

PHYSIC MODEL EXAMINATION FOR GRADE 12-STUDENTS (2017E.C).**Number of Items:60****Time allowed: 1:30hrs****General directions**

Each of the following questions is followed by four possible alternatives. Read each question and write the letter of your best choice on the space answer sheet provided.

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

Name of constants	Symb ol	Value
Acceleration due to gravity	g	10 m/s ²
Charge of electron	e ⁻	1.6×10 ⁻¹⁹ C
Universal gravitational constant	G	6.67×10 ⁻¹¹ Nm ² /kg ²
Density of water	ρ	1000 kg/m ³
Magnetic permeability of free space	μ ₀	4π×10 ⁻⁷ Tm/A
Electric permittivity of free space	ε ₀	8.85×10 ⁻¹² F/m
Electrostatic force constant	K	9×10 ⁹ Nm ² /C ²
Speed of light in vacuum	C	3.0×10 ⁸ m/s ²
$\sin 30^\circ = \cos 60^\circ = 0.5$ $\sin 60^\circ = \cos 30^\circ = 0.87$ $\sin 45^\circ = \cos 45^\circ = \frac{\sqrt{2}}{2}$ $\sin 37^\circ$ $\sin 53^\circ =$		

1. Which one of the following is **NOT** true about the characteristics of vector operation?

- A) The dot product of two non-zero vectors is commutative.
- B) The scalar product of two orthogonal non- zero vectors is zero.
- C) The cross product of two orthogonal non- zero vectors is maximum.
- D) The dot product of a non-zero vector by itself is zero.

Answer -D

2. As shown in *figure-1*, the four-sided shape formed by vectors **a**, **b**, **c**, and **d** is parallelogram. What one of the following is **FALSE** about the operations of the vectors?

- A) $\mathbf{P} = \mathbf{b} + \mathbf{a}$
- B) $\mathbf{c} = \mathbf{d} + \mathbf{q}$
- C) $\mathbf{b} = \mathbf{a} + \mathbf{q}$
- D) $\mathbf{q} = \mathbf{d} + \mathbf{c}$

Answer-D

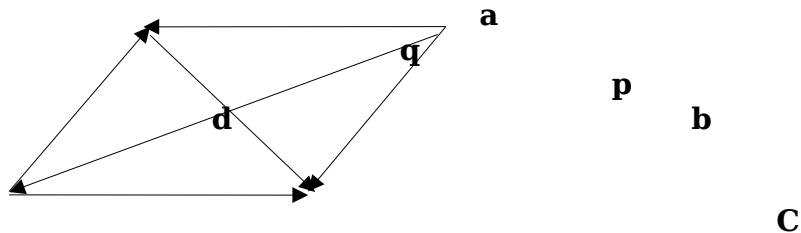


Figure -1

3. A ball of 0.2kg falls vertically and impacts horizontal ground with speed of 4m/s. The ball rebounds vertically with speed 3m/s. The ball was in contact with the ground for 40ms. What is the average force exerted on the ground by the ball?

- A) 35N
- B) 5N
- C) 2N
- D) 8N

Answer -A

4. Two vectors $2\hat{i} + 3\hat{j} + 4\hat{k}$ and $4\hat{i} - 4\hat{j} + \alpha\hat{k}$ are perpendicular to each other, and then what is the value α ?

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

Answer -C

5. Suppose an imaginary planet whose mass is equal to half of the earth and radius is one-third. If the acceleration due to gravity on the Earth's surface is g , then what will be the acceleration due to gravity on that planet?

- A) $(\frac{1}{2})g$
- B) $(\frac{9}{2})g$
- C) $(\frac{5}{2})g$
- D) $(\frac{3}{2})g$

Answer-B

6. On a cold day when a room temperature is 20°C , the metallic cap of a pen becomes much colder than its plastic body, though both are at the same temperature of 20°C , because

- A. metals have higher thermal capacity than plastics
- B. metals are good conductor of heat.

- C. plastics have a lower density than metals.
- D. plastics have a higher thermal conductivity than metals.

