**PHYSICS ENTRANCE EXAMINATION GRADE 11!!**

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

| Constant | Symbol | Value |
|---|---|---|
| Acceleration due to gravity | G | $10m/s^2$ |
| Permittivity of vacuum | $\varepsilon$ | $8.83x10^{12}$ F/m |
| Charge of an electron | E | $1.6x10^{-19}$Coulomb |
| Universal Gravitational Constant | G | $6.67x10^{-11}\frac{NM^2}{Kg^2}$ |
| Density of water | P | $1000^{kg}/_{m^2}$ |
| Planck's constant | H | $6.63X10^{31}$kg |
| Electron mass | | $1.602X10^{19}$C |
| Elementary (unit) charge | | |
| $\sin 30^0 = \cos 60^0 = 0.5$ | | |
| $\sin 37^0 = \cos 53^0 = 0.6$ | | |
| $\sin 45^0 = \cos 45^0 = 0.707$ | | |
| $\sin 53^0 = \cos 37^0 = 0.8$ | | |
| $\sin 60^0 = \cos 30^0 = 0.866$ | | |

**GRADE 11 PHYSICS ENTERANCE EXAM (2000 – 2011 E.C)**

# CHAPER 1

1. Which one of the following experimental errors can be reduced by taking repeated measurements?

   A. Parallax errors B. Systematic errors C. Random errors D. Zeros errors

2. A teacher gave a student a book whose thickness is 4.30 cm. and instructed him to measure the thickness of the book with venire calipers. The student took four measurements. The average and standard deviation of the measurements were 4.33 cm and 0.40cm, respectively. Which one of the following is the uncertainty in the accuracy of the student's measurement?

   A. 0.03cm B. 0.04cm C. 0.035cm D. 0.30cm

3. Which of the following statement is correct about errors in measurement?

   A. Error occur in every scientific investigation C. error make measured values same as accepted value

   B. Experimental error is the same as a mistake D. Error can be avoided by using modern measuring instruments

4. What can be concluded when the number of significant figures increases?

   A. True reading increases B. Accuracy increases C. uncertainty increases D. precision increases

5. If a precision of surveyor measured a distance of 500m (between two points in a village) using a meter that has cm division on it, then what is the measurement result?

   A. 500m B. 500.0m C. 500.00m D. 500.000m

6. From the figure given below, which one of them shows precise but NOT accurate measurements? T represent the true value



7. Which part of a scientific report discusses the accuracy of measurements taken?
A. Aim B. Methods C. Theory D. Results

8. A grade 11 physics teacher ordered four of his students to measure the length of a class room. He provided them the following length measuring instruments. The instruments are meter rule with millimeter division, vernier calipers, micrometer screw gauge and meter tape with centimeter scale, but its zero reading is Not Visible. Which one of these instruments is appropriate for the task?
A. Meter rule B. Micrometer screw gauge C. Vernier calipers D. Meter tape

# CHAPER 1
## Additional Questions

____**1**. Which of the following is the correct procedure in scientific method or investigation?

A. Hypothesis, experiment, observation, analysis, and conclusion
B. Experiment, observation, hypothesis, analysis, and conclusion
C. Observation, hypothesis, experiment, analysis, and conclusion
D. Experiment, observation, analysis, hypothesis, and conclusion

_____2 The mass and the volume of an object are **1000g±1.6g** and **200cm$^3$±1.5cm$^3$** respectively. What is the density of the object? A. 5g/cm$^3$ ± 1.5% B. 2.5g/cm$^3$ ± 1.6% C. 2.5g/cm$^3$ ± 1.1% D. 5g/cm$^3$ ± 1.1%

3.If the error in measurement of mass of a body be 3% and in the measurement of velocity be 4%. What will be maximum possible error in calculation of kinetic energy? A. 11%. B. 7%. C. 20%. D. 5%.

5.The number of significant figures of measurements 0.08, 0.205, 86400m and $5.620 \times 10^{-24}$ respectively are
A. 1, 4, 3,7 B. 1, 3,5, 4 C. 2, 3,3, 3 D. 2,3, 5, 3

**6.** A good scientific theory is one which is

A. Simple (less complex), narrow in scope, and is accurate and consistent
B. More complex, has a wide scope, is accurate and consistent
C. More complex, narrow in scope, consistent but not accurate.
D. Simple (less complex), has a wide scope, and is accurate and consistent

7. When rounding off the numbers 5.93, 3.450, 7.351 and 6.78 to two significant figures gives
A.50, 3.5, 7.3,6.8 B. .5.9, 3.5, 7.4, 6.8 C. 5.9, 3.4, 7.4, 6.8 D. 6.0, 3.4, 7.3,6.7

8. What is the resistance of a light bulb whose electric current and potential difference is given as follows? I = 3.2A $\pm$ 0.2A and V = 18.6V$\pm$ 0.5A. A. 5.8Ω$\pm$ 8.9 % B. 5.8Ω $\pm$ 0.52Ω C. A and B D. All

9..Which of the following is a systematic error?

A. One measuring ones height wearing shoes with thick soles.
B.A stop watch that takes half a second to stop when clicked.
C.A scale reads 1kg when there is nothing on it D. All are correct

10.In laboratory the length of a box is 8.3cm when viewed from the top, and 8.4cm when viewed from side. What is the possible cause of error is caused? A. Random errors B. Parallax error C. Systematic errors D. Zero

11. The length and width of a rectangle are 15.0 $\pm$ 0.1 cm and 58$\pm$ 0.2cm respectively. What is the actual area of the rectangle? A.270cm$^2\pm$ 1% B.870cm$^2$ $\pm$ 0% C. 870cm$^2$ $\pm$ 1% D. 270cm$^2\pm$ 0.1%

12. An experimental result is said to be valid if it is

A. Accurate B. precise C. Both accurate and precise D. neither accurate nor precise

13. How many significant digits are in a number **6.20x10$^{-9}$**? A. 5 B. 3 C. 6 D. 214. The radius of a circle is given by r = **2.6cm ± 2.34%**, then the area of the circle is?

A. 6.67 cm2 ±4.68 % B. 5.2 cm2 ±4.68 % C. 6.67 cm2 ±5.5 % D. 5.2 cm2 ±5.5 %

15. The dimensions of a box are give : length=**40 cm ± 0.5 cm**, width = **20 cm ± 0.2 cm** and height = **30 cm ± 0.3 cm**. what is the volume of the box?

A. 2.4x10$^4$ cm$^3$ ± 3.25% B. 2.4x10$^{-4}$ m$^3\pm$ 3.25% C. 2.4x10$^4$ m$^3$ ± 3.25m$^3$ D. 2.4x10$^{-4}$ cm$^3$ ± 3.25 cm$^3$

16. As you travel along a road, objects in the distance seem to shift position relative to one another. Because of your movement, a distant house may disappear behind a nearer clump of trees, but as you travel further along it comes back into view the other side of them. That is.

A. Random errors B. Parallax error C. Systematic errors D. zero error

***Use the passage below to answer questions 17 & 18.*** Seven students recorded values for acceleration due to gravity whose accepted value for acceleration due to gravity = 9.80665 m/s$^2$ (to 6 s.f.). Their results are 9.81 m/s$^2$ , 9.78 m/s$^2$ , 9.65 m/s$^2$, 9.87 m/s$^2$ , 9.80 m/s$^2$, 9.81 m/s$^2$ and 9.83 m/s$^2$ .17. What is the best estimate for acceleration due to gravity?

A. 9.81 m/s$^2$ B. 9.80 m/s$^2$ C. 9.87 m/s$^2$ D. 9.65 m/s$^2$

18. The possible cause of error is caused seven students a recorded value for acceleration due to gravity is?

A. Parallax error B. Systematic error C. Zero error D. Random error

19.Scientific theories

A. Must constantly be reviewed to see whether they are in accordance with new experimental observation

B. Are summaries of particular experiments

C. Represent guesses that have not yet been compared with observational data

D. Are laws of nature that are not subject to revision

20. Which one of the following statements is **incorrect?**

**A.** A series of precise measurement will have very large variation

B. The precision of an instrument is usually given by the smallest scale division on the instrument

C. .Precision is a measure of the degree of exactness of your value.

D. The significance of a measurement is indicated by the number of significant figures in your value.

21. Which of the following units would be most appropriate to use for measuring the diameter of a small germ?

A. millimeter B. kilogram C. kilometer D. cubic centimeter

22. Which of the following measurements is least precise

A. 8.00 mm B. 8.00 cm C. 8.00 m D. 8.00 km.

23. If an ammeter reads 0.4 too high and the recorded value is 6.8, What is the correct value of ammeter?

A.6.4A B.7.2A C.7.4A D. 2.7A

24. The accepted value of length of a book is equal to 5.3cm which of the following is the more accurate measurement

A.5.32cm B. 5.28cm C. 5.31cm D.5. 29cm

25. Which one of the following statements is **incorrect?**

A. Scientific method is a frame work how experiments showed is presented and how the data should be analyzed before we arrive at conclusion.

B. All measurements have an uncertainty associated with them.

C.The significance of a measurement is indicated by the number of significant figures in your value.

D.If we rounded 0.00079987 to four Significant figures is 0.0008.

26. A measurement gave a mass of 0.45 kg. This is the same as: A. 4.5 g B. 45 g C. 450 g D.4,500 g

27. The accepted value of for acceleration due to gravity (g) is 9.80665 $m/s^2$ (to 6 s.f.). One student might quote a result of (9.82 ± 0.03) $m/s^2$ , while another student gives a value of (9.87 ± 0.0006) $m/s^2$. The result of the former student and the latter student respectively is

A. Precise and accurate B. inaccurate and imprecise C. more accurate and more precise D. None

28. Which one of the following experimental errors can be reduced by redesigning the measuring instrurement?

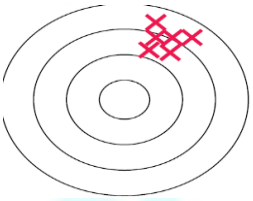
A. Parallax error B. Systematic error C. Environmental error D. Random error

29. When we perform an experiment and form a mental picture without necessarily having a mathematical relationship, this way of representing theexperiment can be described as

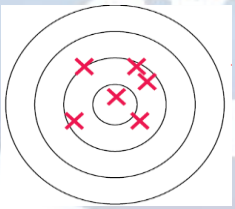
A.visual B. symbolic C.numeric D.graphical

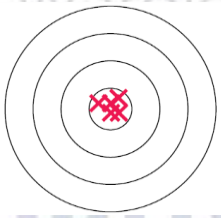
30. Which one of the following instruments provides readings that are precise but inaccurate?

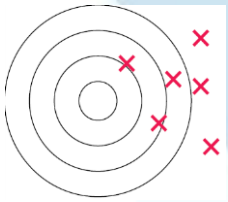
A.



B.



C. 

D. 

31. Which part of a scientific report desribes the equations, concepts and principles to be used ?

A. Theory B. Aim C. Result D. Method

32. A tentative explanation after watching a problem carefully is _____

A. Observation B. experiment C. prediction D. hypothesis

33. Which of the following measurements is most precise? A. 5.00 mm B. 5.00 cm C. 5.00 m D. 5.00 km.

34. If an ammeter reads 0.4 too low and the recorded value is 6.8, What is the correct value of ammeter? A.6.4A B.7.2A C.7.4A D. 2.7A

35. A physical quantity P is related to four observables *a*, *b*, and *c* as follows :

$$P = ab^2 / c^3$$

The percentage errors of measurement in *a*, *b*, *c* and *c* are ±1%, ±3%, and ±2% respectively. What is the percentage error in the quantity P?

A. ±1%, B. ±7%, C. ±13%, D. ±12%,

# CHAPER 2

1. Which statement is wrong about units and dimensions?
   A. Two quantities can have the same units but different dimensions.
   B. Two quantities can have the same dimensions but different units.
   C. It is always possible to add two numbers that have the same units.
   D. There are quantities that have no unit and dimension.

2. Which one of the following expression is correct in a clockwise system?

   A. $\hat{j} \times \hat{k} = \hat{i}$ B. $\hat{i} \cdot \hat{i} = 0$ C. $\hat{j} \times \hat{j} = 1$ D. $\hat{k} \cdot \hat{i} = 1$

3 For what value of a are the vectors $\vec{A} = a\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{B} = 2a\hat{i} + a\hat{j} - 4\hat{k}$ perpendicular to each other?

   A. 2, -1 B. -3,1 C. 0,-2 D. 0,1

4. Suppose vectors $\vec{A} = 2(\hat{i} + \hat{j})$ and $\vec{B} = 2\hat{i} + 3\hat{j} + \hat{k}$. Which of the following is unit vector perpendicular to both vectors?

   A $1/\sqrt{3}(-\hat{i} + \hat{j} + \hat{k})$ B. $1/\sqrt{3}(\hat{i} + \hat{j} + \hat{k})$ C. $1/\sqrt{3}(\hat{i} - \hat{j} - \hat{k})$ D. $1/\sqrt{3}(\hat{i} - \hat{j} + \hat{k})$

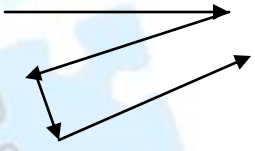
5. Which of the following expression is not correct in a clockwise system?

   A. $\hat{k} \times \hat{i} = \hat{j}$ B. $i \times i = 1$ C. $\hat{i} \times \hat{j} = -\hat{j} \times \hat{i}$ D. $\hat{i} \times \hat{k} = -\hat{j}$

6. Two forces $\vec{F}_1 = (8\hat{i} + 3\hat{j})$ N and $\vec{F}_2 = (4\hat{i} + 6\hat{j})$N are acting on an object. What is the magnitude and direction of the resultant force?

   A. 5N, $-37^0$ B. 15N, $37^0$ C. 5N, $143^0$ D. 225N , $143^0$

7. . The diagram below shows a path taken by a flying bird.



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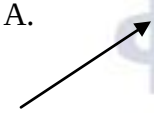
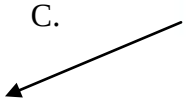
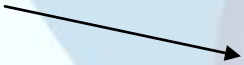
Which one of the following vector may represent a resultant displacement?

A.  B.  C.  D. 

8. Four vectors are listed below

$\overrightarrow{A} = \begin{bmatrix} 4 \\ 10 \end{bmatrix}$ , $\overrightarrow{B} = \begin{bmatrix} 2 \\ -5 \end{bmatrix}$, $\overrightarrow{C} = \begin{bmatrix} -6 \\ 15 \end{bmatrix}$, $\overrightarrow{D} = \begin{bmatrix} 15 \\ -6 \end{bmatrix}$, which pair of the vectors is orthogonal?

A. $\overrightarrow{A}$ and $\overrightarrow{C}$ B. $\overrightarrow{B}$ and $\overrightarrow{C}$ C. $\overrightarrow{C}$ and $\overrightarrow{D}$ D. $\overrightarrow{A}$ and $\overrightarrow{D}$

9. If vector p is 6m in the x-axis and vector q is 8m in the y- axis. Then what is the value of the vector p + q?

A. 10m at $53^0$ from x- axis C. $\sqrt{136}$ m at $45^0$ from x-axis

B. 10m at $37^0$ from x- axis D. $\sqrt{136}$ m at $30^0$ from x-axis

9. Given vectors $\overrightarrow{A} = \sqrt{3}\,\hat{\imath} + \hat{\jmath}$ and $\overrightarrow{B} = \sqrt{3}\,\hat{\imath} - \hat{\jmath}$ . What is the smaller angle between the vectors?

