0.8kgm^2

B) 1.25kgm^2

C) 4kgm^2

D) 40kgm^2

23. A table tennis ball which is spherical in shape has a diameter of 6 cm and average density of 0.400 g/cm^3 . What force is required to hold it completely submerged under water?

- A) 0.68N downward
 B) 0.68N upward
 C) 1.13N downward
 D) 1.13N upward

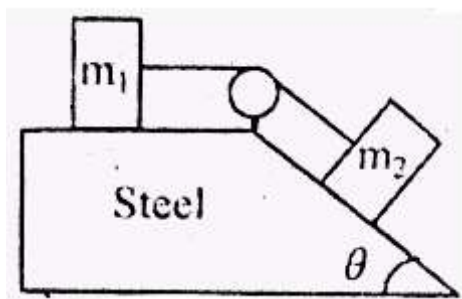
24. A viewing screen is separated from a double slit by 4.80m. The distance between the two slits is 0.030mm. Monochromatic light is directed toward the double slit and forms an interference pattern on the screen. The first dark fringe is 4.50 cm from the center line on the screen. What is the wavelength of the light?

- A) 1250nm
 B) 7200nm
 C) 2500nm
 D) 5625nm

25. A horizontal pipe of 10cm in diameter has a smooth reduction to a pipe of 5cm in diameter. If the pressure of the water in the larger pipe is 80kPa and the pressure in the smaller pipe is 6kPa, at what rate does the water flow through the smaller pipe?

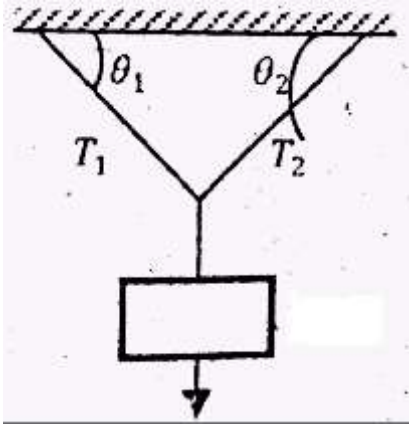
- A) 1.63m/s
 B) 6.53m/s
 C) 13.6m/s
 D) 42.67m/s

26. An aluminium block of mass $m_1 = 3\text{kg}$ and a copper block of mass $m_2 = 5\text{kg}$ are connected by a light string over a frictionless pulley. They sit on a steel surface as shown in figure below, where $\theta = 53^\circ$. The coefficient of kinetic friction between the steel surface and each block is 0.3. If the blocks are released from rest what is the tension T in the string?



- A) 29.40N
 B) 17.25N
 C) 12.25N
 D) 8.60N

27. An object of mass 3kg hangs from three light inextensible wires as shown in figure below. Two of the wires make angles $\theta_1 = 53^\circ$ and $\theta_2 = 37^\circ$ with the horizontal. If the system is in equilibrium, what will be the tensions T_1 and T_2 in the wires?



- A) $T_1 = 18\text{N}$ and $T_2 = 24\text{N}$
 B) $T_1 = T_2 = 18\text{N}$
 C) $T_1 = T_2 = 24\text{N}$
 D) $T_1 = 24\text{N}$ and $T_2 = 18\text{N}$

28. An object of mass m is hung from a spring and set into oscillation. The frequency of the oscillation is measured and recorded as f . If the object of mass m is replaced with an object of mass $2m$ and set into oscillation, what will be the frequency of the motion?

- A) $f/\sqrt{2}$
 B) f
 C) $(\sqrt{2})f$
 D) $2f$

29. A placekicker must kick a football from a point which is at a distance of 36.0 m from the goal. When kicked, the ball leaves the ground with a speed of 20.0m/s at an angle of 37° to the horizontal. If the ball hits the crossbar of the goal at a height h and bounces back what will be the height of the crossbar?

- A) 2.45m
 B) 2.85
 C) 3.00m
 D) 3.15m

30. A body moving with constant acceleration covers the distance between two points 60m apart in 5s. Its velocity as it passes the second point is 15m/s. what is the acceleration?

