NAFYAD PREPARATORY SCHOOL
GRADE 12 MODEL EXAMINATIONS
PHYSICS, HIDAR 2013/NOVEMBER 2020

TIME ALLOWED: 2 HOURS

GENERAL DIRECTIONS:

THIS BOOKLET CONTAINS GRADE 12 **PHYSICS** MODEL EXAMINATION. IN THIS EXAMINATION, THERE ARE A TOTAL OF **50** MULTIPLE CHOICE QUESTIONS. EACH QUESTION IS FOLLOWED BY FOUR POSSIBLE ALTERNATIVES. READ EACH QUESTION CAREFULLY AND WRITE THE LETTER OF YOUR BEST CHOICE ON THE SEPARATE ANSWER SHEET PROVIDED.

1. Physical quantities $\boldsymbol{Q_1}$ and $\boldsymbol{Q_2}$ have $\boldsymbol{n}$ and $\boldsymbol{m}$ number decimal places, respectively, such that $\boldsymbol{m > n}$. Which one of the following is the correct number of decimal places for the measurement $\boldsymbol{Q_1 + Q_2}$?

A. Smaller than that of $\boldsymbol{n}$.
C. Equal to that of $\boldsymbol{n}$.
B. Greater than that of $\boldsymbol{m}$.
D. Equal to that of $\boldsymbol{m}$.

2. The displacement of a body as a function of time in SI units is given by the equation $\boldsymbol{x(t)} = (\boldsymbol{pt^2 - qt})$. The dimensions of the constants $\boldsymbol{p}$ and $\boldsymbol{q}$, respectively are:-

A. L^2T^{-2} and LT^{-1}
C. LT^{-2} and LT^{-1}
B. LT^{-3} and LT^{-2}
D. LT^{-3} and LT^{-2}

3. If the dot and cross products of two non-zero vectors have the same magnitude, then the appropriate angle between the two vectors must be:-

A. 0^0 **B.** 180^0 **C**. 45^0 **D.** 90^0

4. If $\vec{\boldsymbol{a}} = \hat{\boldsymbol{\imath}} + \hat{\boldsymbol{\jmath}}$ and $\vec{\boldsymbol{b}} = \hat{\boldsymbol{\imath}} + \hat{\boldsymbol{k}}$, then what is a unit vector perpendicular to both vectors $\vec{\boldsymbol{a}}$ and $\vec{\boldsymbol{b}}$?

A. $\frac{\hat{\imath}+\hat{\jmath}+k}{\sqrt{3}}$ **B**. $\frac{\hat{\imath}+\hat{\jmath}-k}{\sqrt{3}}$ **C**. $\frac{-\hat{\imath}-\hat{\jmath}+k}{\sqrt{3}}$ **D**. $\frac{\hat{\imath}-\hat{\jmath}-k}{\sqrt{3}}$

5. Given three vectors $\vec{\boldsymbol{a}} = \hat{\imath} + \hat{\jmath} - 2\hat{k}$, $\vec{\boldsymbol{b}} = -\hat{\imath} + 2\hat{\jmath} + \hat{k}$ and $\vec{\boldsymbol{c}} = \hat{\imath} - 2\hat{\jmath} + 2\hat{k}$, then $\vec{\boldsymbol{c}} \cdot (\vec{\boldsymbol{a}} - \vec{\boldsymbol{b}})$ is:

A. -10 **B**. 20 **C**. 10 **D**. 8

6. Two cars headed each other with a velocity of 20 m/s and 30 m/s when they are 1.2 km apart along a straight track. How long does it take for the cars just to pass by each other?

A. 24 sec **B**. 60 sec **C**. 40 sec **D**. 120 sec

7. Which one of the following is **CORRECT** about uniformly accelerated rectilinear motion?

A. The instantaneous and average velocities have the same magnitude.
B. The acceleration of the body changes uniformly throughout the motion.
C. The velocity versus time graph is parallel to the time axis.
D. A body can have eastward velocity while having westward acceleration.
A. It is possible to have forces on an object in the absence of motion of the object.

8. The velocity of a particle along the x-axis is given by the equation $\boldsymbol{v(t)} = (\boldsymbol{2t^2 - 3t})\boldsymbol{m/s}$. What is the instantaneous acceleration of the particle at t=2s?

