Shri Swami Vivekanand Shikshan Sanstha, Kolhapur's

Vivekanand College, Kolhapur

(Empowered Autonomous)

Department of Physics

B. Sc. / M.Sc. Part – I, Semester – I, PHYSICS Paper - _____

Title of the Paper: Mechanics - I Surprise Test

Name of Teacher: Dr. Namrata Narewadikar

Attendance Sheet

Sr. No.	Name of the Student	10-8-24	Marks				
1)	Jiya Salim Mulla	Jsmulla	14				
2)	Sai Sarjerao Navale	Snavale	12				
3)	Trupti D. chougale	Chougale	11				
4)	Saksshi . D. Sakhedkar	Sakhedkar	10				
5)	Shruti A. sutar	Asutar	08				
6)	Aditi Sandip Kumbhar	Akumbhar	11				
7)	Arpita. B. Patil	A.B.Patil	12				
8)	Sakshi. G. Chougule	Schougule	14				
9)	Nikhil. S. Salokhe	NSS	09				
10)	Parth. P. Gavali.	P.P.G	13				
11)	Vinit N. Magdum	Vnith..	11				
12)	Surat . D. Jelpale	S.D.J.	08				
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Vivekanand College (Empowered Autonomous), Kolhapur

Department of Physics

B.Sc.-I SEM- I **Surprise Test**, August-2024

Question 1. Multiple Choice questions **(1mark Each)**

1. **Which of the following is a scalar quantity?**
   a) Velocity b) Force c) Work d) Displacement
2. **The magnitude of a vector is always:**
   a) Negative b) Zero c) Positive or zero d) Positive
3. **If two vectors A and B are perpendicular to each other, their scalar (dot) product is:**
   a) Maximum b) Minimum c) Zero d) Equal to their vector product
4. **The result of the cross product of two parallel vectors is:**
   a) A scalar b) A vector perpendicular to the original vectors
   c) Zero vector d) Maximum magnitude vector
5. **The scalar triple product of vectors A, B and C represents:**
   a) Area of a triangle b) Volume of a parallelepiped
   c) Area of a parallelogram d) Volume of a tetrahedron
6. **Which of the following expressions represents the vector triple product?**
   a) $A\cdot(B\times C)$ b) $(A\times B)\times C$ c) $(A\times B)\cdot C$ d) $A\times(B\cdot C)$
7. **Which of the following is the distributive property of the cross product?**
   a) $A\times(B+C)=A\times B+A\times C$ b) $A\cdot(B+C)=A\cdot B+A\cdot C$
   c) $(A+B)\times C=A\times C+B\times C$ d) Both a and c
8. **If $A\times B=C$, then the magnitude of C is given by:**
   a) $|A||B|\sin\theta$ b) $|A||B|\cos\theta$ c) $|A||B|\tan\theta$ d) $|A||B|$
9. **The vector triple product identity is:**
   a) $A\times(B\times C)=B(A\cdot C)-C(A\cdot B)$ b) $A\cdot(B\times C)=B\cdot(C\times A)$
   c) $A\times(B\times C)=C(A\cdot B)-B(A\cdot C)$ d) $(A\cdot B)\times C=A\times(B\cdot C)$
10. **The result of the scalar triple product $A\cdot(B\times C)$ is:**
    a) A vector perpendicular to A b) A scalar

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c) A vector parallel to B d) Zero

Question 2: Short Answer Questions (Solve any 5) **(2M Each)**

1. Define a scalar quantity and give two examples.
2. What is a vector? Provide an example.
3. State the geometric meaning of the scalar product (dot product) of two vectors.
4. Write the expression for the vector product (cross product) of two vectors A and B.
5. Explain the significance of the scalar triple product in vector analysis.
6. State and prove the vector triple product identity.
7. If $A \times B = 0$, what can you infer about vectors A and B?
8. What is the difference between a scalar product and a vector product?
9. Calculate the magnitude of the vector product $A \times B$ if $|A|=3$, $|B|=4$, and the angle between A and B is $30°$.
10. What does it mean when the scalar triple product of three vectors is zero?

Name : Suraj . D. Yelpale .

date :- 10-08-2024 .

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Roll No. :

Class : BSc I

Subject : physics

Test / Tutorial No. : Surprise test.

Div. : BSc - I

08/20

1) d) displacement

2) d) positive.

3) c) zero

4) c) zero vector.

5) b) volume of parallelopiped.