- A) 3m/s^2
 B) 2.4m/s^2
 C) 1.8m/s^2
 D) 1.2m/s^2

31. Which of the following combinations of properties would be most desirable for a heat sink in a machine?

- A) high specific heat and low conductivity.
- B) low heat specific heat and low conductivity.
- C) high specific heat and high conductivity.
- D) low specific heat and low conductivity.

32. A 6V battery is connected across the primary coil of a transformer having 50 turns. If the secondary coil of the transformer has 100 turns, what voltage appears across the secondary?

- A) 24.0V
- B) 12.0V
- C) 6.00V
- D) 3.00V

33. The change in entropy is zero for:

- A) reversible isobaric processes.
- B) reversible adiabatic processes.
- C) reversible isothermal processes.
- D) reversible processes during which no work is done.

34. Two particles with masses $2m$ and $3m$ are moving toward each other along the x axis with the same initial speed v . Particle $2m$ is traveling to the left, and particle $3m$ is traveling to the right. They undergo an elation glancing collision such that particle $2m$ is moving in the negative y direction after the collision. What are the x component of the final velocity of particle $3m$ and the kinetic energy of particle $2m$, respectively?

- A) $0.33v$ and $0.7mV^2$
- B) $0.33v$ and $1.41mV^2$
- C) $0.67v$ and $0.71mV^2$
- D) $0.67v$ and $1.4mV^2$

35. Two separate coherent sources produce waves whose wavelengths are $0.10m$. which statement is correct about points that are $3.2m$ away from one source?

- A) constructive interference occurs if the points are $3.0m$ from the other source
- B) constructive interference occurs if the points are $3.05m$ from the other source.
- C) constructive interference occurs if the points are $2.95m$ from the other source.
- D) destructive interference occurs if the points are $3.2m$ from the other source.

36. A coil formed by wrapping 50 turns of wire in the shape of a square is positioned in a magnetic field so that the normal to the plane of the coil makes an angle 37° with the direction of the field. When the magnetic field is increased uniformly from 200 mT to 600mT in $4.00s$, an emf of magnitude 160.0 mv is induced in the coil. What is the total length of the wire in the coil?

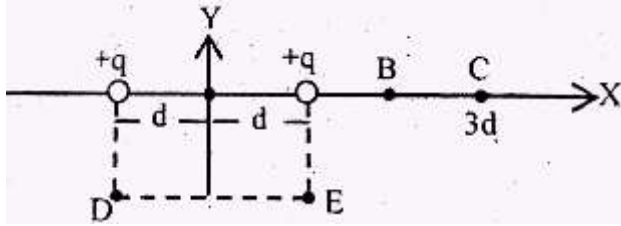
- A) $100m$
- B) $200m$
- C) $300m$
- D) $400m$

37. The half-life of radium 224 is 3.5 days. What fraction of the sample remains undecided after fourteen days? (if needed use $\ln 2 = -\ln(1/2) \approx 0.693$)

- A) ?
- B) $\frac{1}{2}$
- C) $\frac{1}{8}$
- D) $\frac{1}{16}$

38. Two positive charges of magnitude q are each a distance d from the origin A of a coordinate system as shown below.

The magnitude of the electric field is minimum at point



- A) A
- B) B
- C) C
- D) D

39. If the terminals of a battery with zero internal resistance are connected across two identical resistors in series, the total power delivered by the battery is 8 W. If the same is connected across the same resistors in parallel, what is the total power delivered by the battery?

- A) 2W
- B) 4W
- C) 16W
- D) 32W

40. Wire B has twice the length and twice the radius wire A. Both wires are made from the same material. If wire A has a resistance R , what is the resistance of wire B?

- A) $4R$
- B) $2R$
- C) $R/2$
- D) $R/4$

41. The sound level at a distance of 4.00m from a source is 120dB. At what distance is the sound level 100dB?

- A) 0.40m
- B) 4.80m
- C) 40m
- D) 48m

42. An ideal gas is at a temperature of 300K. If we wish to double the root mean square (rms) speed of the molecules of the gas, to what value must we raise its temperature?