A. 5 m/s^2 **B**. 8 m/s^2 **C**. 11 m/s^2 **D**. 2 m/s^2

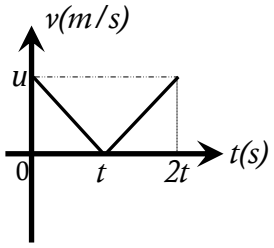
9. Which one of the following is **INCORRECT** about Newton's law of motion?

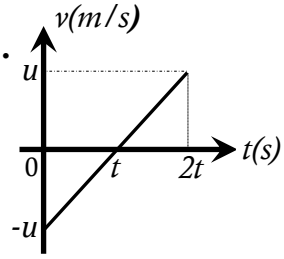
A. A constant force applied on an object provides a constant acceleration.

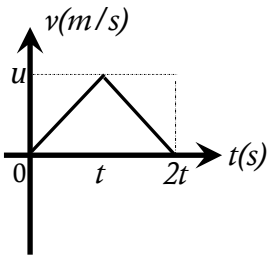
B. It is possible for an object to have motion in the absence of forces on the object.

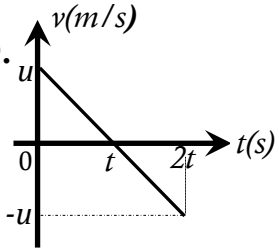
C. Two equal and opposite forces applied on a particle satisfy the third law.

10. A particle is released from rest from a certain height at $\boldsymbol{t = 0}$ and rebounds back to the throwing point in time $\boldsymbol{2t}$ in the absence of air resistance. Which one of the following velocity versus time graph most describes the motion the particle?

A.


B.


C.


D.


11. How large force is needed to change the linear momentum of a particle from 12 kgm/s to 20 kgm/s in 4 s?

A. 2 N **B.** 8 N **C.** 4 N **D.** 32 N

12. An object placed on a smooth horizontal surface is subjected to a constant force. In which one of the following conditions the normal force will be greater than the weight of the object?

A. If the applied force directed above the horizontal.

B. If the applied force is a pushing horizontal force.

C. If the applied force directed below the horizontal.

D. If the applied force is a pulling horizontal force.

13. A 40 kg box dragged horizontally by a force $\vec{\boldsymbol{F}} = (\boldsymbol{200\hat{\imath}})\boldsymbol{N}$ on a rough surface with friction coefficient 0.2. What is the magnitude of acceleration of the box?

A. 5 m/s^2 **B.** 2 m/s^2 **C.** 4 m/s^2 **D.** 3 m/s^2

14. A long train moves at a speed of 180 km/h to the left. A boy walks at a speed of 5 m/s from the rear to the front side of the train. What is the velocity of the boy relative to the ground?

A. 55 m/s to the right. **C.** 55 m/s to the left.

B. 45 m/s to the right. **D.** 45 m/s to the left.

15. A 3 kg body attached at the end of a 2 m long light inextensible rope is rotating in a vertical circle with constant speed of 4 m/s. The tension force in the rope as the body just passes the highest point is:-

A. 24 N **B.** 30 N **C.** 54 N **D.** 6 N

16. Two particles of masses $m_1 = 2\ kg$ and $m_2 = 4\ kg$ are 6 m far apart. At what point along the line joining the particles the total moment of inertia relative to mass m_1 is equal to 48-kgm^2?

A. 3 m **B.** 4 m **C.** 2 m **D.** 1 m

17. A 2 kg solid disc of radius 50 cm rolls on a horizontal surface due to the action a 12 N tangential force is applied at its rim. What is the angular acceleration of the disc?

A. 36 rad/s^2 **B.** 24 rad/s^2 **C.** 12 rad/s^2 **D.** 6 rad/s^2

18. A 5 kg block moving to the right collides with a second 3 kg stationary block and then stick together. What is the ratio of their final kinetic energy to initial kinetic energy?

A. $\frac{5}{8}$ **B.** $\frac{2}{5}$ **C.** $\frac{5}{2}$ **D.** $\frac{8}{5}$

19. How much work is needed to change the angular speed of a rigid body of moment of inertia 20 kgm^2 from 10 rad/s to 30 rad/s?