A. $60^0$ B. $53^0$ C. $45^0$ D. $30^0$

10. If $\overrightarrow{A}$ =(i + 3j)m/s and $\overrightarrow{B}$ =(2j + 3k)m/s , then what is the value of $|\overrightarrow{A} x \overrightarrow{B}|$?

A. $\sqrt{10}$ m/s B. $\sqrt{13}$ m/s C. 7m/s D. $\sqrt{130}$ m/s

12. Which of the following is not true?

A. physical quantities can be classified as fundamental or derived
B. all fundamental physical quantities are scalars
C. vector quantities in the same direction can be added or subtracted just like numbers
D. all derived physical quantities are vectors

13. The vector product of two non – collinear vectors A and B

A. is perpendicular to the plane formed by A and B C. Must be zero
B. Is on the plane formed by A and B D. Is a scalar quantity

14. Which of the following is not true of vector product?

A. A x B = -B xA C. $\overrightarrow{A} \perp \overrightarrow{B} \rightarrow |\vec{A}\,X\vec{B}| = AB$

B. A x( B +C ) = B x A + A x C D. $\vec{A}//\vec{B} \Rightarrow \vec{A}X\vec{B}=O$

15. Suppose A = 3i -2j and B = - i- aj are two vectors in xy – plane. What is the value of a, such that A + B = 2i?

A.3 B.2 C. -2 D. -3

16. 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 D – E, what must be the angle between D and E?

A.$30^0$ B. $37^0$ C. $53^0$ D. $60^0$

17. What is the torque due to a force $\vec{F} = (2i\hat{} - 3j\hat{} + 4k)$ N acting at a point $\vec{r} = 3i\hat{} + 2j\hat{} + 3k\hat{}$ about the origin?

(A). 6i-6j+12k B. -6i+6j+12k C. -17i+6j+13k D. 17i- 6i-13k

18. The sum and difference of two non-zero vectors A and B are equal in magnitude. Which one of the following is correct?

A. A and B have the same direction
B. A and B have same magnitude
C. A and B have opposite direction
D. A and B are perpendicular to each other

19. Which pair of forces cannot give a resultant of 5N?

A. 1N and 4N B.1N and 6N C. 3N and 4N D. 1N and 7N

B.

20. Suppose $\overrightarrow{A} = 3i - 2j, \overrightarrow{B} = -1i - 4j$ and C are three vectors in xy -plane with the property that A+B-C=0. Which of the following is a unit vector along c?

A. 2i-6j B. -2i+6j C. $-\sqrt{\frac{1}{10}}i + \frac{3}{\sqrt{10}}j$ D. $\sqrt{\frac{1}{10}}i - \frac{3}{\sqrt{10}}j$

21. Suppose $\overrightarrow{A} = 3i + 2j + k, \overrightarrow{B} = -i - 4j + 3k$ and C is a vector lying on x- axis with the property that A.(B+C) =0 then vector c is given by

A. $\frac{3}{\sqrt{10}}j$ $B.\frac{-11}{3}i$ $C.\frac{6}{\sqrt{10}}j$ $D.\frac{-8}{3}j$

22. Two non-zero vectors $\vec{A}$ and $\vec{B}$ are related by $\overrightarrow{A}$ = c ($\vec{B}$) where c is a scalar, if the two vectors have opposite direction, then on of the following is true about c?

A. c is a positive number
B. c is a negative number
C. c=1
D. c=0

23. A vector that represents the position of an object in r//n to another object is called

A. unit vectors B. position vectors C. coplanar vectors D. collinear vectors

24. If $\vec{A}$=8$\vec{\imath}$ + $\vec{\jmath}$ -2$\vec{k}$ and $\vec{B}$=5$\vec{\imath}$ – 3$\vec{\jmath}$ +$\vec{k}$, then, what is the value of $\vec{B}$X$\vec{A}$?

A. 3i + 4j – 3k
B. -3i – 4j +3k
C. -5i -18j-29k
D. 5i +18j +29k

25. Which of the following is a vector quantity?

A. Power B. Momentum C. Temperature D. Electric current

26. What is the angle between vectors A = (a i + a$\sqrt{3}$ j) units and B = (a$\sqrt{3}$ i + $a$ j) units?

A. $90^0$ B. $60^0$ C. $37^0$ D. $30^0$

27.The magnitudes of two vectors A and B and 12 units and 5 units, respectively. Which one of the following is NOT the possible value for the magnitude of the resultant vector A + B?

A. 60 units B. 17 units C. 13 units D. 7 units

28. What is the vector product $\vec{A}$x$\vec{B}$ of two vectors?

$\vec{A}$ = 7i + 4j - 8$\overline{k}$ and $\vec{B}$ = 3i – 2j + 5$\overline{k}$?

A. $36\dot{\imath}$+11 $\tilde{\jmath}$-2$\tilde{k}$ B. $4\dot{\imath}$-59 $\tilde{\jmath}$-26$\tilde{k}$ C. $-4\dot{\imath}$+59 $\tilde{\jmath}$+26$\tilde{k}$ D $-36\dot{\imath}$-11 $\tilde{\jmath}$+2$\tilde{k}$

29. An airplane flies at speed of 720km/hr at $37^0$ north of west direction. How far does the plane travel to the west in 1 hour ?

A. 432km B. 720km C. 576km D. 504km

30. Determine the torque due to a force $\vec{F} = (2\hat{\imath} - 3\hat{\jmath} + 4)$ acting at a point $\vec{r} = 3\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$ about the origin?

A. $6\hat{\imath} - 6\hat{\jmath} + 12\hat{k}$ C. $17\hat{\imath} + 6\hat{\jmath} - 13\hat{k}$

B. $-6\hat{\imath} + 6\hat{\jmath} + 12\hat{k}$ D. $-17\hat{\imath} - 6\hat{\jmath} + 13\hat{k}$

31. An airplane travelled from Addis Ababa to Mekele, 780km, in 45 minutes. What was its average speed?

A. 0.28m/s B. 1040km/hr C. 17.3m/min D. 585km/hr

31. Two forces exerted on a block as shown in the figure below. What is the horizontal component of the net force?

A. 14 N, West
B. 30 N, West
C. 70 N, East
D. 28 N. West




$\theta_1 = 53^0$ and $\theta_2 = 37^0$

33. What is the magnitude of the resultant velocity for a bird flying first at Speed of 10 m/s North East and then flying to South at a speed of 8m/s?

A. 12.8 m/s B. 7.13 m/s C. 16.6 m/s D. 7.07m/S

34. Let **C=AXB** and $\theta \neq 90^0$, where $\theta$ is the smaller angle between **A** and **B** when they are drawn with their tails at the same point. Which of the following is NOT true?

A. **A.C**= 0 C. /**C**/=/**A**//**B**/ sin$\theta$

B. **A. B** = 0 D. –**C** =**B**X**A**

# CHAPER 2

## Objective Type Question

Q.1 Each questions has four possible answers. Choose the correct answer and encircle it.

__1. Magnitude of the vector $2i - 2j - k$ is:
(a) 4 (b) 3 (c) 2 (d) 1

__2. Unit vector of $i + j + k$ is:
(a) $i + j + k$ (b) $\frac{1}{3}(i + j + k)$
(c) $\frac{1}{\sqrt{3}}(i + j + k)$ (d) $\frac{1}{2}(i + j + k)$

__3. Unit vector of $i - 2j - 2k$ is:
(a) $i - 2j - 2k$ (b) $\frac{1}{3}(i - 2j - 2k)$
(c) $\frac{1}{\sqrt{3}}(i - 2j - 2k)$ (d) $\frac{1}{2}(i - 2j - 2k)$

__4. If $\hat{i}$, $\hat{j}$ and k are orthogonal unit vectors, then j x i is:
(a) k (b) $-k$ (c) 1 (d) $-1$

__5. The magnitude of a vector $\hat{i} - 3\hat{j} + 5k$ is:
(a) 3 (b) 25 (c) 35 (d) $\sqrt{35}$

__6. In $l$, m and n are direction cosine of a vector, then:
(a) $l^2 - m^2 - n^2 = 1$ (b) $l^2 - m^2 + n^2 = 1$
(c) $l^2 + m^2 - n^2 = 1$ (d) $l^2 + m^2 + n^2 = 1$

__7. If $\theta$ is the angle between the vector $\vec{a}$ and $\vec{b}$, then cos $\theta$ is:
(a) $\vec{a} \cdot \vec{b}$ (b) $\frac{\vec{a} \cdot \vec{b}}{|\vec{a}||\vec{b}|}$
(c) $\frac{\vec{a} \cdot \vec{b}}{|\vec{a}|}$ (d) $\frac{\vec{a} \cdot \vec{b}}{|\vec{b}|}$

__8. If $\vec{a} = a_1j + a_2j + a_3k$, $\vec{b} = b_1i + b_2j + b_3k$, then $\vec{a} \cdot \vec{b}$ is:
(a) $a_1b_1j + a_2b_2j + a_3b_3k$ (b) $a_1b_1 + a_2b_2 + a_3b_3$
(c) $a_1b_2j + a_2b_3j + a_3b_1k$ (d) None of these

(c) Non-parallel (d) Oblique

__10. If $\vec{a} = i + j + k$ and $\vec{b} = -i - j - mk$ are perndicular then m will be equal to:
(a) 1 (b) $-2$ (c) $\pm 1$ (d) $\pm 3$

__11. $\vec{a} \cdot \vec{b}$ is a:
(a) Vector quantity (b) Scalar quantity
(c) Unity (d) None of these

__12. $\vec{a} \cdot \vec{a}$ is equal to:
(a) 1 (b) $a^2$ (c) $|\vec{a}|$ (d) None of these

__13. If $\vec{a} = 2i - 3j + k$ and $\vec{b} = -i + 2j + 7k$ then $\vec{a} \cdot \vec{b}$ is equal to:
(a) $-1$ (b) $-2$ (c) $-3$ (d) $-4$

__14. If $\vec{a} \times \vec{b} = 0$ then $\vec{a}$ and $\vec{b}$ is:
(a) Non-parallel (b) Parallel
(c) Perpendicular (d) None of these

__15. The cross product of two vectors $\vec{a}$ and $\vec{b}$ is:
(a) $|\vec{a}||\vec{b}| \cos\theta$ (b) $|\vec{a}||\vec{b}| \sin\theta$
(c) $|\vec{a}||\vec{b}| \sin\theta\, \hat{n}$ (d) $|\vec{a}||\vec{b}| \cos\theta\, \hat{n}$

__16. If $\hat{n}$ is the unit vector in the direction of $\vec{a} \times \vec{b}$, then $\hat{n}$ is:

(a) $\dfrac{\vec{a} \times \vec{b}}{|\vec{a}||\vec{b}|}$ (b) $\dfrac{\vec{a} \cdot \vec{b}}{|\vec{a}||\vec{b}|}$ (c) $\dfrac{|\vec{a} \times \vec{b}|}{|\vec{a}||\vec{b}| \sin\theta}$ (d) $\dfrac{\vec{a} \times \vec{b}}{|\vec{a} \times \vec{b}|}$

__17. $|\vec{a} \times \vec{b}|$ is area of the figure called:

(a) Triangle (b) Rectangle (c) Parallelogram (d) Sector

__18. $\vec{a} \times \vec{b}$ is equal to:

(a) $-\vec{b} \times \vec{a}$ (b) $\vec{b} \times \vec{a}$ (c) $|\vec{a} \times \vec{b}|$ (d) $|\vec{b} \times \vec{a}|$

__19. If $\vec{a}$ and $\vec{b}$ are collinear vectors, then:

(a) $\vec{a} \times \vec{b} = 0$ (b) $\vec{a} \cdot \vec{b} = 0$
(c) $\vec{a} - \vec{b} = 0$ (d) $\vec{a} + \vec{b} = 0$

__20. $|\vec{a} \times \vec{b}|$ is a:

(a) Vector quantity (b) Scalar quantity
(c) Unity (d) None of these

21. If $\vec{A} \times \vec{B} = 0$ and $\vec{B} \times \vec{C} = 0$, then the value of $\vec{A} \times \vec{C}$ is

A.0 B. AC cos$\theta$ C.ACsin $\theta$ D.ABtan $\theta$

22. Projection of $\vec{A}$ *on* $\vec{B}$ is A. $\vec{A} \cdot \vec{B}$ B. $\frac{\vec{A}}{|A|} \cdot \vec{B}$ C. $\vec{A} \times \vec{B}$ D. $\vec{A} \cdot \frac{\vec{B}}{|B|}$

23. Suppose the sum and difference of two vectors is perpendicular to each other. Which one of the following is **true** about the vectors?

A. $|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$ B. $|\vec{A}| = |\vec{B}|$ C. $\vec{A} = B$ D. $A^2 = B$

24**.**Which one of the following **is NOT** a unit vector?

A.-j B. i-j C. $\frac{\sqrt{2}}{2}$ i - $\frac{\sqrt{2}}{2}$j D. k

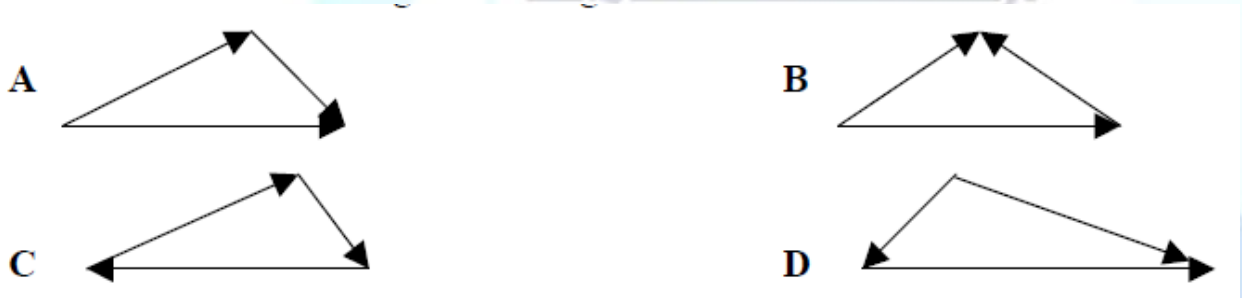
25. $\frac{\vec{A} \times \vec{B}}{\vec{A} \cdot \vec{B}}$ = _____A. sin $\theta$ B.tan $\theta$ C. cot $\theta$ D.cos $\theta$

26. Two vector $\vec{A}$ and $\vec{B}$ are such that $\vec{A} + \vec{B} = \vec{C}$ and $A^2 + B^2 = C^2$ .Which of the following is correct?

A. $\vec{A}$ is parallel to $\vec{B}$ C. $\vec{A}$ is anti- parallel to $\vec{B}$

B. $\vec{A}$ is perpendicular $\vec{B}$ D. $\vec{A}$ and $\vec{B}$ are equal in magnitude

27. In which of the following vector diagrams is the resultant of the three vectors zero?




28. A vector has a positive x-component and a negative y-component. The angle theta that specifies its direction is measured counterclockwise from the x axis. In what range is theta ?

A. between $180^0$ and $270^0$. C. between $90^0$ and $180^0$

B. between $270^0$ and $360^0$. D. between $0^0$ and $90^0$

29. A set of vectors taken in a given order gives a closed polygon. Then the resultant of these vector is

A. concurrent vector B. scalar vector C. null vector D. unit vector

30. Two non-Zero vectors **A** and **B** are related by **A**= k (**B)** where k is a scalar. Then one of the following **is not true** about k?