6) b) $A \times (B \times C)$

7) d) both a & c

8) Addition.

9) b) $A \times (B \times C) = B(A \cdot C) - C(A \cdot B)$

10) b) A scalar

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Q2)

1) Scalar quantity :-

Scalar quantity have dot product. 91 obey's commutative law.

properties :- 1) $\bar{A}.\bar{A} = A^2$

2) $\hat{i}.\hat{i} = \hat{j}.\hat{j} = \hat{k}.\hat{k} = 1$

$\hat{i}.\hat{j} = 0 \quad \hat{j}.\hat{k} = 0 \quad \hat{k}.\hat{i} = 0$

3) $\bar{A}.\bar{B} = |A||B|\cos\theta$.

ex. 1) $\bar{A} = \hat{i} + \hat{j} + \hat{k} \qquad \bar{B} = \hat{i} - \hat{j} + \hat{k}$

$\bar{A}.\bar{B} = (\hat{i}+\hat{j}+\hat{k}).(\hat{i}-\hat{j}+\hat{k})$

$= 1 - 1 + 1$

$= 1$

2) $\bar{A} = 2\hat{i} - 3\hat{j} + \hat{k} \qquad \bar{B} = \hat{i} - \hat{j} - \hat{k}$

$\bar{A}.\bar{B} = (2\hat{i} - 3\hat{j} + \hat{k}).(\hat{i} - \hat{j} + \hat{k})$

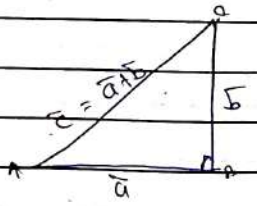
$= 2 + 3 - 1$

$= 4$

2) vector :-

vector has types of vector. i.e. polar vector, unit vector, vector (cross product), scalar (dot product), scalar triple product, vector triple product, Addition vector,

i) Addition vector



$AC = AB + BC$

$\bar{c} = \bar{a} + \bar{b}$

ii) Unit vector :- $\hat{a} = \frac{a}{|a|}$

iii) Scalar product. $\bar{A} = x_1\hat{i} + y_1\hat{j} + z_1\hat{k}$ $\bar{B} = x_2\hat{i} + y_2\hat{j} + z_2\hat{k}$

$\bar{A}.\bar{B} = (x_1\hat{i} + y_1\hat{j} + z_1\hat{k}) . (x_2\hat{i} + y_2\hat{j} + z_2\hat{k})$ using $\hat{i}.\hat{i} = \hat{j}.\hat{j} = \hat{k}.\hat{k} = 1$

$= (x_1x_2)\hat{i} + (y_1y_2)\hat{j} + (z_1z_2)\hat{k}$ $\hat{i}.\hat{j} = \hat{j}.\hat{k} = \hat{k}.\hat{i} = 0$

iv) vector product $\bar{A} = x_1\hat{i} + y_1\hat{j} + z_1\hat{k}$ $\bar{B} = x_2\hat{i} + y_2\hat{j} + z_2\hat{k}$

$\bar{A} \times \bar{B} = (x_1\hat{i} + y_1\hat{j} + z_1\hat{k}) \times (x_2\hat{i} + y_2\hat{j} + z_2\hat{k})$ using $\hat{i}\times\hat{i} = \hat{j}\times\hat{j} = \hat{k}\times\hat{k} = 0$

$\hat{i}\times\hat{j} = \hat{k}$, $\hat{j}\times\hat{k} = \hat{i}$, $\hat{k}\times\hat{i} = \hat{j}$

$$\bar{A}\times\bar{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \end{vmatrix} = \hat{i}(y_1z_2 - y_2z_1) - \hat{j}(x_1z_2 - x_2z_1) + \hat{k}(x_1y_2 - x_2y_1)$$

vector product have a magnitude as well as direction.

It obey's Anti commulative law.

v) Vector product.

