

In 2011 academic calendar Gondar city administrative educational office physics model exam for grade 12. Time allowed 2 hours

DIRECTIONS: Each of the following questions is followed by four possible alternatives. Read each question and carefully put the letter of your choice on the separate answer sheet provided.

You may refer to the information given below when you work on some of the questions.

Constant	Symbol	Value
Acceleration due to gravity	g	10m/s²
Permittivity of vacuum	ϵ_0	8.85x10⁻¹²F/m
Permeability of free space	μ_0	4 π x 10⁻⁷ Tm/A
Charge of electron	e	1.6x10⁻¹⁹C
Universal gravitational constant	G	6.67x10⁻¹¹Nm²/kg²
Density of water	ρ	1000 kg/m³
Atmospheric pressure	P_{atm}	101.3 kPa
sin30°=cos60°=0.5 sin37°=cos53°=0.6 sin53°=cos37°=0.8 sin45°=cos45°=0.707		

1. What is the best description of parallax error?

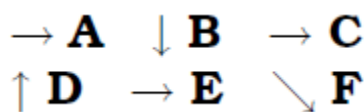
- A) Another name for observational error.
- B) Apparent shift of an object when the position of the observer is changed.
- C) The error caused by the distance between the scale and the measured feature.
- D) The average of measurements when the object is viewed from left and from the right.

2. Four students each measured the mass of one 1.55 g sample four times. The results in the table below indicate that the data collected by which student reflects the most accuracy and precision?

	Trial 1	Trial 2	Trial 3	Trial 4
Student A	1.43 g	1.52 g	1.47 g	1.42 g
Student B	1.43 g	1.40 g	1.46 g	1.44 g
Student C	1.54 g	1.46 g	1.58 g	1.50 g
Student D	0.86 g	1.26 g	1.52 g	1.42 g

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

3. Six vectors **A** through **F** have the magnitudes and direction as shown in figure. Which statement is true?



- A) **B + C = F**
- C) **D + C = F**

- B) **A + E = F**
- D) **B + E = F**

4. Consider three vectors $\vec{A} = \hat{i} + \hat{j} - 2\hat{k}$, $\vec{B} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{C} = 2\hat{i} - 3\hat{j} + 4\hat{k}$. A vector $\vec{D}$ of the form $\alpha \vec{A} + \beta \vec{B}$ (α and β are numbers) is perpendicular to $\vec{C}$. What is the ratio of α to β ?

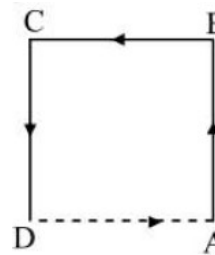
A) 1 : 1

B) 2 : 1

C) -1 : 1

D) 3 : 1

5. Three vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ are such that $|\vec{A}|=|\vec{B}|$, $|\vec{C}|=\sqrt{2}|\vec{A}|$ and $\vec{A}+\vec{B}+\vec{C}=\vec{0}$. The angle between $\vec{A}$ and $\vec{B}$, $\vec{B}$ and $\vec{C}$ respectively are
- A) 45° , 90° B) 90° , 135° C) 90° , 45° D) 45° , 135°



6. A particle moves along the sides AB, BC, CD of a square of side 25 m, as shown in the figure, with a velocity of 15 m/s. Its average velocity is _____
- A) 15 m/s B) 10 m/s C) 7.5 m/s D) 5 m/s

7. Which of the following is a correct statement?

A) A body have zero velocity will not necessarily have zero acceleration.
 B) A body have zero velocity will necessarily have zero acceleration.
 C) A body having uniform speed can have only uniform acceleration.
 D) A body having non-uniform velocity have zero acceleration

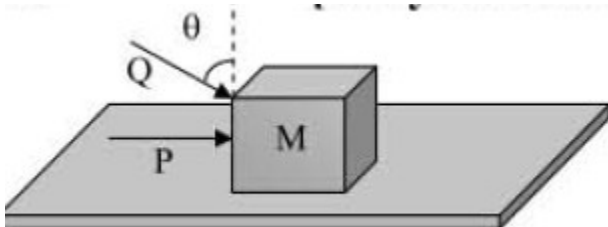
8. Two particles are projected from the same point on ground simultaneously with speeds 20 m/s and 10 m/s at angles of 37° and 53° respectively with the horizontal in the same direction. What is the maximum distance between them till both of them strike the ground?