A. If the two vectors have the same directions, k is a positive number.
B. If the two vectors have the opposite directions, k is a negative number.
C. If the two vectors have equal in magnitude, k is different from one.
D. Vector **A** is null vector when k is zero

31.The components of vector $\vec{A}$ are given as follows:

Ax = 10.5 Ay = 15.2 What is the magnitude of the vector?

A. 10.5 B. 15.2 C. 18.5 D. 25.7 E. 4.7

32. The components of vector $\vec{A}$ are given as follows:

Ax = 5.6 Ay = -4.7 What is the angle between vector $\vec{A}$ and positive direction of x – axis?

A. 320˚ B. 180˚ C. 90˚ D. 127˚ E. 230˚

33. The components of vectors $\vec{A}$ and $\vec{B}$ are given as follows:

Ax = 5.1 Bx = -2.6

Ay = -5 By = -4.3 What is the magnitude of vector sum $\vec{A} + \vec{B}$

A. 5.1 B. 2.5 C. -9.3 D. 9.6 E. -3.8

34. Two vectors are given as follows:

$\vec{A}$ = -2i – 5j + 2k $\vec{B}$ = -4i – 2j – 3k .What is the angle between the vectors?

A. 114˚ B. 67˚ C. 41˚ D. 132˚ E. 94

35. Which of the following statements is true?

A.A scalar quantity can be added to a vector

B. It is possible for the magnitude of a vector to equal zero even though one of its components is non-zero

C. Scalar quantities are path dependent, while vectors are not.

D. Scalar quantities and vector quantities can both be added algebraically

E. A scalar contains magnitude and direction while a vector does not.

Questions 36-38:

Two vectors are given as follows:

$\vec{A} = -3\vec{i} + 6\vec{j} - 5\vec{k}$

$\vec{B} = -2\vec{i} + 3\vec{j} + \vec{k}$

36. The vector dot product $\vec{A} \cdot \vec{B}$ equals: a) -12 b) 10 c) 14 d) 19 e) 20

37. The difference between vectors $\vec{A}$ and $\vec{B}$ is:

A. $-\vec{i} + 9\vec{j} - 4\vec{k}$ B. $-\vec{i} + 3\vec{j} - 6\vec{k}$

C. $-3\vec{i} + 3\vec{j} - 6\vec{k}$ D. $-5\vec{i} + 9\vec{j} - 4\vec{k}$ E. $-6\vec{i} + 18\vec{j} - 5\vec{k}$

38. The magnitude of the sum of the vectors $\vec{A}$ and $\vec{B}$ is most nearly:

A. 6.8 B. 7.4 C.9.0 D. 10.4 E.11

39. Two vectors are given as follows: $\vec{A}$ = -2i – 5j + 2k $\vec{B}$ = -5i – 2j – 3k Find the magnitude of the following vector: $\vec{A}$ x $\vec{B}$.

A. 12 B. 43 C. 18 D. 26 E. 31

40. A force of magnitude F acts at an angle $\theta$ to the horizontal. The magnitude of the horizontal component of the force is . **A** F cos$\theta$ **B.** F sin $\theta$ **C** F sin $(90^0 - \theta)$ **D** 0

41. Which of the following pairs are both scalar quantities?

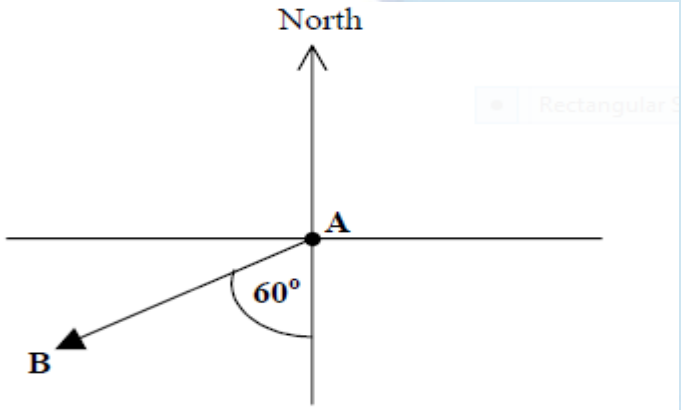
**A** energy and force **B** speed and mass **C** temperature and velocity **D** volume and weight **E** density and acceleration

42. Which of the following pairs are both vector quantities?

**A.** weight and mass **B.** velocity and speed **C.** force and acceleration **D.** acceleration and speed **E.** velocity and energy

43. Two forces of magnitude 20 N and 50 N act simultaneously on a body. Which one of the following forces cannot be a resultant of the two forces? **A.** 20 N **B.** 30 N **C.** 40 N **D .**70 N

44. Which one of the following statements is CORRECT? The direction of vector AB on the sketch can be written as a bearing of.




**A.** 240⁰ **B.** 120⁰ **C.** 210⁰ **D.**60⁰

45. . Which pair of forces **cannot** give a resultant of 10N?

A.1N and 9N B .6N and 8N C. 2N and 12N D. 3N and 4N

46. Which one of the following **is not** true?

A. scalar product can be a negative quantity, when $\frac{\pi}{2} < \theta < \frac{3\pi}{2}$.

B. The commutative and associative laws does not apply to vector subtraction.

C.The magnitude of a vector have a negative value.

D.For three non-coplanar vectors **A, B** and **C, A+B+C cannot** zero.

47. The magnitude of vector $\vec{A}$ and $\vec{B}$ are 3 and 4 units . respect ively . The largest and smallest passable values of the magnitude of their resultant is

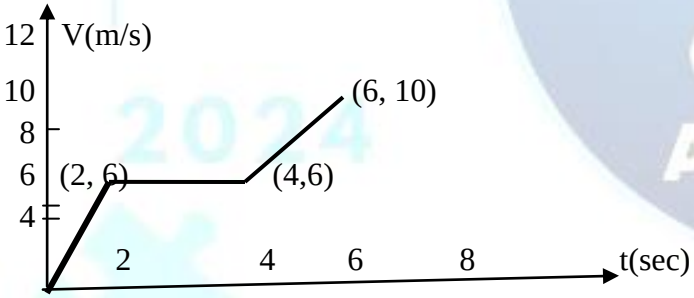
A.5 and – 5 units B. 5 and 1 units (s) C. 7 and 1 units (s) D. 3 and 4 units

# CHAPTER 3

1. A racecar is moving at a constant speed of 35m/s. A security car was moving at a speed of 5m/s as the racecar passes by it and was accelerating at a constant rate of 5m/s$^2$. What was the speed of the security car when it took over the racecar?

   A. 35 m/s B. 65 m/s C. 60 m/s D. 5 m/s

2. A car start moving from rest and its motion on a straight line is shown in figure below. What is the average velocity of the car within the first 6 sec?




A. 1.67m/s C. 5m/s

B. 5.67m/s D. 6m/s

3. Which one of the following statements is correct regarding the motion in a plane?
   A. The centripetal force for a body moving in either vertical or horizontal circle is toward the center.
   B. When a body moves in horizontal circle, its velocity is constant.
   C. When a body moves in a vertical circle, its speed is constant.
   D. In projectile motion, the horizontal component of the motion is uniformly accelerated motion.

4. A bullet is fired at an angle of $30^0$ above the horizontal. If air resistance is neglected, what should be the bullet's horizontal Acceleration ($a_x$) and vertical acceleration ($a_y$)when it reaches its maximum height?
   A. Both $a_x$ and $a_y$ are zero
   B. $a_x$ is $10m/s^2$ downward and $a_y$ is zero
   C. $a_x$ is zero and $a_y$ is $10m/s^2$ downward
   D. Both $a_x$ and $a_y$ are $10m/s^2$ downward

5. Two students A and B, with masses $m_A$ and $m_B$ respectively, stand on a wheeled trolleys as shown below. If student A has larger mass and pushes student B, then what can be said about their accelerations?
   A. The acceleration of student B is less than that of student A
   B. Both boys will be accelerated by the same magnitude but in opposite directions
   C. There would be no acceleration because the force are equal and opposite
   D. The acceleration of student A is less than that of student B

6. A cricketer throws a ball vertically upwards with initial speed of 20m/s. How long is it in the air before it returns to the cricketer's hands? A. 2sec B. 10sec C. 1.5sec D. 4sec

7. A fun making boy swings a blinking ball tied to the end of a string in a vertical circle. If the radius of the circle is 0.5m, then what should be the minimum speed of the ball at the bottom of the circle to make a complete circular motion at the top?
   A. 5m/s B. $\sqrt{5}$ m/s C. $\sqrt{15}$ m/s D. $2\sqrt{5}$ m/s

8. The range of canon ball fired horizontally from a laboratory table is equal to 8/3 times the height of the table. What is the direction of velocity vector of the projectile as it strikes the ground?
   A. $45^0$ from the horizontal B.530 from the horizontal C. $60^0$ from the horizontal D. $37^0$ from the horizontal

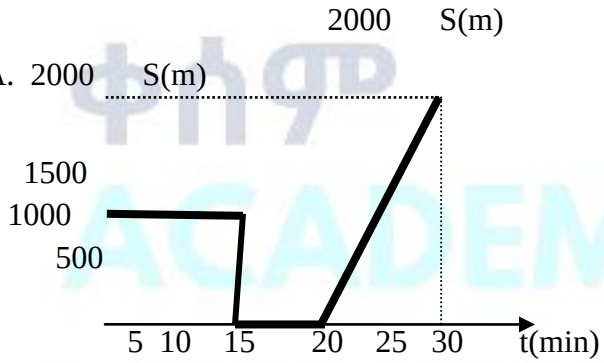
9.



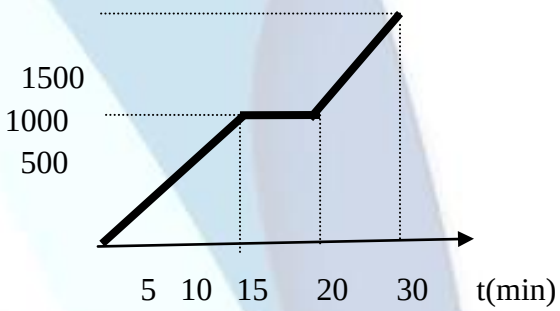


Abeba walks to school. She walks 1km in 15min. She meets her friend Makeda – they talk for 5min and then carry on walking to school. They walk 800m in 10min. Which of the following displacement – time graph shows Ababa's journey to school

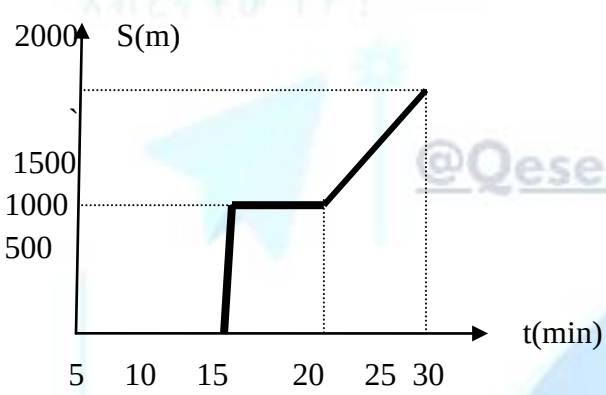
A.



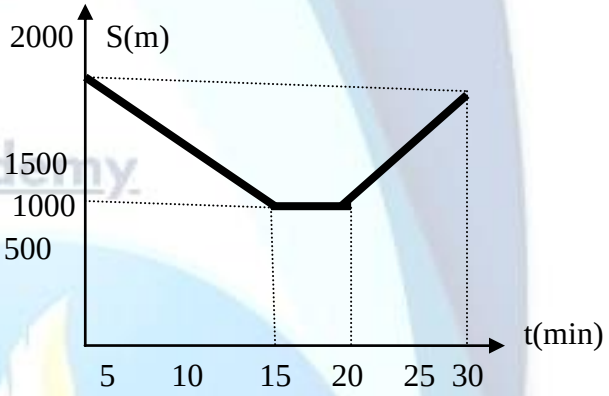

C.




B.




D.




10. Galileo carried out a 'thought' experiment on motion. The line between A and B represents a surface and the center of the ball is placed at A. What would happen in each of the three situations shown in the figure below, without friction when the ball is released?




A. The ball would never reach point B in all instances
B. The ball would reach point B in all instances even if point B keeps on receding to infinity in (c)
C. The ball would reach point B in (a and (b) and not in (c)
D. The ball would reach point B only in (a)

11. A stone is dropped from the roof of the building and is found to reach the ground in 2.0 seconds. How high is the building? ($g = 9.8 m/s^2$) A. 40m B. 20m C. 10m D. 5m

12. A bird is flying toward north with a velocity of 40 km/h and a train is moving with a velocity of 40km/h toward east. What is the velocity of the bird noted by a man in the train?
    A. $40\sqrt{2}$km/h northeast
    B. $40\sqrt{2}$km/h southeast
    C. $40\sqrt{2}$km/h northwest
    D. $40\sqrt{2}$km/h southwest

13. Hannah threw a rock straight upward from the top of a hill with a velocity of 30m/s. the hill is 100 meter tall. What is the time needed in second for the rock to return at the level of Hannah?
    A. 6.1 B. 5.3 C. 4.2 D. 3.4

14. A footballer kicks a ball at an angle of $37^0$ from the horizontal, with an initial speed of 25m/s. How long will the ball be in the air and how far down the field did the ball land, respectively? ($g = 9.8m/s^2$)
    A. 5.35 seconds, 55.3 meters
    B. 3.24 seconds, 67.8 meters
    C. 3.07 seconds, 61.3 meters
    D. 4.62 seconds, 70.5 meters

15. An object has a constant acceleration of $3.2m/s^2$. At a certain instant, its velocity is 9.6m/s. What is the ratio of its velocities at 2.5 second later to 2.5 second earlier? A.111 B.11 C. 11.1 D.1.1

16. A body is rotated with a uniform speed in a circle of radius 1m. What is the centripetal acceleration in $m/s^2$ if it completes 12 rotations in 3seconds ? A. $36\pi^2$ B. $64\pi^2$ C. $72\pi^2$ D. $144\pi^2$

17. An athlete accelerates at $1.9m/s^2$ for 2.2 sec at the beginning of a race. What is the speed of the athlete at the end of a 3000 meters? A. 0.86m/s B. 1.16m/s C. 4.18 m/s D. 9.20m/s

18. If a car moves round a circular read of radius r at a constant speed v
    A. Its velocity changes and the acceleration is $v/r^2$
    B. There is no force on the car since its speed is constant
    C. There is no velocity change since the speed is constant
    D. The force per unit mass on the car is towards the center and is $v^2/r$

19. A car with initial speed of 4m/s starts accelerating in a straight line at $3.2m/s^2$ for 10 seconds. If the brakes are then applied and it travels a further 20m before stopping, what is the acceleration in $m/s^2$?
    A.-48.6 B.-16.2 C.-8.1 D. -32.4

20. A ball rolls off the edge of a horizontal tabletop 4m light. It strikes the floor at a point 5m horizontally away from the edge of the table. How long was the ball in the air in seconds?
    A. $\frac{3}{\sqrt{5}}$ B. $\frac{1}{\sqrt{5}}$ C. $\frac{2}{\sqrt{3}}$ D. $\frac{2}{\sqrt{5}}$

21. A boat is traveling at 15 km/hr with respect to the water of a river in the upstream direction .the water itself is flowing at 6kn/hr with respect to the ground. A child on the boat walks from rear seat to front seat at 5km/hr with respect to the boat. What are the velocities of the boat and the child in km/hr with respect to the ground respectively? A. 6, 12 B. 5, 9 C. 21, 12 D. 9, 14

22. In a 100m race, Usain Bolt and Assafa Powel cross the finish line in a dead heat, both taking 10s. Accelerating uniformly, Usain Bolt took 3s and Assafa Powel took 2s to attain maximum speed, which they maintained for the rest of the race. What was the acceleration of Usain Bolt and Assafa Powel respectively?