Let vector $\bar{A} = x_1\hat{i} + y_1\hat{j} + z_1\hat{k}$

& vector $\bar{B} = x_2\hat{i} + y_2\hat{j} + z_2\hat{k}$

Using properties $\hat{i}\times\hat{i} = \hat{j}\times\hat{j} = \hat{k}\times\hat{k} = 0$ &

$\hat{i}\times\hat{j} = \hat{k}$, $\hat{j}\times\hat{k} = \hat{i}$, $\hat{k}\times\hat{i} = \hat{j}$

Then $\bar{A}\times\bar{B} = (x_1\hat{i} + y_1\hat{j} + z_1\hat{k}) \times (x_2\hat{i} + y_2\hat{j} + z_2\hat{k})$

also write.

$$\bar{A}\times\bar{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \end{vmatrix}$$

$\therefore \bar{A}\times\bar{B} = \hat{i}(y_1z_2 - y_2z_1) - \hat{j}(x_1z_2 - x_2z_1) + \hat{k}(x_1y_2 - x_2y_1)$

Q 8)

Scalar product	Vector product
i) is have a magnitude	i) it have a magnitude & direction
ii) have a dot product	ii) have a cross product
iii) $\bar{A}.\bar{B} = \|A\|\|B\| \cos\theta$	iii) $\bar{A}\times\bar{B} = \|A\|\|B\| \sin\theta$
iv) $0 \leq \theta \leq \pi$	iv) $\theta = 90$ ~~$\theta \leq 180$~~

9) $A \times B = ?$

Given

$\Rightarrow |A| = 3 \quad |B| = 4$

$A \times B = |A||B| \sin\theta$

$= |B||A| \sin 30^\circ$

$= \frac{12}{2}$

$A \times B = 6$

Sakshi Chougule
09-08-24

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Roll No. :	Test / Tutorial No. : Surprise Test
Class : BCC-FY	Div. : A

Q.1

1) d) Displacement 01

2) b) zero 00

3) c) zero 01

4) d) Maximum magnitude vector. 0

5) b) Volume of a Parallelepiped 01

6) a) $(A \times B) \cdot C$ 02

7) d) Both a and C 0

8) a) $|A||B| \sin\theta$ 01

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9) a) $A \times (B \times C) = C(A \cdot B) - B(A \cdot C)$

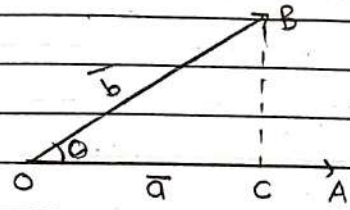
10) d) zero

Q.2 8)

Scalar product	Vector product
1) It is called as dot product	1) It is called as Cross product
2) It obey distributive law $\bar{A} \cdot (\bar{B} \cdot \bar{C}) = \bar{A} \cdot \bar{B} + \bar{A} \cdot \bar{C}$	2) It does not obey Commetative law $\bar{A} \times \bar{B} \neq \bar{B} \times \bar{A}$ $\bar{A} \times \bar{B} = -\bar{A} \times \bar{B}$
3) Scalar product Maximum at $\theta = 0$ $\bar{a} \cdot \bar{b} = \lvert\bar{A}\rvert \lvert\bar{B}\rvert \cos\theta = ab$	3) Vector product Maximum at $\theta = 90^\circ$
4) $\hat{i} \cdot \hat{i} = \hat{j} \cdot \hat{j} = \hat{k} \cdot \hat{k} = 1$	4) $\hat{i} \cdot \hat{i} = \hat{j} \cdot \hat{j} = \hat{k} \cdot \hat{k} = 0$
5) $\hat{i} \cdot \hat{j} = \hat{j} \cdot \hat{k} = \hat{k} \cdot \hat{i} = 0$	5) $\hat{i} \cdot \hat{j} = \hat{j} \cdot \hat{k} = \hat{k} \cdot \hat{i} = 1$ $\hat{i} \cdot \hat{j} = \hat{k}$, $\hat{j} \cdot \hat{k} = \hat{i}$, $\hat{k} \cdot \hat{i} = \hat{j}$ or $\hat{j} \cdot \hat{i} = -\hat{k}$, $\hat{k} \cdot \hat{j} = -\hat{i}$, $\hat{i} \cdot \hat{k} = -\hat{j}$

Q.2

(3)



The Scalar product of two vector is product of Magnitude of one vector and length of projection of another vector in the direction of 1st vector.

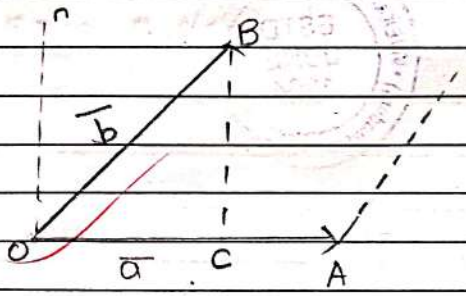
$$\bar{a}\cdot\bar{b} = |\bar{A}||\bar{B}|\cos\theta$$
$$= OA \cdot \frac{OB \cdot BC}{OB}$$
$$= OA \cdot BC.$$

$OA = \bar{a}$

BC = Is length projection in the direction of 1st vector.