A. 8000 J B. 4000 J C. 2000 J D. 1000 J

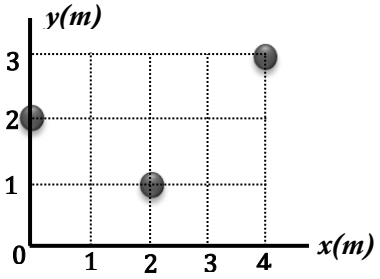
20. As shown in the figure, the three particles sited on xy-plane have equal mass of 2-kg. Which one of the following is the position vector $\vec{r}_{cm}$ of their center of mass?

A. $\vec{r}_{cm} = (4\,\hat{\imath} + 2\,\hat{\jmath})\ m$

B. $\vec{r}_{cm} = (\,\hat{\imath} + 2\,\hat{\jmath})\ m$

C. $\vec{r}_{cm} = (2\,\hat{\imath} + 2\,\hat{\jmath})\ m$

D. $\vec{r}_{cm} = (2\,\hat{\imath} + 4\,\hat{\jmath})\ m$



21. A 2-kg moving object at a height of 4 m has a mechanical energy of 116 J. Ignoring frictional losses, what is the speed of the object?

A. 3 m/s **B**. 9 m/s **C**. 6 m/s **D**. 2 m/s

22. A block is pulled by a force in three different directions as shown in the diagram. In each case, the displacement of the block $\Delta\vec{r}$ is to the left. Which one of the following is the correct situation of the work done by $\vec{F}_1$, $\vec{F}_2$,and $\vec{F}_3$,respectively?



A. Negative, Positive, Zero

B. Negative, Zero, Positive

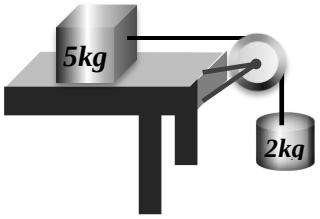
C. Positive ,Negative, Zero

D. Positive, Zero, Negative,

23. What must be the minimum coefficient of static friction between the block with mass $\boldsymbol{m_1}$ and the horizontal table for the cylinder-block system shown in figure to be in static of equilibrium? (Take $g = 10\ m/s^2$)

A. 0.4 **C. 0.2**

B. 0.8 **D. 0.1**



24. A uniform light meter stick is pivoted at the 40-cm mark and bodies of masses 8-kg and 3-kg are placed at the 10-cm and 80-cm marks, respectively. Where a 6-kg body must be placed to keep the stick in state of equilibrium?

A. 50-cm **B**. 60-cm **C**. 20-cm **D**. 40-cm

25. Which one of the following is FALSE about Stress and Strain?

A. Stress is a measure of the degree of deformation.

B. Strain is a dimensionless physical quantity.

C. The ratio of Stress to Strain is the elastic modulus.

D. Stress the measure of the force's ability to deform a body.

26. Which one of the following statement is **FALSE** about the properties of an ideal fluid flow?

A. All particles at a point have the same velocity.

B. The density of an ideal fluid is constant.

C. In an ideal fluid internal friction is neglected.

D. The flow of an ideal fluid is rotational.

27. If a body with density $\rho_0 = 900\ kg/m^3$ is floats in a liquid of density $\rho_f = 1200\ kg/m^3$, then what fraction of the body's volume is beneath the layer of the liquid?

A. 25 % **B**. 50 % **C**. 90 % **D**. 75 %

28. An ideal fluid is moving with from wider to narrower section of a pipe with a speed of $v_1$and v_2, respectively. Which one of the following is the **CORRECT** relationship between the two speeds and the corresponding pressures P_1 and P_2 at each respective section of the pipe?

A. $v_2 < v_1\ and\ P_2 < P_1$. **C**. $v_2 < v_1\ and\ P_2 > P_1$.

B. $v_2 > v_1\ and\ P_2 > P_1$. **D**. $v_2 > v_1\ and\ P_2 < P_1$.

29. Hollow and solid spheres are made of the same metal and have the same radius. The spheres then are taken through the same temperature increase. Which one of the following is **TRUE** about the expansions of the two sphere?