A) 28.8 m B) 38.4 m C) 9.6 m D) 48 m

9. A boy is whirling a stone around his head by means of a string. The string makes one complete revolution every second, and the tension in the string is T. The boy then speeds up the stone, keeping the radius of the circle unchanged, so that the string makes two complete revolutions every second. What happens to the tension in the string?

A) The tension is unchanged.
 B) The tension reduces to half of its original value.
 C) The tension increases to twice its original value.
 D) The tension increases to four times its original value.

10. A block of mass m lying on a rough horizontal plane is acted upon by a horizontal force P and another force Q inclined at an angle θ to the vertical. The block will remain in equilibrium, what is the static coefficient of friction between the block and surface?



$\frac{P+Q \sin \theta}{mg+Q \cos \theta}$	$\frac{P \cos \theta+Q}{mg-Q \sin \theta}$
A)	B)
$\frac{P+Q \cos \theta}{mg+Q \cos \theta}$	$\frac{P \sin \theta-Q}{mg-Q \cos \theta}$
C)	C)

11. A crate remains stationary after it has been placed on a ramp inclined at an angle with the horizontal. Which of the following statements is TRUE about the magnitude of the friction force that acts on the crate?

A) It is equal to the weight of the crate.
 B) It is equal to the component of the gravitational force acting down the ramp.
 C) It is less than the component of the gravitational force acting down the ramp.
 D) It is greater than the component of the gravitational force acting down the ramp.

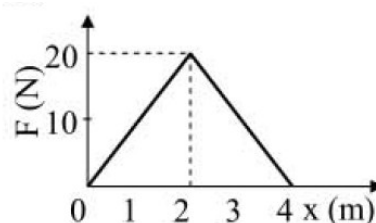
12. On a frictionless surface, a block of mass M moving at a speed v collides elastically with another block of the same mass M which is initially at rest. After collision the first block moves at an angle θ to its initial direction and

has a speed of $\frac{v}{3}$. What is the speed of the second block after collision?

- A) $\frac{\sqrt{3}}{2}v$ B) $\frac{2\sqrt{2}}{3}v$ C) $\frac{3}{4}v$ D) $\frac{3}{\sqrt{2}}v$

13. AB is a straight line of length 150 cm. Two particles of masses 1 kg and 3 kg are placed at a distance of 15 cm from A and 50 cm from B respectively. The distance of the third particle of mass 2 kg from A, so that the center of mass of the system is at the middle point of AB is
- A) 40 cm. B) 50 cm. C) 67.5 cm. D) 95 cm.

14. The graph between the resistive force F acting on a body and the distance covered by the body is shown in the figure. The mass of the body is 25 kg and initial velocity is 2 m/s. When the distance covered by the body is 4 m, what is its kinetic energy?



- A) 40 J B) 50 J C) 20 J
D) 10 J

15. Consider four simple pendulums. Pendulum A has a length L and a mass M , pendulum B has a length $2L$ and a mass M , pendulum C has a length L and a mass $2M$, and pendulum D has a length $2L$ and a mass $2M$. Each pendulum is displaced by the same angle θ from the vertical and then released from rest at that position. Compare the maximum speed that each pendulum has as it passes through the lowest point in its swing.

- A) Pendulum A has the largest speed.
B) Pendulum D has the largest speed.
C) Pendulums B and D have equal speeds that are larger than the others.
D) Pendulums A and C have equal speeds that are larger than the others.

16. A laborer A takes 4 minute in raising a box from ground to the top of a bus. Another laborer B takes 3 minute for the same task, then

- A) the work done by both of the them is the same but power is different.
B) the work done as well as power is the same for both of them.
C) the work done as well as power is different for both of them.
D) the work done is different for both but power is the same.

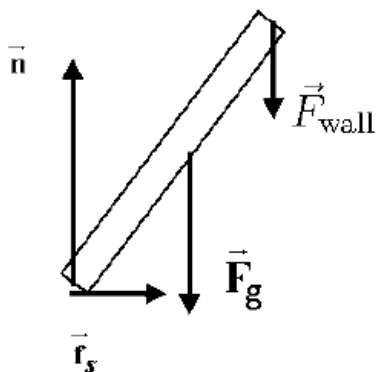
17. If a rigid body roll along a horizontal surface without slipping, then

- A) angular speed is different at different points of the rigid body.
B) linear speed is the same at all points of the rigid body.
C) linear speed minimum at highest point but maximum at the point of contact.
D) linear speed maximum at highest point but minimum at the point of contact.