A. 4.32 $m/s^2$, 2.25$m/s^2$ C. 4.92 $m/s^2$ , 6.45$m/s^2$

B. 3.92 $m/s^2$, 5.55$m/s^2$ D. 4.92 $m/s^2$ , 5.35$m/s^2$

23. A projectile is fired at $60^0$ with the horizontal. At the highest point of its path, the vertical component of its velocity is momentarily zero. What is the magnitude of its acceleration at this point?

A. 20$m/s^2$ B. 5$m/s^2$ C.10$m/s^2$ D. 0 $m/s^2$

24. An object moving with uniform acceleration has a velocity of 12m/s in the positive x direction when its x coordinate is 3 cm. if its x coordinate 2s later is -5cm. what is its acceleration?

A. -12 $m/s^2$ B.-13 $m/s^2$ C. -16 $m/s^2$ D. 12 $m/s^2$

25. 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.

26. What does the slope of a velocity-times graph represent?

A. Distance B. Acceleration C. Displacement D. Speed

27. Two projectiles are fired form 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. C. Both hit at the same time

B. 30 degrees D. cannot be determined from the given information

28. An object of mass m moving with initial speed of 15m/s got an acceleration of 10$m/s^2$ after a constant force F is applied to it. How long does it take the object to reach 90 m from its initial position?

A.3.22s B.0.75s C.3s D.2.5s

29. A ball is thrown downward (not dropped) from the top of a tower after being released, its downward
    A. Velocity will be uniform
    B. Acceleration will be equal to g
    C .Acceleration will be greater than g
    D. Acceleration will be smaller than g

30. A car initially at rest and at the origin has moved a distance of 5,10,15,20,25,30,40,50,60,70 meters during the 1,2,3,……10 seconds periods respectively. What is the average speed during the first 5 seconds and the second half period from t=6sec to t=10 seconds in m/s respectively?
    A. 4, 10 B. 4, 9 C. 5, 9 D. 5, 10

31. A small car and a bus move with velocities given by $V_c$ = (3i- 2j)m/s and $V_0$= (-5i-4j)m/s respectively according to an observer on the ground. What is the velocity of the bus according to the car driver?
    A. (-2i+6j)m/s B. (-2i-6j)m/s C. (-8i+2j)m/s D.(-8i-2j)m/s

32. The x and the y of a particle at any time t is given by $x = 9t + 5t^2$ and y=5t + 8 where x and y are in meter and t in seconds. The acceleration of the particle at t = 5 seconds is
    A. Zero B. 10 $m/s^2$ C. 14$m/s^2$ D.20$m/s^2$

33. The coordinates of a particle in meters is given by $x(t)=25t - 3t^3$ where the time t is in seconds. What value of t will the particle become momentarily at rest?
    A. 2.78s B. 1.67s C. 0.6s D. 0.36s

34. Dire Dawa is approximately 300km east of Addis Ababa. A plane leaves Addis Ababa flying due east at 500km/hr while the wind is blowing to the south at 100km /hr. What is the velocity of the plane relative to the ground?
    A. 510km/hr north of the east B. 510km/hr south of east C. 490km/hr west D. 490km/hr south of west

35. A stone is thrown vertically upward. on its way up it passes point A with speed V and point B,3m higher than A, with speed V/2. What is the speed V in m/s & the maximum height reached by the stone above point B in meters respectively? A. 7.75, 0.5 B. 8.9, 1 C. 7.75, 0.75 D.7.85,1.15

36. If the x and y coordinates of a particle at any time t is given by $x=7t+4t^2$and y=5t where x and y are in m and t is s, then what is the acceleration of the particle at t=5?
    A. zero B. 8$m/s^2$ C.20$m/s^2$ D.40$m/s^2$

37. Uniform circular motion is a
    A .motion with constant velocity
    B. motion in one dimension
    C. motion with acceleration of constant magnitude
    D. motion in which net force is constant

38. When a small mass m is suspended from one end of a vertical string and then whirled in a horizontal circle at a constant speed v.
    A. The string stays vertical
    B. There is no force on m except its weight
    C. The angle of inclination to the vertical of the string does not depend on v
    D. The string becomes inclined to the vertical

39. As a satellite orbit in an elliptical orbit around the earth the gravitational attraction of the earth for the satellite;
    A. Is greater than the satellite's gravitational attraction for the earth
    B. Is less than the satellite's gravitational attraction for the earth
    C. Varies inversely as the square to the distance between the earth and the satellite
    D. Remains constant

40. A car accelerates steadily from 0 m/s to 30 m/s in a distance d and a time t. another car takes a time 3t to accelerate steadily from stationary to the same final velocity. What distance does the second car cover during the new acceleration? A. 3d C. d/3 B. d D. d/9

41. One person drops a ball from the top of a building while another person at the bottom observes its motion. The two people disagree on which of the following?
    A. the value of the total energy of the ball
    B. the change in potential energy of the ball
    C. the value of the gravitational potential energy of the ball earth system
    D. the kinetic energy of the ball at some point of its motion if one of them is walking

42. The coordinates of a particle in meters is given by $x(t) = 25t - 3t^2$, where the time t is in seconds. At what value of t will the particle become momentarily at rest?
    A. 2.78s B. 1.67s C. 0.6s D. 0.36s

43. A driver moving at a constant peed of 20m/s sees an accident up ahead and hits the brakes. If the car decelerates at a constant rate of $-5 m/s^2$,how far does the car go before it comes to a stop?
    A. 120m B. 100m C. 40m D. 20m

44. 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.

45. What does the slope of a velocity-times graph represent?
    A. Distance B. Acceleration C. Displacement D. Speed

46. A body moving with constant acceleration covers the distance between two points 60 m a part in 5 s. its velocity as it passes the second point is 15 m/s. what is the acceleration?
    A. $3 m/s^2$ B. $2.4 m/s^2$ C. $1.8 m/s^2$ D. $1.2 m/s^2$

47. A place kicker 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 20.0 m/s at an angles of $53^0$ 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. 2.85m C. 3.00 m D. 3.15 m

48. One of the following statements is correct?
    A. An object moving which toward the east cannot have acceleration toward the west.
    B. If the average velocity of an object is zero in some time interval the average speed of the object for that time interval is zero
    C. The velocity-time graph of an object moving with constant acceleration is parallel to the time axis

D. An object having zero velocity can have acceleration different from zero.

49. A car travels along a straight line at a constant speed of 20 m/s for a distance d and then another distance d in the same direction at a constant speed of 36 km/hr. What is the average speed for the entire trip?

A. 23km/h B. 48km/h C. 54km/h D. 60km/h

50. If a long distance jumper athlete leaves the ground at an angle of $37^0$ above the horizontal surface at a speed of 10.0 m/s. How far does he jump in the horizontal direction?

A. 4.8m B. 6m C. 9.6m D. 12m

51. An example of a body moving with constant speed but still accelerating is:

A. A body moving on a straight road
B. A body moving in a circular path
C. A body moving on a straight railway track
D. A body falling in a viscous fluid

52. A student moves along the boundary of a square field of side 10m in 40sec. if he started from one of the corners of the square what will be the magnitude of the displacement of the student at the end of 2 minutes and 20 seconds from his initial position?

A. 10m B. $10\sqrt{2}$ m C. 40m D. 30m

53. If the x and y coordinates of a particle at any time t is given by $x = 7t + 3t^2$ and $y=5 - 4t^2$ where t in sec, then what is the acceleration of the particle at t = 5sec?

A. $-2m/s^2$ B. $2m/s^2$ C. $10m/s^2$ D. $14m/s^2$

54. A car is travelling around a corner of radius 36m. If the coefficient of friction between the car and the road surface is 0.4, what is the greatest speed for the car without skidding?

A. 12m/s B. 10m/s C. 16m/s D. 13m/s

55. A ball is dropped from a balloon moving vertically upward with a speed of 30m/s. If the balloon is 80m above the ground at the instant the ball is dropped, how long does it take the ball to reach the ground?

A. 4s B. 6s C. 8s D. 10s

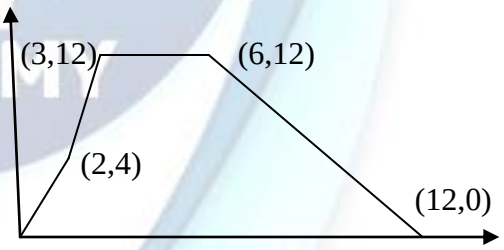
56. A satellite moves at a constant speed in a circular orbit about the center of the Earth at aa altitude half the radius of the Earth above its surface. If g is gravitational acceleration at the surface of the Earth and R its radius, then what is the speed of the satellite?

A. $\sqrt{2gR}$ B. $\sqrt{3gR/2}$ C. $\sqrt{gR}$ D. $\sqrt{2gR/3}$

57. A driver of an automobile travelling at a constant speed of 20 m/s suddenly applies a brake and the automobile comes to rest in 2.0 seconds after skidding for a certain distance. What is the length of the skid distance?

A. 20 m B. 10 m C .40 m D. 400 m

58. Which of the following is correct about the motion shown in the velocity-time graph below?




A. between C and D, the motion is with constant acceleration
B. Between B and C, the acceleration is 4 m/s
C. Total displacement is 84m.
D. between D and E the motion is with constant positive acceleration

59. An object of mass M is set in a vertical circular motion. The tension T from the rope keeps the object in a circular Path with speed v. Where does the rope experience a maximum tension?

A. At the top of the circle B. When it is at $45^0$ to the vertical line

C. When the object is at half of the circle D. At the bottom of the circle

60. A shell is fired from a gun, whose barrel is inclined at an angle to the horizontal. During the flight, the shell explodes in air into fragments. The center of mass of different fragments will follow

A. a horizontal straight line B. a parabola C. a vertical straight line D. an unpredictable path

61. An example of a body moving with constant speed but still accelerating is:

A. A body moving on a straight road B. A body moving on a straight railway track

C. A body moving in a circular path D. A body falling in a viscous fluid

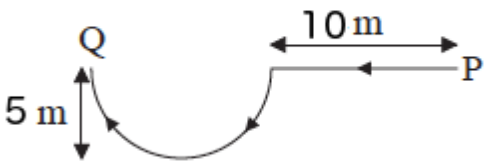
62. A flywheel is rotating with an angular velocity of 2.0 rad/s and acted by an acceleration of $1/\pi$ rad/s$^2$. How long will it take to complete three revolutions? A. $0.5\pi$ s. B. $\pi$ S. C. $2\pi$ S D. $4\pi$ S

63. A student moves along the boundary of a square field of 1 m in 40 sec. If he started from one of the corners of Square what will be the magnitude of displacement of f dent at the end of 2 minutes and 20 seconds from his initial position? A. 10m. B. $10\sqrt{2M}$ C. 40 m. D. 30 m.

64. An airplane travelled from Addis Ababa to Mekele, 780km. in 45 minutes. What was its average speed?

A. 0.28 m/sec B. 1040 km/hr C. 17.3 m/min D. 585 km/hr

65. Steve walks from Point P to Point Q. The curved part of his path is a semicircle. What is the magnitude of his




displacement from point P to point Q?

A.5 B.15 C.20 D.20.7 E.25.7

# CHAPER 4

1. A block is placed on an inclined plane. The plane is then raised until it makes an angle α with the horizontal. If the coefficient of friction μ for the block and plane is 0.3, then what is the value of α to which the plane may be raised before the block begins to slide?

   A. $45^o$ B. $30^o$ C. $22^o$ D. $\tan^{-1}(0.3)$

2. Which of the following reasoning is correct about the difficulty to walk in sand than on hard ground?
   A. The action of the feet on the sandy ground is greater than the reaction of the sandy ground on the feet.
   B. The action of the feet on the sandy ground is less than the reaction of the sandy ground on the feet.
   C. The hard ground can exert more reaction than the action of the man to keep him moving.
   D. The feet cannot put in sufficient action that result in sufficient reaction to make walking difficult.

3. A wooden box loaded with books is given a push on a concrete floor. An initial velocity of 8m/s was imparted to it. How far the box moves in meters before becoming to a stop, if the coefficient of kinetic friction between the box and the floor is 0.8?($g = 9.8 m/s^2$)

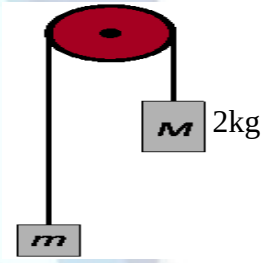
   A.5.07 B. 6.04 C. 4.08 D. 7.10

4. Two heavily loaded trucks collide head on and become entangled as a result of the collision. One of them, which was at rest has a mass of 2500kg.the other truck having a mass of 2000kg was moving with a velocity of 100km/hr before collision. What is the velocity (in m/s) of the entangled mass after collision?

   A. 20.34 B. 8.23 C. 15.34 D. 12.34

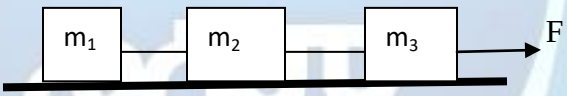
5. Two masses 2kg & 3kg are attached to the end of a light string passing over a frictionless pulley, fixed at the top. What are the tension & acceleration in the string in terms of g?

   A. 12g/5, g/5
   B. 7g/8, 5
   C.21g/8 ,g/8
   D.7g/8, g/8




6. Three blocks of mass $m_1$, $m_2$, and $m_3$ are connected by thread and placed on a smooth horizontal surfaces as shown in the figure below. A force F is applied on the block of mass $m_3$ in forward direction as shown. Neglecting friction, find the tension in the thread connecting $m_1$ and $m_2$.

   A. $\frac{m_1 F}{m_1+m_2+m_3}$
   B. $\frac{m_2 F}{m_1+m_2+m_3}$
   C. $F - \frac{m_3 F}{m_1+m_2+m_3}$
   D. $\frac{(m_2+m_3)F}{m_1+m_2+m_3}$



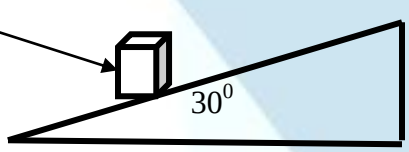

7. A 5kg block is pulled along a horizontal frictionless floor by a cord that exerts a force F=12N at angle of $30^0$ above the horizontal. If the force F is slowly increased, then what are the values of the force in Newton & acceleration in $m/s^2$of the block just before it's lifted of the floor, respectively?

   A. 116, 21 B.100, 20 C.116, 20 D.100, 21

8. A newly discovered planet has twice the mass of the earth and three times the radius of the earth. What is the free-fall acceleration at its surface in terms of the free-fall acceleration g the surface of the earth?

   A. 4/3g B. 3/4g C. 2/9g D. 2/3g

9. A 100kg box is pushed at a constant speed up the smooth $30^0$ inclined plane shown below. What horizontal force F is required?