A. The solid sphere expands more. **C**. The hollow sphere expands more.

B. They expand by the same amount. **D**. It depends on the initial temperature.

30. The ice-point and steam-point of a certain ideal thermometer "Z" are -25^0Z and 175^0Z, respectively. Which one of the following formula is used to convert any temperature reading in Celsius scale "C" to that of an equivalent temperature reading in thermometer "Z" scale?

A. $Z = 2C - 25$ **B.** $Z = C + 25$ **C**. $Z = 2C + 25$ **D**. $Z = C - 25$

31. Two different objects, with different sizes, masses, and temperatures, are placed in thermal contact. In which direction does the heat energy travel?

A. From bigger to smaller mass. **C**. From high to low heat capacity.

B. From higher to lower temperature. **D**. From larger to smaller size.

32. 20 kJ of heat energy is rejected from the system when 10 kJ of work is done on the system in a direct process. If 40 kJ of work is done by the system during the reverse process, what is the amount of heat transfer during the reverse process?

A. 50 kJ **B**. 70 kJ **C**. 30 kJ **D**. 10 kJ

33. If heat is transferred from hot reservoir to a cold one, then which one of the following is **TRUE** about the entropy changes of the hot and cold reservoirs?

A. The entropy of both reservoirs increase.

B. The entropy of both reservoirs decrease.

C. The entropy of the hot reservoirs increases while that of the cold one decreases.

D. The entropy of the cold reservoirs increases while that of the hot one decreases.

34. Two containers hold the same type of an ideal gas at the same temperature and pressure. But container **Y** has twice the volume of container **X**. What is the average translational kinetic energy per molecule in container **Y** as compared to that of the gas in container **X?**

A. Twice that of container **X**. **C**. Half that of container **X**.

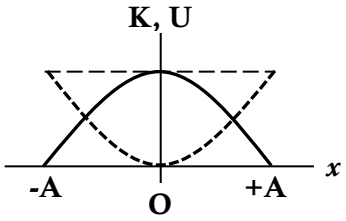
B. The same as that of container **X**. **D**. Impossible to determine.

35. The velocity of a particle along the x-axis under SHM as a function of time is governed by the equation $v(t) = (10m/s)\,cos(20t)$. What are the magnitudes of the maximum displacement, velocity and acceleration of the particle?

A. 50 cm, 10 m/s and 200 m/s^2 **C**. 20 cm, 40 m/s and 400 m/s^2

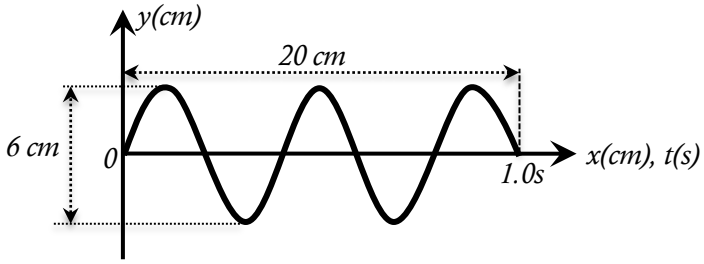
B. 40 cm, 20 m/s and 200 m/s^2 **D**. 40 cm, 10 m/s and 400 m/

36. The following graph shows the kinetic energy K and potential energy U versus position *x* for a simple harmonic oscillator. The horizontal dashed line and curved dashed line respectively represents:



A. Kinetic energy and Total energy.
B. Potential energy and kinetic energy.
C. Total energy and potential energy.
D. Total energy and kinetic energy.

37. The diagram shows a sinusoidal wave traveling to the right along the x-axis. Which one of the following characteristics of the wave is WRONG?



A. Its amplitude is 3 cm.
B. Its period is 1.0 s.
C. Its wave length is 8 cm.
D. Its frequency is 2.5 Hz.

38. A node and an adjacent antinode are 4 cm far apart at the observed first overtone of a bar fixed at one end only. What is the length of the bar?

A. 4 cm **B**. 2 cm **C**. 12 cm **D**. 6 cm

39. Which one of the following factor does not produce any continuous change on the pitch or frequency received by the listener according to the Doppler's effect?