Answer-B

7. A jet plane lands with a speed of 100m/s and slow down at rate of 5m/s^2 as it comes to rest. The distance travelled by this jet travel to land on air port will be:
- A) 0.5km B) 1km C) 2km D) 3km

Answer-B

8. Which of the following wave types has the shortest wavelength and is used for certain communication technologies like satellite and radar?
- A) Infrared waves B) Radio waves C) Microwaves D) Gamma rays

Gamma rays

Answer-C

9. A force of 50N acts on a body and displaces it through a distance of 10meters in a direction making an angle of 60° with the force. What is the work done by the force?
- A) 100J B) 150J C) 200J D) 250J

Answer-D

10. Which of the following statements is **CORRECT** about the effect and formation of a magnetic field?
- A) A magnetic field exerts a non-zero force on a stationary charged object.
 - B) A magnetic field exerts a non-zero force on a conducting wire placed in a magnetic field.
 - C) A uniform magnetic field can be created at all points around a long current carrying wire.
 - D) A magnetic field can be created in the space surrounding and charged object that is in motion.

Answer-D

11. Three forces each having equal magnitude of 10N, are applied to an object on a horizontal surface. A force F_1 makes an angle of 30° above positive x-axis, F_2 makes 30° above the surface the negative x-axis, and the third force F_3 is directed along the positive x-axis. The magnitude and direction of their resultant force are respectively:

A) $10\sqrt{2}\text{N}$, in positive y-axis. C) $10\sqrt{2}\text{N}$, 45° above the positive x-axis.

B) 20N, 45° above the positive x-axis. D) 20N, in the negative y-axis.

Answer-C

12. Which of the following configurations provides both voltage and current gain in a transistor?

- A) Common-base C) Common-collector
- B) Common-emitter D) Both A and C

Answer-B

13. A manometer is used to measure the pressure in the tank. The fluid used has a relative density of .85, and the manometer column height is 55cm, as shown in *figure-2*. If the local atmospheric pressure is 96kpa, then what the value of absolute pressure within the tank?

A) 4.7kpa B) 85k pa C) 91.3kpa

D) 100.7kpa

Answer-D

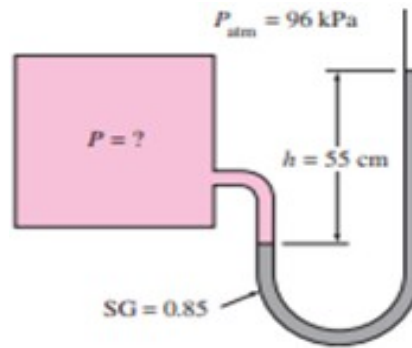


Figure -2

14. A small wooden block is floating in a tub of water. The water is gradually heated. What will happen to the volume of the wooden block visible above the water level?

A) Increases

B) Decreases

C) Fluctuates

D) Remains the same

Answer-B

15. Three identical charges of $2\mu\text{C}$ are placed at $(-3, 0)$ m, $(3, 0)$ m, and $(0, 4)$ m in a rectangular coordinate system. What is the resultant force on the charge that is placed at $(0, 4)$ m?

A) $2.3 \times 10^{-3}\text{N}$

B) $2.88 \times 10^{-3}\text{N}$

C) $1.73 \times 10^{-3}\text{N}$

D)

$4.32 \times 10^{-3}\text{N}$

Answer-A

16. If two bulbs are connected in parallel and one bulb blows out, what happens to the other bulb?

A) The other bulb blows out as well.

B) The other bulb continues to glow with the same brightness.

C) The other bulb glows with increased brightness.

D) The other bulb stops glowing.

Answer-B

17. An astronaut on a strange planet finds that she can jump a maximum horizontal distance of 15m if her initial speed is 3m/s. What is the free-fall acceleration on the planet?

A) 0.2m/s^2

B) 0.6m/s^2

C) 1.67m/s^2

D) 10m/s^2

Answer-B

18. Which one of the following is **NOT** true about laminar and turbulent flow type?

A) In laminar flow the fluid flows smoothly.

B) In turbulent flow there is disruption between the layers.

- Answer-D

A) $T_1 = 50\text{N}$ and $T_2 = 87\text{N}$
 B) $T_1 = 87\text{N}$ and $T_2 = 50\text{N}$
 C) $T_1 = T_2 = 87\text{N}$
 D) $T_1 = T_2 = 50\text{N}$

Answer-B

A) Formation of images by the mirror.
B) A stick immersed in water appears to be broken.
C) The star looks in the sky
D) The apparent depth of water is smaller than the actual depth.