A. 577.35N
B. 1000.35N
C. 1732.35N
D. 1154.70

10. A 4kg block is given an initial speed of 8m/s at the bottom of 300 inclined plane. The fractional force that retards its motions is 15N. If the block is directed up the inclined plane, how far will it move before it stops?

A. 3.66m B.4.4m C. 3.38m D. 4.67m

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

A. 0.8 kg m$^2$
B. 1.25 kg m$^2$
C. 4 kg m$^2$
D. 40 kg m$^2$

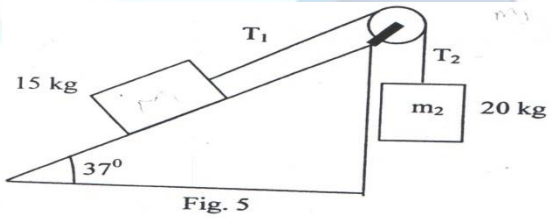


Fig. 5

12. An Aluminum block of mass $m_1$ = 3 kg and a copper block of mass $M_2$ = 5 kg are connected by a light string over a frictionless pulley. They sit on a steel surface as shown in Figure 4, where $\theta = 53^0$. The coefficient of kinetic friction between the steel surfaces and each block is 0.3. If the blocks are released from rest what is the tension T in the string?

A. 29.40 N
B.17.25 N
C. 12.25 N
D. 8.60 N

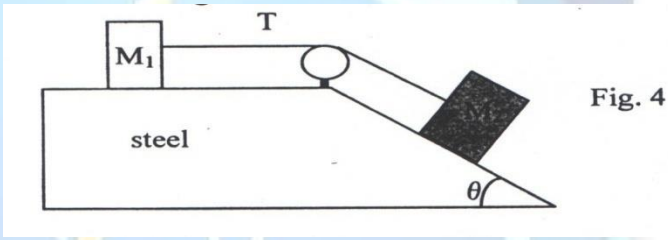


Fig. 4

13. Two particles with masses 2m and 3m are moving toward each other along the x- axis with the same initial speeds V. particle 2m is traveling to the left, and particle 3m is traveling to the right. They undergo an elastic glancing collision such that particle 2m is moving in the negative y direction after the collision. What are the x components of the final velocity of particle 3M and the kinetic energy of particle 2M, respectively?

A. 0.33v and 0.7 mv$^2$ B. 0.33v and 1.40 mv$^2$ C. 0.67v and 0.70 mv$^2$ D. 0.67v and 1.4 mv$^2$

14. A block of mass 1.6 kg is attached to a horizontal spring that has a force constant of 2000 N/m. the spring is compressed 2.0 cm and is then released from rest. At what speed will the block pass through the equilibrium position if a constant friction force of 10.0 N retards its motion from the moment it is released?

A. 70m/s B. 50 m/s C. 70 cm/s D. 50 cm/s

15. Which one of the following statements is true about action and reaction forces referred to in Newton's third law of motion?

A. They act upon the same body. C. They act upon two different bodies
B. They are equal in magnitude but need not have the same line of action.

C. They are not equal in magnitude but have the same line of action

16. A 4 kg block is given an initial speed of 8m/s at the bottom of 30 degree inclined plane. The frictional force that retards its motion is 15N. If the block is directed up the inclined plane, how far will it move before it stops?
A. 3.35m B. 3.66m C. 4.40m D.4.67m

17. As a satellite orbit in an elliptical orbit around the earth the gravitational attraction of the earth for the satellite ;
A.Is greater than the satellite's gravitational attraction for the earth
B .Is less than the satellite's gravitational attraction for the earth
C. Varies inversely as the square to the distance between the earth and the satellite
E. Remains constant

18. A woman driving a 2000 kg car along a level road at 30m/s takes her foot off the gas to see how far her car will roll before t slows to a stop. She discovers that it takes 150m.What is the average force of friction acting on the car?
A. 9000N B. 6000N C. 3000N D. 400N

19. A 2kg object experience two concurrent forces of 100N at $30^0$ above the positive x—axis and 80N at $60^0$ above the negative x-axis, What is the magnitude of acceleration of the object?
A. $68m/s^2$ B. $64\ m/s^2$ C. $48m/s^2$ D. $46m/s^2$

20. A driver moving at a constant peed of 20m/s sees an accident up ahead and hits the brakes, if the car decelerates at a constant rate of $-5m/s^2$,how far does the car go before it comes to a stop?
A. 120m B. 100m C. 40m D. 20m

21. The planet Jupiter is about 318 times as massive as earth, yet on its surface you would weigh only about 2.4 times your weight on earth. why is this happened?
A. your mass is 132.5 times less on Jupiter
B. you are 132.5 times more weightless there
C. Jupiter is significantly farther from the sun
D. Jupiter radius is about 11.5 times the earth's radius

22. If two particles have equal momenta, then which one of the following statement is true about their kinetic energies?
A. their kinetic energies are always equal
B. their kinetic energies are never equal
C. their kinetic energies are equal when their masses are the same
D. their kinetic energies are equal when the speed of one the particle is half speed of the other & masses are the same

23. A bullet of mass 10gm,moving horizonatally, strikes and embedded itself in a box of mass 1kg suspended from a light string as shown in the figure below. If the composite mass rises to a height H=0.45m, then what is the speed of the bullet before collision?
A. 303m/s
B. 300m/
C. 90.9m/s
D. 90m/s




24. A 1500kg car going at 30m/s applies its brakes and skids to rest. If the friction force between the sliding tires and the road is 600N, then how far does the car skid before coming to rest?
A. 112.5m B. 11.25m C. 112.5km D.1.125km

25. A cart on an air track is moving at 0.5 m/s when the air is suddenly turned off. The cart comes to rest after traveling 1m. the experiment is repeated, but the cart is moving at 1m/s when the is turned off . How far does the cart travel before coming to rest?

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

26. What is the direction, which a fish must push the water with its fins in order to propel eastward?
A. eastward B. upward C. westward D. downward

27. A rocket moving in free space has a speed of $3x10^3$m/s relative to the earth. Its engines are turned on, and fuel is ejected in a direction opposite the rocket's motion at a speed of $5x10^3$m/s relatives to the rocket. What is the speed of the rocket relative to earth once the rocket's mass is reduced to half its mass before ignition?
A. $7x10^3$m/s B. $4x10^3$m/s C.$5x10^3$m/s D. $2x10^3$m/s

28. A man is standing on a spring scale in an elevator. When the elevator is at rest, the scale reads 560N. When the elevator starts to move, the scale reads 600N. The elevator has:
A. An upward acceleration ` C. A constant downward speed
B. A constant upward speed D. Downward acceleration

29. What is the necessary and sufficient condition for conservation of linear momentum?
A. The presence of more linear than nonlinear forces in the system
B. Net force on the system is zero.
C. The presence of only non-linear forces
D. Internal forces exceed external forces.

30. A 50kg block rests on a smooth plane inclined at $37^0$ to the horizontal. The force needed to push the block up the plane is 400N. What is the magnitude of the acceleration of the block?
A. $1m/s^2$ B. $2m/s^2$ C. $3m/s^2$ D. $8m/s^2$

31. If the momentum of a body increases by 30%, then what is the percentage increase in its kinetic energy?
A. 30 B. 69 C. 138 D. 169

32. A string is wrapped round a cylinder of 1kg and radius 10cm, which is sitting on flat surface. The string comes off the top of the cylinder horizontally. The string is pulled with with force 10N. The coefficient of friction between the cylinder and the surface is 0.4. What is the acceleration of the cylinder if the cylinder rolls without slipping?
A. $20m/s^2$ B. $6m/s^2$ C. $10m/s^2$ D. $12m/s^2$

33. An iron sphere released from rest at a height $h$ falls freely under gravity. It reaches half the height at the instant $t_1$ and hits the ground at the instant $t_2$. if air resistance is negligible, the ratio $t_1/t_2$ is
A. $2^{1/2}$ B. $2^{-1/2}$ C. $2^{-1/4}$ D. $2^{1/4}$

34. A crate weighing $9.8 \times 10^3$ N is pulled up a $37^o$ incline by a pulley arrangement. If the coefficient of kinetic friction between the crate and the plane is 0.75, what force applied parallel to the plane will move the crate up the plane without acceleration?
A. 11768 N B. 17966 N C. 5898 N D. 2000 N

35. A 0.30-kg bird is flying from right to left at 30 m/s. The bird collides with and sticks to a 0.50-kg ball which is moving straight up with speed 6.0 m/s. What is the magnitude of the momentum of the ball/bird combination immediately after collision?
A. 12.0 Ns B. 3.0 Ns C. 9.0 Ns D. 6.0 Ns

36. Which of Newton's Laws would explain if a passenger flies right out of his seat because he did not have a lap belt over him when the car he is in suddenly stopped?
A. First law B. Second law C. Third law D. Neither

37. A 2 kg ball moves with a speed of 8 m/s and collides with a 4 kg ball moving in the same direction with a speed of 2 m/s. After the collision, the heavier ball has a speed of 5 m/s. The collision results in a decrease in the total

kinetic energy of translation of two balls of

A. 0 J B. 6 J C.12 J D. 18J

38. An airplane heading due east at 215 km/h is blown off course by a strong wind of 65 km/h blowing 45° south of west. What is the resultant speed of the plane?

A. 150 km/h B. 180 km/h C. 260 km/h D. 280 km/h

39. A 27 kg object moving eastward at 25 m/s exploded into a 17 kg fragment and a smaller 10 kg fragment. After the explosion, the 10 kg fragment moved at 18 m/s, $30^0$north of east. What was the speed of the 17 kg fragment after the explosion?

A. 14 m/s B. 28 m/s C. 29 m/s D. 31m/s

40. Which one of the following statements is true about action and reaction forces referred to Newton's third law of motion?

A. They act upon the same body C. They are equal in magnitude but need not have the same line of action.

B. They act upon two different bodies. D. They are not equal in magnitude but have the same line of action.

41. The rate of change of momentum of the raindrop can be given by F = ma + uΔm/Δt. In this expression what does u represent?

A. The rate of change of the velocity for combined system

B. The velocity of the raindrop

C. The velocity of the loss in mass of raindrop

D. The velocity of the extra mass added to the raindrop

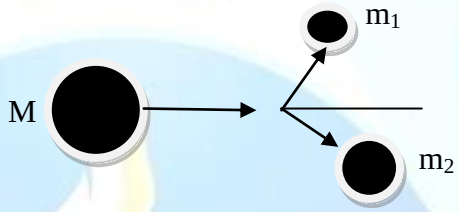
42. A ball of mass M moves with speed V in the + x-direction. It explodes into two pieces that go off at angles$\theta_1$ and $\theta_2$ as shown below. What are the magnitude of the momenta of the two pieces?

A. $P_1 = \frac{MV\,COS\theta_1}{Sin(\theta_1+\theta_2)}$ , and $p_2 = \frac{MV\,Cos\theta 1}{Sin(\theta 1+\theta 2)}$

B. $P_1 = MV\tan\theta_2$, and $p_2 = MV\tan\theta_1$

C. $P_1 = \frac{MV\,Sin\theta 2}{Sin(\theta 1+\theta 2)}$ , and $P_2 = \frac{MV\,Sin\,\theta 1}{Sin(\theta 1+\theta 2)}$

D. $P_1 = \frac{MV\,Cos\,\theta 2}{Cos(\theta 1+\theta 2)}$ , and $P_2 = \frac{MV\,Cos\theta 1}{Cos(\theta 1+\theta 2)}$




43. A 5 kg mass pushed upward along an inclined plane of inclination $30^0$ with constant force F. If the acceleration of the block for this motion is 1 $m/s^2$ and the plane is assumed to be friction less, what is the magnitude of the constant force F?

A. 30.0 N B. 25.0 N C. 20.0 N D. 5.0 N

44. A man is standing on a spring scale in an elevator. When the elevator is at rest, the scale reads 560N. When the elevator starts to move, the scale reads 60ON. The elevator has:

A. an upward acceleration. B. a constant downward speed.

C. a constant upward speed. D. downward acceleration

45. A large mass (A) and a small mass (B) are pushing one-another apart, as shown in the figure below. The small mass moves away at a velocity of 20 m/s to the right. What is the- recoil velocity of the large mass?

A. -20m/s C. 20 m/s

B. 8m/s D.-8m/s

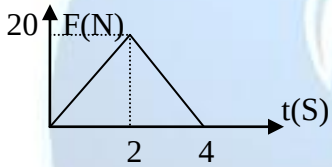


# CHAPER 5

1. If the momentum of a body increased by 20%, then what is the percentage increased in its kinetic energy?
   A. 20 B. 44 C. 66 D. 88
2. Particle A has less mass than particle B .both are pushed forward across a frictionless surface by equal forces for 1s.which of the following statement is correct if bots start from rest?
   A. the amount of work done on A is greater than the work done on B.
   B. the final speed of A is less than that of B. E. A and B
   C. the impulses delivered to both particles are the same
   D. the change in kinetic energy is the same for both particles
3. If a single constant force F acts on a particle of mass m and the particle starts from rest, what is the instantaneous power delivered by the force at time t?

   A. $2\frac{F^2}{m}t$ B. $\frac{F^2}{2m}t$ C. $\frac{F^2}{m}t$ D. $3\frac{F^2}{m}t$

4. A body has moved from initial position having a coordinate of (0, 1, 1.5) meters to a final position with coordinate given by ( 1.2,2,1.5) meters under the influence of a constant force given by F = (-i+2j+3k) N. What is the work done by the force in moving the body from its initial position to its final position ?
   A. 8J B. 0.8J C. 4J D. 0.4J
5. The net force acting on a system of p[articles is zero. Which one of the following quantities may vary with time
   A. The momentum of the system C. The velocity of the center of mass of the system
   B. The kinetic energy of the system D. The position of the center of mass of the system
6. A force F acts on a ball initially, at rest on a smooth surface for a time t. The variation of F with t is shown in the figure below . The momentum of the ball, in Ns, after 4 sec is
   A. 10
   B. 20
   C. 30
   D. 40




7. A running man has half the kinetic energy that a boy of half his mass has. The man speeds up by 1m/s and then has the same kinetic energy as the boy. What is the original speed of the man in m/s?

   A. $\frac{1}{\sqrt{2}+1}$ B. . $\frac{1}{\sqrt{2}-1}$ C. $\frac{1}{\sqrt{2}+2}$ D. $\frac{1}{\sqrt{2}-21}$

8. The speed of a mass is increased by two fold. By what factor does the kinetic energy change?
   A. 2 B. 4 C. 8 D. 16
9. A 1 kg mass is attached to a spring of stiffness constant 100 N/m. what is the maximum displacement of the mass from its equilibrium displacement of the mass from its equilibrium position if its speed is 3 m/s at the equilibrium point? A. 0.1m B. 0.3m C. 3m D.10m
10. A car(mass $m_1$ ) is driving at velocity v, when it smashes into an unmoving car(mass $m_{2)}$, locking bumpers. Both

cars move together at the same velocity. The common velocity will be given by:

A. $m_2v/m_1$ B. $m_1v/m_2$ C. $m_1v/(m_1+m_2)$ D. $(m_1+m_2)v/m_1$

11. A stationary mass explodes into two parts of masses 0.4kg and 4kg. if the larger mass has a kinetic energy of 100J. What is the kinetic energy of the smaller mass?