18. A thin circular ring of mass M and radius R ($I = MR^2$) is rotating about its axis with a constant angular speed ω . Two objects of mass m are attached gently to the opposite ends of diameter of the ring. The wheel will now rotate with angular speed of _____

A) $\frac{\omega M}{M+m}$ B) $\frac{\omega(M-2m)}{M+2m}$ C) $\frac{\omega M}{M+2m}$ D) $\frac{\omega(M+2m)}{M}$

19. If a constant torque acts on a rigid body, the rigid body
- A) will acquire a linear acceleration according to Newton's second law.
 B) will acquire angular momentum. C) will rotate with a constant angular velocity.
 D) will move with a constant velocity or remain motionless in accordance with Newton's first law.
20. Two forces are acting on an object. Which of the following statements is correct?
- A) The object is in equilibrium if the forces are equal in magnitude and opposite in direction.
 B) The object is in equilibrium if the net torque on the object is zero.
 C) The object is in equilibrium if the forces act at the same point on the object.
 D) The object is in equilibrium if the net force and the net torque on the object are both zero.
21. A student has drawn a free-body diagram for a ladder of mass m leaning against a frictionless wall. The diagram is shown below. What is the error in the diagram?



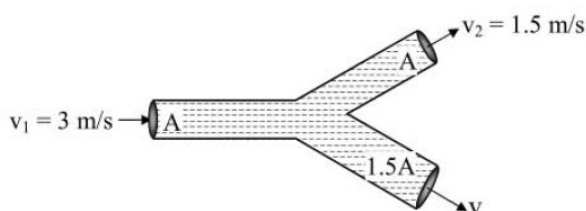
- A) f_s is in the wrong direction.
 B) $\vec{F}_{wall}$ should be directed upwards, not down.
 C) $\vec{F}_{wall}$ should be perpendicular to the wall, not parallel to it.
 D) $\vec{n}$ should be down into the floor for f_s to have the given direction.

22. Two wires are made of metals A and B. Their length and diameters are related by $L_A = 2L_B$ and $D_A = 2D_B$. When the wires are subjected to the same

tensile force, the ratio of elongation is $\frac{\Delta L_A}{\Delta L_B} = \frac{1}{2}$. What is the ratio of Young's modulus $\frac{Y_A}{Y_B}$?

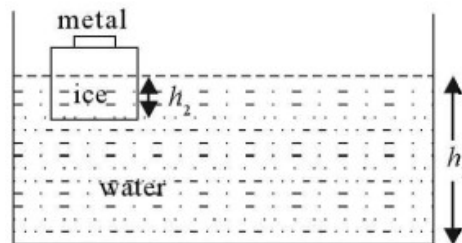
A) 1 B) 2 C) $\frac{1}{2}$ D) $\frac{1}{\sqrt{2}}$

23. An incompressible liquid flows through a horizontal tube as shown in figure below. What is the speed v of the liquid?



- A) 3 m/s B) 2.25 m/s
 C) 1 m/s D) 0.15 m/s

24. A metal piece is kept on ice top as shown. If the metal piece falls into water what happens to level h_1 and h_2 ?



- A) h_1 increases, h_2 decreases
 B) h_2 increases and h_1 decreases
 C) both h_1 and h_2 increase
 D) both h_1 and h_2 decrease
25. The temperature of a black body increases from T to $2T$.

The factor by which the rate of emission will increase is

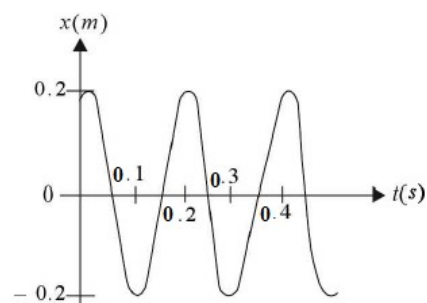
- A) 2 B) 4 C) 8 D) 16
26. Two monatomic gases, helium and neon, are mixed in the ratio of 2 to 1 and are in thermal equilibrium at temperature T (the molar mass of neon = $5 \times$ the molar mass of helium). If the average kinetic energy of each helium atom is U , what is the average energy of each neon atom.