A. The variation of the distance between the source and the listener.
B. The variation relative velocity between the source and the listener.
C. The variation of the temperature of the environment.
D. The variation of the frequency emitted by the source.

40. A beam of light of wavelength 600 nm from a distant source falls on a single slit 0.5 mm wide and the resulting diffraction pattern is observed on a screen 2 m away. What is the distance between the first dark fringes on either side of the central bright fringe?

A. 1.2 cm **B**. 1.2 mm **C**. 2.4 cm **D**. 2.4 mm

41. Which one of the following is **INCORRECT** about Young's double slit apparatus?

A. The interference fringes become further apart when the order of maximum increases.
B. The fringes become closer together as the slit-to-screen separation decreases.
C. The interference fringes become further apart as violet light is replaced by red one.
D. The interference pattern become closer together when the slits spacing increases.

42. If the rays from the top and the bottom of a thin film are both reflected without phase change, then which one if the following is **TRUE** about the index of refraction of the film n_{film} as compared with the index of refraction top medium n_{top} and bottom medium n_{bottom}?

A. $n_{film} > n_{top}$ and $n_{film} > n_{bottom}$ **C**. $n_{film} > n_{top}$ and $n_{film} < n_{bottom}$

B. $n_{film} < n_{top}$ and $n_{film} < n_{bottom}$ **D**. $n_{film} < n_{top}$ and $n_{film} > n_{bottom}$

43. By what factor does the electrostatic force of repulsion change if the distance between two positive charges is doubled and either of the charge quantity is tripled?

A. 4 **B**. $\frac{1}{4}$ **C**. $\frac{1}{2}$ **D**. 2

44. What is the electric flux through a surface of area vector $\Delta\vec{S} = (\hat{i} - 3\hat{j} + 2\hat{k})\ m^2$ when it is placed in the region of a uniform electric field $\vec{E} = (-20\hat{i} - 10\hat{j} + 30\hat{k})\ N/C$?

A. 10 Vm **B.** 50 Vm **C.** 70 Vm **D.** 110 Vm

45. Two positive point charges q_1 and q_2, such $q_2 = 4q_1$, are located on the $x - axis$ at positions $x_1 = 0\ cm$ and $x_2 = 60\ cm$, respectively. At what point the net electric field due to the two charges will be zero?

A. $x = +20\ cm$ **B.** $x = +40\ cm$ **C.** $x = +30\ cm$ **D.** $x = +60\ cm$

46. A 1.5×10^{-6} kg tiny drop with charge $+5\ nC$ is floated freely in air against the force of gravity by a uniform electric field. What is the magnitude and the direction of the electric field strength? ($g = 10\ m/s^2$)

A. 3000 N/C, upward **C.** 6000 N/C, upward

B. 6000 N/C, downward **D.** 3000 N/C, downward

47. Two points X & Y are separated by 16 mm. The potential of A is 95 V, and that at B is 31 V. What is the magnitude and direction of the electric field between the two points?

A. 4000 N/C from X to Y. **C.** 2000 N/C from X to Y.

B. 2000 N/C from Y to X. **D.** 4000 N/C from Y to X.

48. An electric dipole moment as a vector in a uniform external electric field is directed:

A. From the negative charge toward the positive along the line joining the charges.

B. From the positive charge toward the negative along the line joining the charges.

C. Perpendicular to the line joining the two charges.

D. At right angle to the plane formed by the two charges.

49. A capacitor stores charge Q at a potential difference ΔV. What happens if the voltage applied to the capacitor by a battery is doubled to 2ΔV?

A. The capacitance falls to half its initial value, and the charge remains the same.

B. The capacitance and the charge both fall to half their initial values.

C. The capacitance and the charge are both doubled.

D. The capacitance remains the same, and the charge doubles.

50. Capacitors $\mathbf{C}_1$ = 20 μF and $\mathbf{C}_2$ = 16 μF are connected in series across a source battery such that the voltage across $\mathbf{C}_2$ is 10 V. What is the potential difference across capacitor $\mathbf{C}_1$?

A. 24 V **B.** 8 V **C.** 32 V **D.** 18 V