A. $4\sqrt{50J}$ B. 100 J C. 1000 J D. The change in kinetic energy is the same for both particles

12. A block of mass 0.25kg is placed on top of a light vertical spring of force constant 5000 N/m and pushed downward so that the spring is compressed by 0.10m. After the block is release from rest, it travels upward and then leaves the spring. To what maximum height above the point of realest does it rise? g= $9.8m/s^2$

A.10.2m B.9.2m C. 8.0m D. 9.0m

13. Two men, A and B, are loading identical boxes onto a truck. A lifts his box straight 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 of 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. 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.

14. A body has moved from is initial position at origin along x- axis to a final position x=5 meters under the influence of a force given by F=(4x)i Newton. What is the work done by the force in moving the body from its initial position to it final position?

A. 100J B. 50J C. 25J D. 20J

15. one person drops a ball from the top of a building while another person at the bottom observes its motion. The two people disagree on which of the following?

A. the value of the total energy of the ball
B. the change in potential energy of the ball
C. the value of the gravitational potential energy of the ball earth system
D. the kinetic energy of the ball at some point its motion if one of them is walking

16. Two heavily loaded trucks collide head on and become entangled as a result of the collision. One of them which was at rest has a mass of 2500kg.the other truck having a mass of 2000kg was moving with a velocity of 100km/hr before collision. What is the velocity (in m/s)of the entangled mass after collision?

A. 20.34 B.18.23 C.15.34 D.12.34

17. A force acts on a 3kg particle in such a way that the position of the particle as a function of time is given by $x=3t-4t^2$,where x is in meters & t is in seconds. What is the work done by the force during the first 4.0 second?

A.1218J B,1228J C,1248J D,1258J

18. A running man has half the kinetic energy that a boy of half his mass has. The man speeds up by 1m/s and then has the same kinetic energy as the boy. What is the original speed of the man in m/s?

$A.\frac{1}{\sqrt{2}+1}$ B. $.\frac{1}{\sqrt{2}-1}$ $C.\frac{1}{\sqrt{2}+2}$ $D.\frac{1}{\sqrt{2}-21}$

19. A cart moving at a speed v collides with an identical stationary cart on an air track and the two stick together after collision. What is their velocity after collision?

A. -0.5v B. Zero ` C. 0.5v` D.V

20. If two particles have equal momentum, then which one of the following statement is true about their kinetic

energies?

A. their kinetic energies are always equal

B. their kinetic energies are never equal

C. their kinetic energies are equal when their masses are the same

D. their kinetic energies are equal when the speed of one the particle is half speed of other&

21. A car of mass 1500kg is travelling at a uniform velocity of 30m/s due east. The driver applies the brakes to slow down the car to a velocity of 10 m/s due east. What is the work done in slowing down the car?

A. 15KJ B. 300KJ C. 600KJ D. 750KJ

22. A block of mass 10kg is pulled up a rough inclined plane with a force of 100N parallel to the inclined plane. The inclined plane makes an angle of $37^0$ with the horizontal. At the instant when the force is applied the block has a speed of 1.5 m/s. If the coefficient of kinetic friction is 0.40, and the block is pulled up 5m. What is the change in the kinetic energy of the block?

A. 20J B. 30J C. 40J D. 45.5J

23. The area under a force versus distance graph represents:

A. Acceleration B. The change in energy C. the change in momentum D. work done

24. A net external non-zero force acts on a particle that is moving along a straight line. Which one of the following statements is correct?

A. The velocity, but not the kinetic energy, of the particle is changing.

B. Both the velocity and the kinetic energy of the particle are changing.

C. The kinetic energy, but not velocity, of the particle is changing.

D. The momentum is conserved.

25. Which statement is correct about conservative and dissipative forces?

A. The work done by conservative forces is path dependent.

B. The work done along a closed path, by non-conservative forces is non zero

C. Gravitational force is an example of non conservative force

D. Friction is an example of conservative force.

26. A spring of force constant 160N/m fixed at one-end lies on a frictionless horizontal table. If a 2kg block moving with a speed of 12m/s strikes the spring, what will be the speed of the block at the instant the spring is compressed by 1m?

A. 8m/s B. 4m/s C. 12m/s D. 20m/s

27. A motor pump engine raises 100litter of water in well from depth of 10m in 10sec. What power of engine developed?

A. 2KW B. 1KW C. 10KW D. 0.1KW

28. A conservative force $F = -4(\hat{i} + \hat{j})$ Newton moves a particle in the xy-plane. Initially the particle is at the origin. The work done by the force when the particle is given a displacement $r = (2\hat{i} + 2\hat{j})$ meter is ($\hat{i}$ and $\hat{j}$ are unit vectors along the x and y directions respectively)

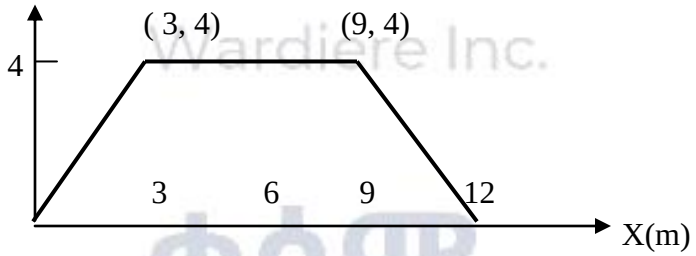
A.– 8 J B. 8 J C. –16 J D. 16 J

29. The kinetic energy of an object is quadrupled. Its momentum will change by a factor?

A. 0 B. 2 C. 8 D. 4

30. A boy pushes a block over 12m distance within 6 sec. The force applied by the boy varies as shown in the diagram below. What is the average power loss by the boy?

$F_x$(N) A. 6W B. 8W C. 7W D. 4W




31. For a constant force F, if the impulse imparted to the system is large, then what can you conclude about the condition?

A. The contact or impact time is large
B. Linear momentum is conserved
C. Kinetic energy is conserved
D. The change in velocity is small

32. An open trolley is rolling on a level surface without frictional loss through a vertical downpour of rain, as shown below . As trolley rolls, an appreciable amount of rainwater accumulates in the cart. What will be the speed of the cart?



A. It increases because of conservation of mechanical energy
B. It decreases because of conservation of mechanical energy
C. B. It decreases because of conservation of momentum
D. It remains the same because the raindrops are falling perpendicular to the direction of the cart's motion

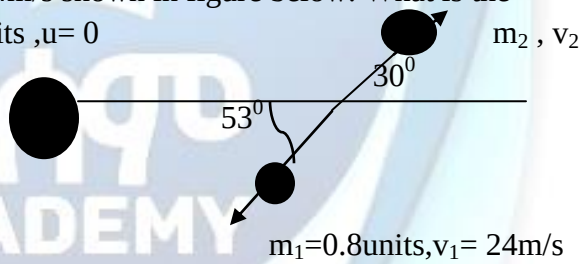
33. An object of mass 1kg moving with a speed of 2m/s was acted by a force that produces an acceleration of $2m/s^2$. What is the change in kinetic energy of the object if the force is exerted on the object for 2sec in its direction of motion?

A. 16J B. 4J C. 8J D. 1J

34. A body that is released from the top of a tall building reaches the ground after 6 sec. what is the ratio of the kinetic energy acquired by it at the end of the first 3sec to the increment in the kinetic energy during the next 3sec?

A. 1 B. 1/3 C. 3/2 D. 2

35. A Uranium atom initially at rest has a mass of 2units and spontaneously disintegrated into two fragments. One of the fragments has a mass of 0.8 units and moves at a speed of 24m/s shown in figure below. What is the speed of the second fragments?




A. 25.6m/s
B. 21.3m/s
C. 16m/s
D. 14.8m/s

36. A 1kg object explodes and breaks up into three pieces. One piece has a mass of 400g and has a velocity of $(15\hat{\imath} + 10\hat{\jmath})$ m/s. A second piece has a mass of 250g and has a velocity of $(25\hat{\imath} - 10\hat{\jmath})$m/s. What is the velocity of the third piece?

A. $(-4.3\hat{\imath} + 35\hat{\jmath})$m/s B. $(-35\hat{\imath} - 4.3\hat{\jmath})$m/s C. $(35\hat{\imath} - 4.3\hat{\jmath})$m/s D.$(-35\hat{\imath} - 4.3\hat{\jmath})$m/s

37. A spring with a spring constant of 300 N/m is stretched 20cm in 2sec.What is the power applied to stretched the

spring?

A. 3W B. 6W C. 30KW D. 60KW

38. A 50KW machine is used to lift heavy objects to the top of a building under construction. If this machine is replaced with a new machine of 100KW power, then which of the following statements is NOT true about the new machine?

A. The new machine can raise objects with the same mass at twice the speed of the old machine

B. The new machine can raise objects with twice as much mass at the same speed as the old machine

C. The new machine takes twice as much time to do the same work as the old machine

D. The new machine can do twice as much work in the time as the old machine

39. Which of the following is correct about a work done for dissipative forces?

A. path dependent C. the same as the loss in kinetic energy

B. the same as the gain in potential energy D. the same as the potential energy stored in spring

40. In which of the following case is no work done by a dissipative force?

A. When a parachute jump from a plane

B. On a racing car that moves in a desert

C. For a freely falling object D. When someone slides a box on a horizontal rough surface

47. Which of the following is equal to the amount of work required to stop a moving object

A. the kinetic energy of the object C. the square of the velocity of the object

B. the mass of the object times its acceleration D. the mass of the object times its velocity

48. A 1kg roller coaster is acted on by a 4N force over a displacement of 2m in the direction of force and then set free. The roller is moving on a smooth and horizontal surface towards a free end of a spring of constant k, whose other end is fixed on the wall. If the spring is compressed by 20cm to bring the roller coaster to rest, then what is the value of the spring constant?

A. 100 N/m B. 800 N/m C. 200 N/m D. 400 N/m

49. Find the distance of the center of mass of the system shown in the diagram from point A. The rod is massless.

A. 3.73 m C. 2.45 m

B. 2.09 m D. 5.86 m




50. The area under a force versus distance graph represents:

A. acceleration. B. the change in energy. C. the change in momentum. D. Work done

51. A net external non-zero force acts on a particle that is moving along a straight line. Which one of the following Statements is correct?

A. The velocity, but not the kinetic energy, of the particle is changing.

B. Both the velocity and the kinetic energy of the particle are changing.

C. The kinetic energy, but not the velocity, of the particle is changing. D. The momentum is conserved.

52. Which statement is correct about conservative and dissipative forces?

A. The work done by conservative forces is path dependent.

B. The work done, along a closed path, by non conservative forces is nonzero.

C. Gravitational force is an example of non-conservative force.

D. Friction is an example of conservative force.

# CHAPER 6

1. When torque acting upon a system is zero, which one of the following will be constant?

   A. Force B. Linear momentum C. angular momentum D. linear impulse

2. The angular position of a swinging door is described by $\theta = 5 + 10t + 2t^2$ rad. What is the angular speed and acceleration of the door at t =3s?

   A. 22rad/s, 4rad/s$^2$ B. -17 rad/s, 4rad/s$^2$ C. 22rad/s , 12rad/s$^2$ D. 12 rad/s , 3rad/s$^2$

4 .A wheel starts from rest and rotates with constant angular acceleration to reach an angular speed of 12 rad/s in 3s. What is the magnitude of the the angular acceleration of the wheel in rad/s$^2$ and the angle in radians through which it rotates in this time interval respectively?

   A. 4,18 B. 3,18 C. 18,5 D.18,4

5. A ladder of length 3m and mass 20kg Leans against a smooth, vertical wall so that the angle between the wall and the ladder is $30^0$. Determine the magnitude of the normal forces at the contact point on the the wall /$N_w$/ and at the contact point on the ground /$N_g$/

   A .$N_w$= 57.7 N, $N_g$ = 200 N B. $N_w$ = 200N, $N_g$ = 57.7 N C. $N_w$ = ON, $N_g$ = 200 N D. $N_w$ = 200 N, $N_g$ = ON

6. Which of the following objects has the largest moment of inertia assuming they all have the same mass and radius?

   A. A solid disk B.A solid sphere C.A circular loop D.A solid cylinder

7. Which of the following is not true?
   A. The magnitude of average angular velocity is directly proportional to the angular displacement during a given time
   B. Average angular velocity and instantaneous angular velocity are the same for uniform angular motion.
   C. The direction of the average angular velocity is determined by the right hand rule.
   D. The direction of average angular velocity is parallel to a tangent line along the trajectory of the object.

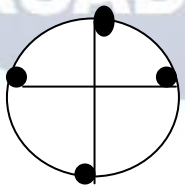
8. A disk rolls without slipping along a horizontal surface. The center of the disk has a translational speed v. the uppermost point on the disk has a translational speed A. Zero B. V C. 2v D. 2π

9. The angular momentum of a particle is
   A. Independent of the specific origin of coordinates
   B. Zero when its position and momentum vectors are parallel
   C. Zero when its position and momentum vectors are perpendicular
   D. Not zero for non zero position and momentum vectors

10. Two bodies of moments of inertia $I_1$ and $I_2$ about their respective axes (which are the normal to the disc and passing through the centre) and rotating with angular speeds w1 and w2 are brought into contact face to face with their axes of rotation coincident. take $w_1 \neq w_2$ what is the angular speed of the two system after contact

    A. $I_1w_1 + 2I_2w_2 / I_1 + I_2$ B. $I_1w_1 + I_2w_2 / I_1 + I_2$ C.$I_1w_1 + 2I_2w_2 / I_1 - 2I_2$ D.$I_1w_1 + I_2w_2 / I_1 - I_2$

11. The radius of the wheel shown below is 0.75m.what is its moment of inertia if each mass is 3kg?
    A. 2.25 kg m$^2$
    B. 3.38 kg m$^2$
    C. 6,75 kg m$^2$
    D. 9.00 kgm$^2$



12. A uniform ball of radius & mass m starts from rest and rolls down a frictionless inline of height h. When the ball reaches the ground, how fast is it going?

A. $\sqrt{\frac{10}{7}}$ gh  B. $\sqrt{\frac{9}{10}}$ gh  C. $\sqrt{\frac{10}{9}}$ gh  D. $\sqrt{\frac{7}{10}}$ gh

13. The necessary and sufficient condition for rigid body to be in equilibrium is the sum of

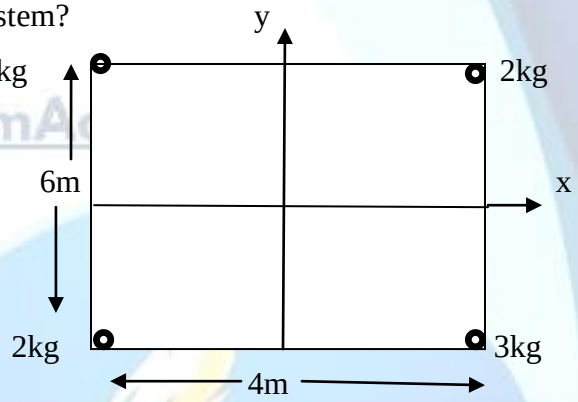
A. All torques acting on it is zero  D. All forces acting on it should be zero
B. All forces should be equal in magnitude, but opposite in direction to the sum of all torques acting on it
C. All forces and the sum of all torques should be zero

14. A 1.5 kg particle moves in the xy-plane with velocity $\vec{V}$= (4.2$\vec{\imath}$ – 3.6$\vec{\jmath}$)$^{m}/_{s}$ what is its angular momentum when its position vector is $\vec{r}$ = (1.5$\vec{\imath}$ +2.2$\vec{\jmath}$)m?