- A) 450K
- B) 600k
- C) 800k
- D) 1200k

43. Suppose that the index of refraction of a soap bubble film is 1.25, what is the minimum thickness of the soap-bubble film that results in constructive interference in the reflected light if the film is illuminated with light whose wavelength in free space is $\lambda = 600\text{nm}$?

- A) 120nm
- B) 150nm
- C) 300nm
- D) 450nm

44. A wire carries a steady current of 2.4A. A straight section of the wire is 0.75m long and lies in xy-plane along the x-axis within a uniform magnetic field, $B=1.6\text{kT}$. If the current is in the positive x direction, what is the magnetic force on the section of wire?

- A) 2.88N, in the negative y direction.
- B) 2.88N, in the positive y direction.
- C) 3.84N, in the negative y direction.
- D) 3.84N, in the positive y direction.

45. Two different capacitors of capacitance $C_1 = 2\mu\text{F}$ and $C_2 = 3\mu\text{F}$ are connected in series across a 120V supply line. The charged capacitors are disconnected from the line and from each other, and reconnected with terminals of like sign together. What will be the final charges on C_1 and C_2 respectively?

- A) 57.63 μC and 86.4 μC
- B) 115.2 μC and 127.8 μC
- C) 144 μC across each
- D) 288 μC across each

46. A glass flask whose volume is exactly 1,000 cm^3 at 0°C is totally filled with 1000 cm^3 of mercury at this temperature. When flask and mercury are heated to 100°C, 15.2 cm^3 of mercury overflow. If the coefficient of volume expansion of mercury is 1.82×10^{-4} per Celsius degree, what should be the coefficient of volume expansion of the glass?

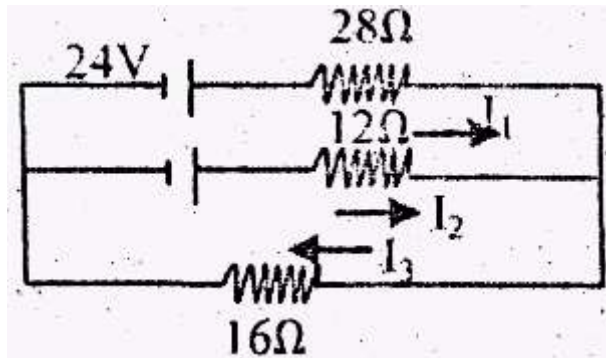
- A) $1.52 \times 10^{-4}/\text{C}^\circ$
- B) $1.82 \times 10^{-4}/\text{C}^\circ$
- C) $3.00 \times 10^{-4}/\text{C}^\circ$
- D) $1.00 \times 10^{-5}/\text{C}^\circ$

47. A heat engine is being designed to have a Carnot efficiency of 65.0% when operating between two energy reservoirs. If the temperature of the cold reservoir is 20.0°C, what must be the temperature of the hot reservoir?

- A) 570C
- B) 3100C

- C) 5640C
 D) 8070C

48. In Figure given below, the current in the 16Ω resistor is



- A) 0.64A
 B) 0.15A
 C) 0.49A
 D) 1.28A

49. A 10.0m uniform ladder weighing 200N rests against a frictionless wall. The ladder makes 53° angles with the horizontal, if the ladder is just on the verge of slipping when a 600.0N firefighter is 6.00m along the ladder from the bottom, what is the coefficient of static friction between the ladder and ground?

- A) 0.3240
 B) 0.4313
 C) 0.5750
 D) 0.7667

50. A block of mass 1.6kg is attached to a horizontal spring that has a force constant of 200N/m . The spring is compressed 2.0cm and is then released from rest. At what speed will the block pass through the equilibrium position if a constant friction force of 10.0N retards its motion from the moment it is released?

- A) 75m/s
 B) 50m/s
 C) 70m/s
 D) 55m/s

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