- A) U B) $0.5U$ C) $2U$ D) $5U$
27. A mole of a monatomic ideal gas has pressure P , volume V , and temperature T . Which of the following processes would result in the greatest amount of energy added to the gas from heat?

- A) A process doubling the temperature at constant pressure.
 B) An adiabatic free expansion doubling the volume.
 C) A process doubling the pressure at constant volume.
 D) A process doubling the volume at constant temperature.
28. A reversible heat engine works between a high temperature reservoir at 227°C and low temperature reservoir of 27°C . If the engine absorbs an amount of heat Q at the high temperature reservoir, how much heat will it exhaust at the low temperature reservoir?

- A) $227Q/27$ B) $27Q/227$ C) $5Q/3$
 D) $3Q/5$

29. From the displacement time graph of an oscillating particle shown. What is the maximum velocity of the particle.



- A) 2 m/s B) $\pi \text{ m/s}$ C) $2\pi \text{ m/s}$ D) $\pi/2 \text{ m/s}$
30. An open pipe is suddenly closed at one end. As a result the frequency of third harmonic of the closed pipe is found to be higher by 100 Hz . The fundamental frequency of open pipe is _____

- A) 30 Hz B) 200 Hz C) 240 Hz D) 480 Hz
31. Two sinusoidal waves having the same amplitude (A), frequency and wavelength, travel in the same direction and have a phase difference ϕ . Which one of the following statements is TRUE?

- A) Their interference will be constructive if $\phi = 100\pi$.
 B) Their interference will be constructive if $\phi = \pi$.
 C) The frequency of the resultant wave is twice the original frequency.
 D) The resultant wave will be a standing wave for $\phi = 0$.
32. A monochromatic beam of light of wavelength 600 nm falls on a grating at normal incidence and produces a second-order image at an angle of 30° . The grating spacing must be

- A) $0.60 \mu\text{m}$ B) $2.4 \mu\text{m}$ C) $0.30 \mu\text{m}$ D) $1.4 \mu\text{m}$
33. With white light in interference experiment
- A) only white band is seen
 B) central white band with rainbow coloured fringes is seen
 C) central white band with reverse rainbow coloured fringes is seen

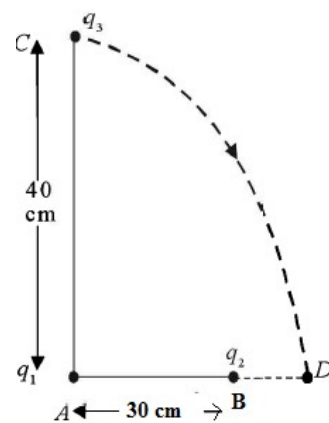
D) no interference pattern seen

34. The maximum number of a possible interference maxima (including the central) for slit separation equal to twice the wavelength in young's double slit experiment is

A) infinite B) five C) three D) zero

35. Two charges q_1 and q_2 are placed 30 cm apart as shown in the figure. Third charge q_3 is moved along the arc of a circle of radius 40 cm from C to D. The change in electrical potential energy of the system is _____

A) $8kq_1q_3$ B) $6kq_1q_3$ C) $8kq_2q_3$ D) $6kq_2q_3$



36. Electric charges are distributed in a small volume. The flux of the electric field through a spherical surface of radius 10 cm surrounding the total charge is 25 V. m. The flux over concentric sphere of radius 20 cm will be

A) 25 V. m B) 50 V. m C) 100 V. m D) 200 V. m

37. Positive charges of 2 μC and 8 μC are placed 15cm apart. At what distance from the smaller charge will the electric field due to them be zero?

A) 3 cm B) 5 cm C) 7 cm D) 10 cm.

38. A large conducting plane has surface charge density 10^{-4} C/m^2 . What is the electrostatic energy stored in a cubical volume of side 1cm in front of the plane?

A) 1.4J B) 2.8J C) 5.6 J D) 8.2 J

39. In the circuit shown, What is the value of R so that no deflection is noticed in the galvanometer when the switch S is closed or open?