A. -22$\vec{k}$ kg $^{m^2}/_{s}$  B. . -14.6 $\vec{k}$ kg $^{m^2}/_{s}$  C. 14.6 $\vec{k}$ kg $^{m^2}/_{s}$  D. 22 $\vec{k}$ kg $^{m^2}/_{s}$

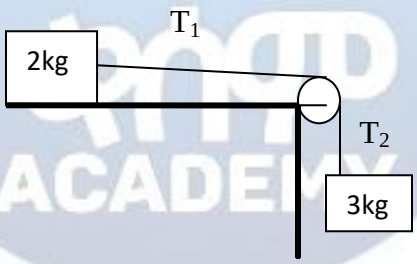
15. The particles shown in Figure 2 are connected by rectangular rigid rods of negligible mass. The origin of the xy plan is at the center of the rectangle. The system rotates in the xy plane about the z- axis with an angular speed of 6 rad/s. what is the rotational kinetic energy of the system?

A. 2574 J
B. 2340J
C. 1287J
D. 1170J




16. Two blocks are connected by a string of negligible mass passing over a pulley of radius r = 0.2m and moment of inertial I as shown in Figure 3. The block on the horizontal frictionless surface is moving with a constant acceleration a = 2.0m/s$^2$. If the pulley axis is frictionless, the string is inextensible and does not slip on the pulley, what should be the moment of inertia of the pulley?

A. 0.40kgm$^2$
B. B. 0.80kgm$^2$
C. C. 4.00kgm$^2$
D. D. 8.00kg m$^2$



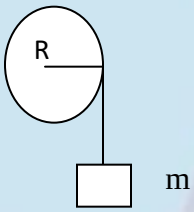

17. An object with a mass of m =3.0kg is attached to the free end of a light string wrapped around a pulley of radius R = 0.50m and moment of inertia $I$= 0.75kg m$^2$. The pulley is free to rotate in a vertical plane about a fixed frictionless axis passing through its center as shown in fig4. The suspended object is released from rest at 3.60m above the floor. What is the angular momentum of the pulley at the time when the object strikes the floor?

A. 4.5kg $m^2/s$

B. 9.0$kgm^2/s$

C. 12.3$kgm^2/s$

D. 18$kgm^2/s$



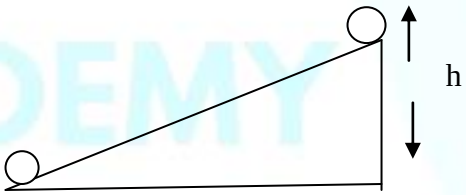

18. A hoop of mass M and radius R is at rest at the top of an incline as shown. The hoop rolls down the plane without slipping. If the hoop reaches bottom, then what is its angular momentum about its center of mass?

A. MR$\sqrt{gh}$

B. MR$\sqrt{gh}/2$

C. MR$\sqrt{2gh}$

D. Mgh




19. The rotational analogue of mass is:

A. Moment of inertia B. angular momentum C. Torque D. angular acceleration

20. A flywheel is rotating with an angular velocity of 2.0rad/s and acted by an acceleration of $1/\pi rad/s^2$. How long will it take to complete three revolutions?

A. $0.5\pi\ s$ B. $\pi\ s$ C. $2\pi$s D. $4\pi s$

21. Consider ring, solid sphere and solid cylinder, all are made from the same material, the same mass and the same radius. They are at the top of inclined plane inclined at an angle θ, they are release from the top of the inclined plane at the same time, all shapes roll without slipping, Which of them reaches first at the bottom of the inclined plane?

A. The ring C. The solid Cylinder

B. The solid sphere D. All of them reach at the same time

22. A sphere, a cube, and a cylinder, all of equal mass, are released from rest from the top of a short incline. The surface of the incline is extremely slick, so much so that the objects do not rotate when released, but rather slide with negligible friction. Which reaches the base of the incline first?

A. the sphere B. the cube C. the cylinder D. all reach the base at the same time

23. An ice skater spins at 2.5rev/s when his arms are extended. He draws his arms in and spins at 6.0 rev/s. By what factor does his moment of inertia change in the process?

A. 2.4 B. 1.0 C. 0.42 D. 0.12

24. If a net torque is applied to an object, that object will experience:

A. a constant angular speed C. a constant moment of inertia

B. an angular acceleration D. an increasing moment of inertia

25. A thin rod when rotated about an axis at the end of the rod has a moment of inertia $\frac{1}{3}ML^2$. The rod has a mass of 1.5kg and length of 1m. If the rod initially at rest gains a rotational kinetic energy of 1000J, at what speed does it rotate? A. $10\sqrt{5}$ rad/ s B. 18.8rad/s C. 10rad/s D. $20\sqrt{10}$ rad/s

26. A ring, a solid cylinder and a solid sphere, all having the same mass and the same radius, are held at the top of an inclined plane . If the objects roll without slipping and the coefficient of static friction between each object and plane is 0.3, which one of the following shows the order in which they will get to the bottom of the plane?

A. Sphere, solid cylinder, ring C. Ring, solid cylinder, sphere

B. All will reach the bottom at the same time D. solid cylinder, sphere, ring

27. If in a given rotational system of a body the angular momentum is increased with time, which one of the

following is NOT correct?

A. The radius of the rotation may increase
B. The moment of inertia may increase
C. There is no torque exerted on the system
D. There is a torque exerted on the system

28. A block of mass $m_1$ = 10kg placed on a frictionless incline plane connected to mass $m_2$ = 15kg using a string of negligible mass passing over a pulley of moment of inertia I = 0.25kgm$^2$ and radius R = 10cm as shown in the diagram. What is the torque on the pulley?




A. 2.5m
B. 4Nm
C. 5Nm
D. 12Nm

29. A pulley is rotating at a frequency of 20rev/min. A motor speeds up the wheel so that 30sec later the frequency of the motor is 60min/min. How far will a point n on the pool 0.3 m from its center has travelled during that period? A. 125.7m B. 0.1m C. 37.68m D. 4.2m

30. A disk of radius R with uniform distribution of mass M, rotates about an axis perpendicular to its plane at the rim with angular speed ω. The moment of inertia of the disk about the axis through the center is $\frac{1}{2}$MR$^2$.What is the kinetic energy of the disk?

A. $\frac{1}{4}MR^2\omega^2$ B. $\frac{1}{3}MR^2\omega^2$ C. $\frac{1}{2}MR^2\omega^2$ D. $\frac{3}{4}MR^2\omega^2$

31. In a playing room a turn table of radius 2m has moment of inertia 250Kgm$^2$ and is rotating about a frictionless vertical axel. When a boy of mass 50Kg stands near he rim, the system rotates with angular speed 3rad/s. The boy walks towards the center and stands at 1m from the axel. What is the final angular speed of the system?
A. 3rad/s (B) 2.5rad/s (C) 4.5rad/s (D) 5.4rad/s

32. A thin circular ring of mass M and radius r and moment of inertia Mr$^2$ is rotating about its axis with a constant angular velocity ω. Two objects each of mass m, are attached gently to the opposite ends of a diameter of the ring. What would be the angular velocity of the wheel?

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

33. Five beads of equal mass are fixed on a rigid light rod that is free to rotate about a frictionless vertical bearing. The arrangement is such that, four of them are placed at 0.25 m and the fifth one is at 0.5m from the axis of rotation The rotational kinetic energy is 144J when the beads were rotating with angular speed of 48rad/s. What is the mass of each bead? A. 0.5Kg B. 0.25Kg C. 0.75 Kg D. 1Kg

34. If the impulse of a rotating disc is non-zero, what can you conclude?

A. The change in linear momentum is zero.
B.The torque acting on object is constant.
C. Impulse of the disc equals its moment of inertia
D. The change in angular momentum is non zero.

# CHAPER 7

1. A ladder stands on the ground, leaning against a wall. It is safer climbing up the ladder if
   A. the ground is frictionless and the wall is rough B. the ground is rough and the wall is frictionless
   C. the ground if frictionless and the wall is frictionless
   D. the ladder leans at 45 degree and the ground is frictionless
2. A 10.0 m uniform ladder weighting 200 N rests against a frictionless wall. The ladder makes $53^0$ Angle with the horizontal. If the ladder is just on the average of slipping when a 600N firefighter is 6.00 m 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
3. The necessary and sufficient condition for rigid body to be in equilibrium is the sum of
   A. All torques acting on it is zero
   B. All forces acting on it should be zero
   C. All forces should be equal in magnitude, but opposite in direction to the sum of all torques acting on it
   D. All forces and the sum of all torques should be zero
4. A ladder of length 3m and mass 20kg leans against a smooth, vertical wall so that the angle b/n the wall and the ladder is $30^0$.what are the magnitude of the normal forces at the contact point on the wall($N_w$)and at the contact point on the ground?
   A. $N_w$=0 N, $N_g$=200N C. $N_W$=57.7N,$N_g$ =200N
   B. $N_W$200 N,$N_g$=0N D.$N_W$=200N,$N_g$=57.7N
5. A uniform ladder of length l and weight w = 50N rests against a smooth vertical wall. If the coefficient of static friction between ladder and ground is $\mu$=0.5 find the minimum $\geq \Theta_{min}$ between the ladder and ground such that the ladder will not slip. A. $45^0$ B. $53^0$ C. $60^0$ D.$37^0$
6. An Object of mass 3 kg hangs from three light inextensible wires as shown in Figure 6. Two of the wires make angles$\theta_1 = 53^0$ and $\theta = 37^0$ 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 N and $T_2$ = 24 N
   B. $T_1 = T_2$ = 18N
   C. $T_1 = T_2$ = 24N
   D. $T_1$ = 24 N and $T_2$= 18 N

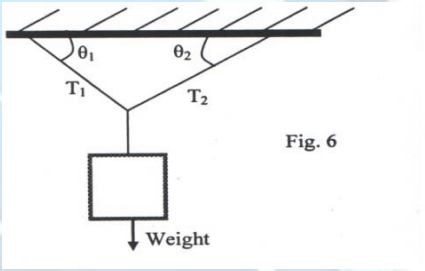
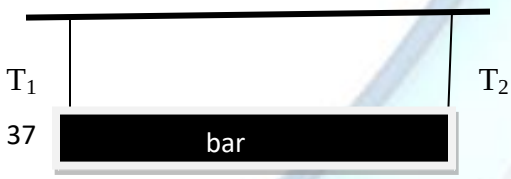


Fig. 6

7. Which one of the flowing statement is Not correct about a particle that is in equilibrium
   A. it can have a velocity different from zero C. It can be under the action of more than one force
   B. its velocity can be equal to zero D. It can have acceleration different from zero.
8. A uniform bar of length 2.0 m and mass 30.0 kg is supported by two massless ropes, which are attached to a fixed horizontal bar, as shown in figure 5. What are the tensions in each rope when a 700N weight is suspended at d = 0.50m from the left end of the bar?
   A.$T_1$ = 675 N and $T_2$ = 325N
   B. $T_1$= 325 N and $T_2$ = 675 N



C. $T_1$ 500 N and $T_2$ = 500 N

D. $T_1$= 525 N and $T_2$ = 175N

d  weight

9. If the impulse of a rotating disc is non-zero, what can you conclude?

A. The change in linear momentum is zero. C. Impulse of the disc equals its moment of inertia.

B. The torque acting on object is constant D. The change in angular momentum is non zero

10. For a body to be in equilibrium, which of the following conditions must exist?

A. no forces may be acting on the body C. the velocity of the body must be zero.

B. the body must be accelerating. D. the sum of the forces acting on the body must be equal to zero.

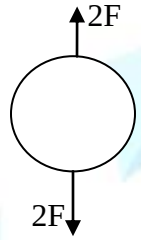
11. Which of the following is a correct statement about the first condition of equilibrium?

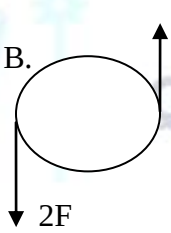
A. The sum of all torques must be zero B. The net force on an object must be zero

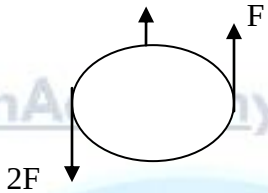
C. Clockwise moments should balance counter clockwise moments

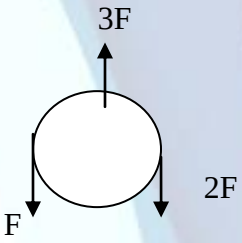
D. The torque produced by a force should be perpendicular to the force

12. From the figures given below, which one is in equilibrium?

A. 


B. 


C. 


D. 


13. Which of the following statement is NOT correct?

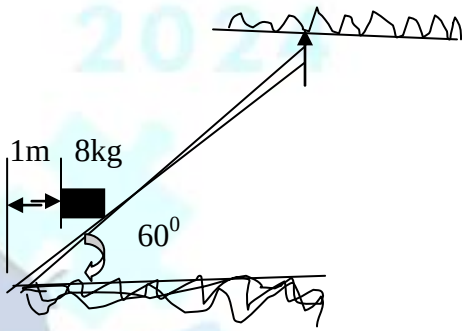
A. Dynamic equilibrium is an equilibrium in which a body is moving at steady velocity without net torque acting on it

B. Static is an equilibrium in which a body is at rest without net torque or force acting on it

C. Couples are set of forces with a resultant torque but no net force

D. The necessary and sufficient condition for equilibrium of a rigid body is to have the sum of all torques acting on it is zero

14. A 4m long uniform board of mass 10kg hinged on the ground at one end is hanging by a string at the other end. A block of mass 8kg is placed at 1m from the hinge on the ground as shown in the diagram below. What is the tension in the string?




A. 10N C. 50N

B. 70N D. 110N

29. Which of the following statement is correct about the first condition of equilibrium?

A. The net force on the object must be zero C. Clockwise moments should balance counter clockwise moment

B. The sum of all torques must be zero D. The torque produced by a force should be perpendicular to the force

30. Two forces $\vec{F}_1 = 3i\ N$ *and* $\vec{F}_2 = 4j\ N$ are acting on particle of mass m. What is the magnitude and direction of a force that balances the two?

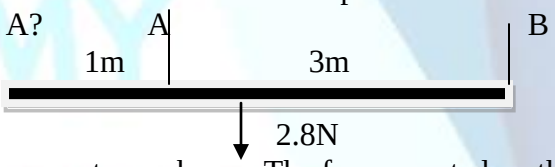
A. $\vec{F}$ =7N at $127^0$ counterclockwise from $\vec{F}_2$

B. $\vec{F}$=7N at $127^0$ counterclockwise from $\vec{F}_1$

C . $\vec{F}$=5N at $143^0$ counterclockwise from $\vec{F}_2$

D. $\vec{F}$ = 5N at $143^0$ counterclockwise from $\vec{F}_1$

31. The rod shown, in the figure below is uniform and its weight is 2.8 N. The length of the rod is 3.0 m. Two ropes A and B keep the rod in horizontal position. Rope A is 1m from one end and rope B is at the other end of the rope. What is the calculated value of the tension in rope A?




A. 14N

B. 0.7 N

C 2.8 N D 2.1N

32. A uniform, 6m long, and 600-N beam, rests on two supports, as shown. The force exerted on the beam by the right support B is closest to:



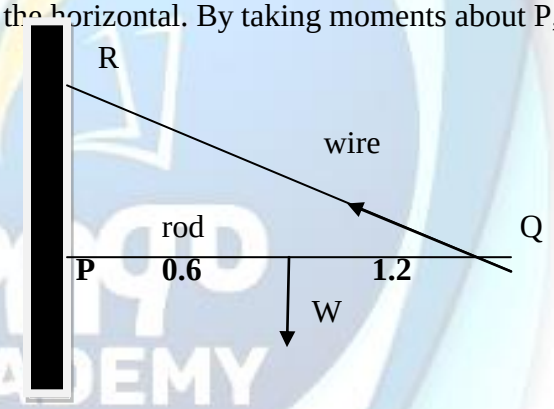

A.75 N.