Answer-A

A) When the object is located between the focal point and the lens.
B) When the object is at the focal point.
C) When the object is located at infinity.
D) When the object is placed beyond the focal point.

Answer-D

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

Answer-D

- B) The horizontal acceleration of the projectile is zero.
- C) The minimum speed of the projectile during its flight is equal to its initial vertical component of the velocity.
- D) The minimum speed of the projectile during its flight is equal to its initial horizontal component of the velocity.

Answer-C

24. What are the magnitude and direction of magnetic force on an electron traveling $8 \times 10^5 \text{ m/s}$ horizontally to the East in a vertically upward of magnetic field 75 T?
- A) $9.6 \times 10^{-12} \text{ N}$, towards positive z-axis.
 - B) $9.6 \times 10^{-12} \text{ N}$, towards negative z-axis.
 - C) $6 \times 10^9 \text{ N}$, towards positive y-axis.
 - D) $6 \times 10^9 \text{ N}$, towards negative y-axis.

Answer-B

25. Which of the following apparatus construction uses electromagnetic induction?
- A) Voltmeter
 - B) Galvanometer
 - C) Generator
 - D) Electric Motor

Answer-C

26. Bernoulli's Principle helps explain why the pressure decreases at the top of an airplane wing. This phenomenon occurs because:
- A) the air above the wing is moving slower than the air below.
 - B) the air above the wing is moving faster than the air below.
 - C) the air pressure is always the same over and under the wing.
 - D) the wing shape is always symmetrical.

Answer-B

27. What is the magnitude of the acceleration of the system shown in *figure-4*? (Ignore friction and the mass of the pulley. (Assume $M > m$)

A) $\frac{(M+m)g}{M-m}$

B) $\frac{(M-m)g}{M+m}$

C) $\frac{(M-m)g}{2M}$

D) $\frac{(M+m)g}{2m}$

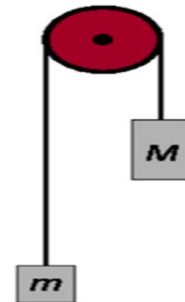


Figure -4

Answer-B

28. A feather and a rock are dropped simultaneously from the same height. Neglecting air resistance:

- A) The rock accelerates faster because it is heavier.
- B) The feather accelerates faster because it has a smaller mass.
- C) The rock accelerates slower because it has more inertia.

D) Both accelerate at the same rate because they have the same weight to mass ratio.

Answer-D

29. Which of the following institution/project does **NOT** apply the principle of physics?

- A) Ethiopian Aviation Industry
- B) Grand Ethiopian Renaissance Dam (GERD)
- C) Quality and Standard Authority of Ethiopia
- D) Ethiopian Radiation Protection Authority

Answer-C

30. A closed loop of wire having a cross-sectional area of 7.5cm^2 is placed at right angles to a magnetic field. If the field increases at a rate of $4 \times 10^{-3}\text{T/s}$, what emf is induced in the loop?

- A) $3 \times 10^{-3}\text{V}$
- B) $3 \times 10^{-5}\text{V}$
- C) $3 \times 10^{-6}\text{V}$
- D) $3 \times 10^{-4}\text{V}$

Answer-C

31. Which one of the following method provides a more reliable measurement of time in daily life activities?

- A) Looking the rotation of stars in the sky
- B) Using a digital watch
- C) Looking the position of shadows of trees
- D) Looking the position of the sun on the sky

Answer-B

32. A flywheel has a mass of 25kg has a radius of 0.2m. What force should be applied tangentially to the rim of the flywheel so that it acquires an angular acceleration of 2rad/s^2 ?

(Use moment of inertia of wheel = $\frac{1}{2} mr^2$)

- A) 2N
- B) 5N
- C) 25N
- D) 1

Answer-B

33. A machine used 50 N efforts through a distance of 10 m in order to lift a load of 100 N through a distance of 4 m. What is the efficiency of the machine?

- A) 70%
- B) 80%
- C) 90%
- D) 100%

Answer-B

- 34. Which of the following simple machines reduces the effort required to lift a load by spreading the force over a longer distance?**

- A) Wedge
- B) Lever
- C) Inclined plane
- D) Pulley

Answer-C

35. The following *figure-5* shows the speed versus time graph of a car moving in a straight line. Between which two points is the car experiencing uniformly accelerated motion?