(4) Expression for the vector product.

The vector of two vector having magnitude of one vector and product of magnitude of another vector and the sine angle bet^n the two vector.



$\bar{a} \times \bar{b} = |\bar{A}||\bar{B}| \sin\theta$

$= OA \cdot OB \cdot \frac{OC}{OB}$

$= OA \cdot OC$

= Base × hight

(5) Significance of the scalar triple product

1) Scalar triple product gives the volume of parallelepiped

2) Scalar triple product remain unchanged even through order is changed

$$\bar{a}(\bar{b} \times \bar{c}) = (\bar{b} \times \bar{a})\bar{c} = (\bar{a} \times \bar{c})\bar{b}$$

3) When the order is changed (-ve) sign come out

$$\bar{a}(\bar{b} \times \bar{c}) = -\bar{a}(\bar{c} \times \bar{b})$$

4) In the scalar triple product dot product intercept with cross

$$\bar{a} \cdot (\bar{b} \times \bar{c}) = (\bar{a} \times \bar{b}) \cdot \bar{c}$$

(9) ~~A×B~~ $|A| = 3$, $|B| = 4$, $\theta = 30^\circ$

$A \times B = |A||B| \cos\theta$

$= 3 \times 4 \times \cos 30^\circ$

$= 12 \times \cos 30^\circ$

Nikhil Nikhil Magdum

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Class : BSc - FY

Signature of Supervisor : 11/20

Subject : Physics

Test / Tutorial No. : surprise test

Div. :

Ques 1

1] c] Work

2] c] Positive or zero

3] c] zero

4] c] zero vector

5] b] Volume of parallelopiped

6] b] $(A \times B) \times C$

7] d] Both a & c

8] a] $|A||B| \sin\theta$

9] b] $A \cdot (B \times C) = B \cdot (C \times A)$

10] b] A scalar

Ques 2

1] scalar quantity :-

The scalar product or dot product specify as the magnitude of object only. both of them the vector and the cosin of the angle bet^n them

$\bar{a} \cdot \bar{b} = |a||b| \cos\theta$

θ is the angle bet^n two vectors

The product of $a \cdot b$ is scalar quantity. Then the θ is positive angle.

~~Example~~ property :

① scalar product obey cumicative law

② $\bar{A} \cdot \bar{A} = A^2$

Example = ① work

① $\bar{A} = \hat{i} + 2\hat{j} + 3\hat{k}$ & $B = 4\hat{i} + \hat{j} + 2\hat{k}$

$(A \cdot B) = (\hat{i} + 2\hat{j} + 3\hat{k}) \cdot (4\hat{i} + \hat{j} + 2\hat{k})$

$= 4\hat{i} + 2\hat{j} + 6\hat{k}$

$= 4 + 2 + 6$

$= 12$

② $\bar{A} = 8\hat{i} - 6\hat{j} + 4\hat{k}$ $\bar{B} = 9\hat{i} + 5\hat{j} + 3\hat{k}$

$(A \cdot B) = (8\hat{i} - 6\hat{j} + 5\hat{k}) \cdot (9\hat{i} + 5\hat{j} + 3\hat{k})$

$= 72 + 30 + 12$

$= 42 + 12$

$= 54$

Q e] Vector product or cross product :-

The vector product or cross product specify as a magnitude & direction of a object

$|a||b| \sin\theta$

then θ is angle betn them

Example :- ① displacement,
② velocity.

Q ④ expression of vector product

$\bar{A} \times \bar{B} =$

$\bar{A} =$

Q8

vector product	scalar product
① It have magnitude & direction	① It have only magnitude
② havet cross product	② having dot product
③ $\bar{A} \times \bar{B} = \lvert a \rvert \lvert b \rvert \sin\theta$	③ $\bar{A} \cdot \bar{B} = \lvert a \rvert \lvert b \rvert \cos\theta$
④ ~~$0 \leq \theta \leq$~~ $\theta = 90°$	④ $0 \leq \theta \leq \pi$

0½

Q9

Given

$|A| = 3 \qquad |B| = 4$

$A \times B = |A||B| \sin\theta$

$= |3||4| \sin\theta$

$= \frac{12}{2}$

$A \times B = 6$

0½

Name- Nikhil Sunil. Salokhe.