B.240 N.

C. 400 N.

D.320 N.

33, A rod PQ is attached at P to a vertical wall, as Sow n the gure below. The length of the rod is 1.80 m. The weigh W of the rod acts at 0.60 m from P. The rod is kept horizontal and in equilibrium by a wire attached to Q and the wall at R. The wire provides a force F on the rod of 0 N at 30° to the horizontal. By taking moments about P, determine the weight W of the rod.




A. 130.0 N C. 75.0N

B.150.0 N D.50.0 N

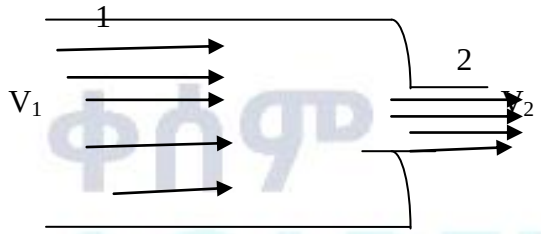
# CHAPER 8

1. Which of the following combinations of properties would be most desirable for a cooking pot?
   A. High specific heat and low conductivity  C .High specific heat and high conductivity
   B. Low specific heat and high conductivity  D. Low specific heat and low conductivity
2. Streamlined objects move more easily through fluids than those of irregular shape. What is the reason for this to happen?
   A. Turbulence is decreased  C. turbulence is increased
   B. Velocity is increased  D. viscosity is decreased
3. Which of the following term correctly describes the mechanism of heat transfer by which you get heat by holding a piece of metal? A, convection  B, conduction  C, radiation  D, none
4. Given the following information: the body surface area is $1.8m^2$ the clothing is 1.0 cm thick. Skin surface temperature is 33 $^0$C, whereas the outer surface of the clothing is $1^0$C, the thermal conductivity of the clothing is 0.04 w/m.k. What is the rate at which body heat flows out through the clothing of a man?
   A. 22.04w  B. 23.04w  B. 2.30w  D. 230.4w
5. Young's modulus is the
   A. Ratio of stress to strain  C. Ratio of strain to stress
   B . Force per unit area  D. Force per unit elongation
6. A large storage tank is filled to a height $h_0$.if the tank is punctured a height h from the bottom of the tank, how far from the tanks bottom will the stream land?
   A. $2\sqrt{h(h_0+h)}$  B. $\sqrt{h(h_0-h)}$  C. $\sqrt{h(h_0+h)}$  D. $2\sqrt{h(h_0-h)}$
7. A garden hose has an inside diameter of 16cm. the house can fill a 10 liter bucket in 20 seconds. If the diameter of the nozzle is reduced to 8cm.
   A. Water exits with a p[speed twice the speed inside the hose. C. A 20-litter bucket can be filled in 40 seconds.
   B. A 10-litter bucket can be filled in 10 seconds.  D. Water exits with a speed half the speed inside the hose
8. When stretched beyond its elastic limit, a metal rod such as steel
   A. Becomes elastic  B . Has no energy  C. Obeys Hook's law  D. becomes plastic
9. What does the value of Reynolds number signify?
   A. It describes the magnitude of the viscosity of the liquid
   B. It describes the magnitude of the viscosity of the liquid
   C. It describes whether the flow is stream lined or turbulent.
   D. It describes the magnitude of the surface tension of the liquid.
10. The pressure at the bottom of a cylindrical tube filled with water was measured to be 5000 pa. If the water in the tube were replaced with ethyl alcohol. What would be the new pressure at the bottom of the tube?(The density of ethyl alcohol is $0.8g/cm^3$)
    A.4000 Pa  B.4800 pa  C. 5000 Pa  D. 6225 Pa
11. Water flows through a fire hose of diameter 6.35 cm at rate of $0.012\ \frac{m3}{s}$. The fire hose ends in a nozzle of inner diameter 2.20 cm. what is the speed with which the water exits the nozzle?
    A. $23.4\ \frac{m}{s}$  B. $63.2\ \frac{m}{s}$  C. $31.6\ \frac{m}{s}$  D. $46.8\ \frac{m}{s}$
12. Which statement is correct about the pressure under a fluid in a container?

A. It depends on the volume of the fluid C. It depends on the shape of the container
B. It depends on the density of the fluid D. It is independent of the depth of the fluid

13. A table – tennis ball that is spherical in shape has a diameter of 6cm and average density of 0.400 g/cm$^3$. What force is required to hold it completely submerged under water?
A. 0.68 N down ward B. 1.13 N downward C. 0.68N upward D. 1.13 N upward
14. When a load of 500 kg is hanging from a steel wire of length 3 m and cross sectional area 0.20 cm$^3$, the wire stretches beyond its no –load length. If the Young's modulus for the wire made of steel is Y = 2x $10^{11}$ pa, what is the change in length of the wire beyond its no – load length?
A. 3.75 mm B. 2.75mm C. 1.75mm D. 0.75mm
15. 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 80 kpa and the pressure in the smaller pipe is 60 kpa, at what speed does the water flow through the smaller pipe?
A. 1.63 m/s B. 6.53 m/s C. 13.6 m/s D. 42.67 m/s
16. A glass flask whose volume is exactly 1000 cm$^3$ at 0 $^0$C is totally filled with 1000 cm$^3$ of mercury at this temperature. When flask and mercury are heated to 100 $^0$C , 15.2cm $^3$ of mercury overflow. If the coefficient of volume expansion of mercury is 1.82 X 10 $^{-4}$ per Celsius degree, what should be the coefficient of volume expansion of the glass?
A. 1.52 X $10^{-4}$/C0 C. 3.00X $10^{-5}$/C0
B. 1.82 X $10^{-4}$/C0 D. 1.00 X $10^{-5}$/C0
17. Through a pipe 15cm in diameter water is pumped from the river outside of Addis Ababa to one of the sub-cities of Addis Ababa. The river is at an elevation of564m and the sub-city is at an elevation of 2096m. What is the minimum pressure at which the water must be pumped if it is to arrive at the sub-city?
A. 15.32Mpa B. 15.01Mpa C. 14.99Mpa D. 16.03Mpa
18. Water flows through a pipe whose cross-sectional area is 50cm$^2$ into another pipe whose cross-sectional area is 10cm$^2$. Both pipes are horizontal. If the velocity of the water in the large pipe is 12m/s, the velocity in the small pipe is
A. 0.24m/s B. 1.2m/s C. 60m/s D. 30m/s
19. A very large open tank is full of oil whose density is 800kg/m$^3$. If the absolute pressure at the bottom of the tank is 1.81x$10^5$pa, then what is the depth of the oil? $P_0$ =101K$P_a$
A. 100.0m B. 75.0m C. 10.0m D. 9.5m
20. A container resting on the floor of an elevator contains an incompressible fluid of density p. when the elevator has an upward acceleration of magnitude 'a' then , what will be the pressure difference b/n two points in the fluid separated by a vertical distance Δh?
A. ρaΔh B. ρ(g+a)Δh C. ρgΔh D. ρgaΔh

21 A fluid flows through a horizontal pipe, shown in the figure below. If the velocity of the flow at 2 is twice at 1, how does the pressure P change between the two points?




A. $P_1<P_2$ C. $P_1>P_2$
B. $P_1=P_2$ D. $P_1-P_2>$ change in kinetic energy density

22. The cross-sectional area of a pipe entering the basement is $4x10^{-4}m^2$.the pipe carries water into the basement at a velocity of 6m/s. the pressure at the basement is $3x10^{+5}N/m^2$.what are the speed and pressure when it reaches the 2nd floor, which is 8m above the basement if the cross-sectional area of a water pipe is half of its value at the basement?

A. 12m/s, $1.66x10^{+5}N/m^2$ C. 24m/s, $1.12x10^{+5}N/ms$
B. 12m/s, $2.12x10^{+5}N/m^2$ D. 18m/s, $2.12x10^{+5}N/m^2$

23. Young's modulus is the

A. Ratio of stress to strain B. Force per unit area C. Ratio of strain to stress D. Force per unit elongation

24. It A table – tennis ball has a diameter of 3.80 cm and average density of 0.084 $g/cm^3$. What force is required to hold it completely submerged under water?

a. 0.521N b.0.258 N c. 0.300 N d. 0.510 N

25. The length of an aluminum rod at a temperature of $20^0$ c is 3m.what will be the ratio of change in the length of the rod to its original length if its temperature is raised to $120^0$ c? The coefficient of liner expansion of aluminum is $3.31x10^{-5}/k$

A. 23% B. 3.2% C.0.33% D. 0.23%

26. When stretched beyond its elastic limit, a metal rod such as steel

A. Becomes elastic B . Has no energy C. Obeys Hook's law D. Becomes plastic

27. A very large open tank is full of oil whose density is $800kg/m^3$. If the absolute pressure at the bottom of the tank is $1.81x10^5$ pa, them what is the depth of the oil?

A. 100.0m B. 75.0m C. 10.0m D. 9.5m

28. Pressure at the bottom of a liquid column is independent of:

A. Shape of the column C. the depth of the point
B. The density of the fluid D. the acceleration due to gravity

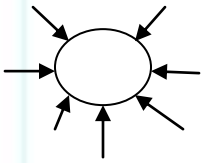
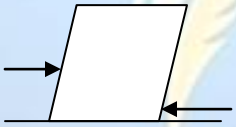
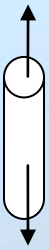
29. The definition of Young's Modulus is given by:

A. Force per unit area. B. Ratio of strain to stress C. ratio of stress to strain D. force per unit elongation

30. A water pipe has a diameter of 5.0cm in the inlet side and 1.5 cm in outlet side. Water flows at $0.50m^3$ per minute at the inlet point. What is the speed of the water at the outlet point?

A. 26.67m/s B. 13.33m/s C. 74.1m/s D. 148.1m/s

31. A metal ball has a diameter that is slightly greater than the diameter of a hole that has been cut into a metal plate. The coefficient of linear expansion for the metal from which the ball is made is greater than that for the metal of the plate. Which of the following procedures can be used to make the ball pass through the hole?
    A. Raise the temperatures of the ball and the plate by the same amount.
    B. Heat the ball and cool the plate.
    C. Lower the temperatures of the ball and the plate by the same amount.
    D. There is no way of passing the ball through the hole.
32. A billiard ball of radius 4 cm is falling through a liquid of viscosity 0.985 at a velocity of 2.5m/s. The drag force on the ball is: A. $0.591\pi\ N$ B. $0.118\pi\ N$ C. $1.182\pi\ N$ D. $0.059\pi\ N$
33. Which one of the following statements is correct?
    A. Elastic materials retain their shape after deformation.
    B. Plastic materials can recover the original size or shape after being distorted.
    C. Plastic materials change their shape by pressure.
    D. Elastic materials cannot recover the original size or shape after being distorted.
34. A open cylindrical tank is filled with water to a height of 200m. A small hole is made at the side of the tank at a depth of 20m below the water surface. What is the maximum distance covered by the jet of water coming out from the small hole of the tank? A. 100m B. 150m C. 160m D. 120m
35. "The rate of loss of heat from a body is propertional to its excess temprature above its surroundings." This is:
    A. Pascal's law C. Stefan-Boltzman's law
    B. Newton's law of cooling D. Stoke's law
36. Young's modulus for aluminum is 7 x $10^{10}$ Pa. The force needed to stretch, an aluminum wire with 2 mm diameter and 800 mm length, by 1 mm is
    A. 2.75 N B. 275 N C.1.10 N D. 275 kN
37. Which of the following figure indicates tensile deformation?

A.  B.  C.  D. 

38. A beaker with water resting on scale weighs 40N. A block suspended on a hanging spring weighs 20N. The spring scale reads 15N when a block is fully submerged in the water. What is the reading of a scale on which the beaker with water rests, while the block is submerged in the water after detached from the hanging spring?
    A. 60N B. 45N C. 55N D.25N
39. An object with a mass of 150kg and volume 0f 0.75$m^3$ is floating in a liquid of density 0.8g/$cm^3$. What Percentage of the object's volume will be submerged below the surface of the fluid?
    A. 75% B.50% C. 25% D. 100%
40. In the figure below, what is the speed of water as it leaves $A_2$?



A. 0.3m/s B. 0.9m/s C. 3.3m/s D. 3.6m/s

41. A large (very large in height and cross-section) water tank open at the top has a small hole through its side near the bottom. To height should the water be filled, to double the speed of water that flow out of the hole when it filled to a height h?

A. H B. 2h C. 3h D. 4h

42. Which of the following is application of Pascal's law?

A. Hydraulic brake in vehicles
B. Siphon to remove fluids
C. working of submarines
D. sucking of liquid into a syringe

43. Which of the following refers to the definition of strain as a ratio?

A. Extension to the original length
B. Force applied to area of the object normal to the force
C. Stress to Young modulus
D. Tensile to applied force

44. Which of the following statement is correct about elastic behavior of materials?

A. In tensile stress the force is parallel to the cross-sectional area, where as in shear stress, the force is perpendicular to the area.
B. All materials do not necessarily have elastic limit.
C. For sufficiently small stress, stress is proportional to strain.
D. With plastic materials, the body goes to original dimensions after removal of the force that caused deformation.

45. A fluid of unknown density filled in a beaker of 250 $cm^3$. The pressure due to the fluid at the base of the beaker is 2.30 Pa. The base area of the beaker is 102 $cm^2$. What is the density of the fluid?

A. 92 $kg/m^3$ B. 7900 $kg/m^3$ C. $9.2x10^6 kg/m^3$ D. 9200 $kg/m^3$

46. Which of the following statement is correct?

A. Surface tension is proportional to the length along with the surface tension force acts.
B. Surface tension pulls the liquid column up until there is Sufficient mass of liquid for weight to overcome the intermolecular forces.
C. The angle between the wall of a container and the liquid Surface has no role on the capillary action
D. In a given tube, the capillary action is large for a liquid of larger density.

47. Water flows at a rate of 0.4 litter per second through garden hose of inside diameter 40 cm. The nozzle of the hose is a circular opening of diameter 2.0 cm. What is the speed of the water when it emerges? ($\pi$=3.14)

A.0.52 m/s B. 12.7 m/s C 3.2 m/s D. 1.2m/s

48. How much heat would be absorbed by 2g of ice at $0^0$c dropped into water at $0^0$c, to melt it totally to water at $0^0$? (Latent heat of melting L=340,000J/Kg)

A. 340J B. 8403 C. 680J D. 420J

49. Pressure at the bottom of a liquid column is independent of:

A. shape of the column.
B. the density of the fluid.
C.the depth of the point
D. the acceleration due to gravity.

50. The definition of Young's Modulus is given by:

(A) force per unit area
(B) ratio of strain to stress.
C. ratio of stress to strain.
(D) force per unit elongation.

51. A water pipe has a diameter of 5.0 cm in the inlet side and 1.5 cm in outlet side. Water flows at 0.50 m per minute at the inlet point. What is the speed of the water at the outlet point?

(A) 26.67 m/s (C) 74.1 m/s (B) 13.33 m/s (D) 148.l m/s

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