A) 4 Ω B) 8 Ω C) 6 Ω D) 12 Ω

40. In order to convert a moving coil galvanometer into ammeter, the following will have to be connected

A) high resistance in series B) low resistance in series
C) high resistance in parallel D) low resistance in parallel

41. In the circuit below, what is the potential difference $V_d - V_c$ between points d and c if

$\mathcal{E}_1 = 4.0 \text{ V}$, $\mathcal{E}_2 = 1.0 \text{ V}$, $R_1 = R_2 = 10\Omega$, and $R_3 = 5\Omega$, and the battery is ideal?

A) + 0.5 V B) -0.5 V C) + 0.25 V D) -0.25 V

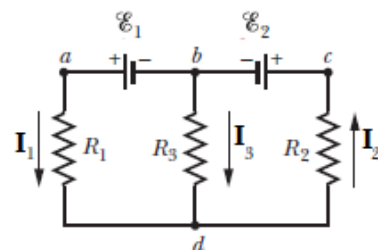
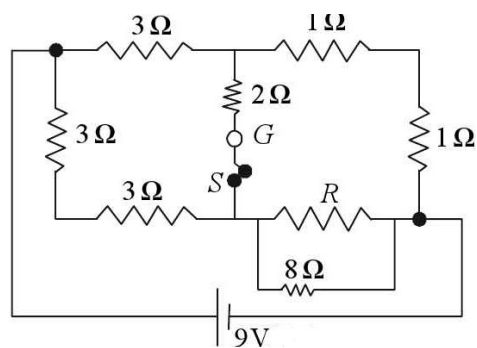
42. In a certain circuit, a current of 2 A is drawn from a battery. The current then divides and passes through two resistors in parallel. One of the resistors has a value of 64 Ω and the current through it is 0.40 A. What is the value of the other resistor?

A) 8.0 Ω B) 16 Ω C) 24 Ω D) 32 Ω

43. How much current must pass through a 400 turn coil 4.0 cm long to generate a 1 T magnetic field at the center?

A) 0.013 A B) 13 A C) 40 A D) 80

44. If a charged particle is moving in a uniform magnetic field, its path can be:



A) a straight line
above.

B) a circle

C) a helix.

D) any of the

45. An electron moving along the $+x$ axis enters a region where there is a uniform magnetic field in the $+y$ direction. What is the direction of the magnetic force on the electron? ($+x$ to right, $+y$ up, and $+z$ out of the page.)

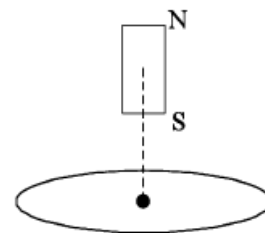
A) $+z$ direction

B) $-z$ direction

C) $-y$ direction

D) $-x$ direction

46. A magnet falls with its S-pole along the axis of a ring as shown in the figure. The direction of the current generated in the loop and the acceleration of the magnet respectively are :



A) clockwise, $> g$

B) clockwise, $< g$

C) anticlockwise, $> g$

D) anticlockwise, $< g$

47. An R-L-C series circuit is connected to a variable frequency 200 V source (rms). $L = 5$ H, $C = 80 \mu\text{F}$ and $R = 40 \Omega$. Which of the following is **false about the circuit?**

A) The impedance of the circuit at resonance is 40Ω .

B) The current amplitude at resonance is 5 A.

C) The rms potential drop across the inductor at resonance is 1250 V.

D) The rms potential drop across the resistor at resonance is 200 V.

48. Two coils are placed close to each other. The mutual inductance of the pair of coils depends up:

A) on the rates at which currents are changing in the two coils

B) on relative position and orientation of the two coils

C) on the materials of the wires of the coils

D) on the currents in the two coils

49. Element X is radioactive and decays via α decay with a half-life of four days. If 12.5 percent of an original sample of element X remains after N days, what is the value of N ?

A) 4

B) 8

C) 12

D) 16

50. When the number of nucleons in the nucleus increased then the binding energy per nucleon ____ (A stands for the atomic mass number.)

A) decreases continuously with A.

B) increases continuously with A.

C) remains constant with A.

D) first increases with A and then decreases.

**Set by: Alemayehu G.
Maru M.**

Asres M.

Answer sheet for grade 12 model exam

Name

e

section

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33.	38.	43.	48.	
34.	39.	44.	49.	