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Q.1 M.C.Q.

i] → d] Displacement

ii] → d] positive

iii] → b] Minimum

iv] → b] a vector perpendicular to the original vectors

v] → ~~d] A x (B x C)~~ c] Area of a parallelogram.

vi] → a] A.(B x C)

viii]

→ d] Both a and c

0/

viii]

→ a] $|A||B| \sin\theta$

0/

xi]

→ c] $A \times (B \times c) = c(A \cdot B) - B(A \cdot c)$

0/

x]

→ b] A scalar

Q.2

1]

→ The quantity which gives magnitude only this quantity is called scalar quantity.

0/

Example: Velocity, Force, work, Displacement, energy Heat etc.

2]

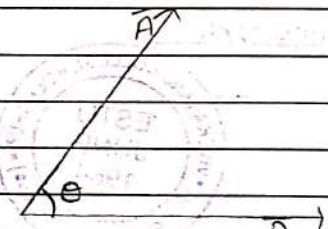
→ The quantity which gives direction and as well as magnitude this is called vector

0/

Example: work, displacement, Force.

3]

→ The product of two vectors is always



$a \cdot b = |\bar{a}||\bar{b}| \cos\theta$

$= ab\cos\theta$

the scalar product of two vector is minimum.

$a \cdot b = |\bar{a}||\bar{b}| \cos\theta$

$= ab \cos\theta \quad (\cos 0 = 1)$

$= ab$

The scalar product of two vector is maximum.

$a \cdot b = |\bar{a}||\bar{b}| \cos\theta$

$= ab \cos\theta$

$= -ab \quad (\cos 180^\circ = -1)$

8]

→

scalar product	vector product.
1] It is scalar quantity	1] It is vector quantity
2] It obeys commutative law	2] It doesn't obey commutative law
3] $a \cdot b = \lvert\bar{a}\rvert\lvert\bar{b}\rvert \cos\theta$ $= ab\cos\theta$	3] $a \times b = \lvert\bar{a}\rvert\lvert\bar{b}\rvert \sin\theta$ $= ab\sin\theta$
4]	

9]

→

$|A| = 3 \quad |B| = 4$

$|A \cdot B| = \sqrt{A^2 + B^2}$

$= \sqrt{3^2 + 4^2}$

$= \sqrt{9 + 16}$

$= \sqrt{25}$

magnitude = 5

$\cos\alpha =$ [redacted]/5

$\cos\beta =$ [redacted]

$|A \times B| = |A||B| \sin\theta$

$= 3 \times 4 \sin 30$

$= 3 \times 4 \times \frac{1}{2}$

$= 6$

Date:- 10/9/2024

Parth Prakash Gavali.

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Class : B.Sc - I	Div. :

Q. 1

1]

→ c] work

2]

→ c] positive or zero

01

3]

→ c] zero

01

4]

→ d] zero vector

01

5]

→ b] volume of a parallelopiped

01

6]

→ b] $(A \times B) \times C$

01

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7]

→ d] Both a & c

8]

→ a] $|A||B|\sin\theta$

9]

→ b] $A\cdot(B\times C)=B\cdot(C\times A)$

10]

→ b] A scalar.

Q.2

1)

→ The quadity which gives magnitude only this quantity is called scalar quantity.

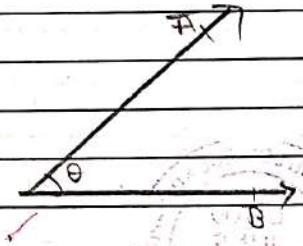
e.g. velocity, force,

2)

→ The quantity which gives direction and as well as magnitude is called vector.

e.g. work

3]



The product of two vectors is always.

$a\cdot b=|\bar{a}||\bar{b}|\cos\theta$

$=ab\cos\theta$

8]

scalar product	vector product
1] It is scalar quantity.	1] It is vector quantity.
2] It obeys commutative law	2] It doesn't obeys commutative law.
3] $a \cdot b = \lvert\bar{a}\rvert\lvert\bar{b}\rvert \cos\theta$ $= ab\cos\theta$	3] $a \times b = \lvert\bar{a}\rvert\lvert\bar{b}\rvert \sin\theta$ $= ab\sin\theta$

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