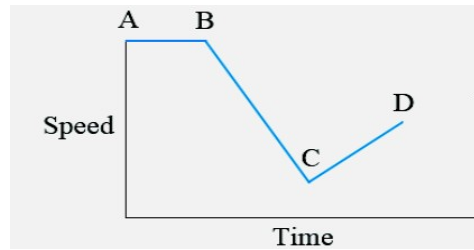


Figure -5

- A) Between B and C
 - B) Between C and D
- Answer-B

- C) Between A and B
- D) Between B and D

36. A person standing on a mattress exerts more pressure when standing compared to lying down because:

- A) The total weight remains the same in both cases.
- B) The contact area is smaller when standing, increasing pressure.
- C) The mattress becomes less compressible when lying down.
- D) The contact area is larger when lying, increasing pressure

Answer-B

37. What is the most likely explanation for why a planet moves faster in its orbit when it is closer to the Sun?

- A) The gravitational force from the Sun increases as the planet gets closer, causing it to speed up.
- B) The planet's mass increases, causing it to move faster.
- C) The Sun exerts less force on the planet as the distance decreases.
- D) The planet's angular velocity increases when closer to the Sun.

Answer-A

38. Kepler's third law can be used to compare the orbital periods of two planets orbiting the same star. If the orbital radius of one planet is four times larger than that of the other, how much longer will its orbital period be?

- A) Twice as long.
- B) Eight times longer.
- C) Four times longer.
- D) Sixteen times longer.

Answer-B

39. An annular thin ring of aluminum is cut from the aluminum sheet as shown figure-6 below. When the ring is heated:



Figure -6

- A) The aluminum expands outward and the hole remains the same
- B) The hole decreases in diameter
- C) The diameter of the hole increases with the same percent as any length of the aluminum
- D) Linear expansion forces the shape of the hole to be elliptical.

Answer-C

40. Cathode rays travelling from east to west enter into region of electric field directed towards north to south in the plane of the paper. The deflection of cathode rays is towards:

A) east
D. south
B. west
C. north

Answer-D

41. Three charges $2q$, $-q$, and $-q$ are located at the vertices of an equilateral triangle. At the center of triangle:

A) The field is zero but potential is non zero.
C. both field and potential are zero.
B) The field is non zero but potential is zero.
D. both field and potential are non zero

Answer-B

42. Which of the following statements about simple machines is correct?

A) Simple machines can only reduce the amount of effort required.
B) Simple machines are designed to increase the amount of work done.
C) Simple machines are used to change the direction or magnitude of a force.
D) Simple machines never involve friction.

Answer-C

43. What is the equivalent capacitance of the four identical capacitors shown in the figure-7 below measured b/n A and B?

A) $\frac{5C}{3}$
B) $\frac{4C}{3}$
C) $3C$
D) $5C$

Answer-A

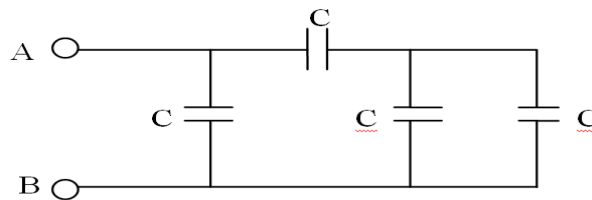


Figure -7

44. A parallel plate capacitor is connected with terminals of a battery. The distance b/n the plates is 6mm. If a glass of plate (dielectric constant $k=9$) 4.5mm is introduced b/n them, then the capacity will be become: A) 12times B. the same C. 3times D. 4times

Answer-A

45. Which of the following statements is true for both series and parallel dc circuit?

A) Currents are additive
C. Powers are additive
B) Voltages are additive
D. Elements have individual currents

Answer-C

46. Four wires having the same resistance, when connected in parallel give a resistance of 0.25Ω . If these wires are connected in series the effective resistance will be:

A) 1Ω B) 2Ω C) 3Ω
D) 4Ω

Answer-D

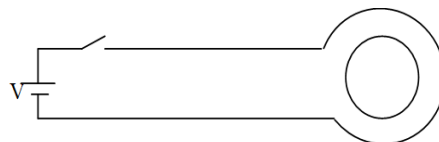
47. What is the moment of inertia of 4 equal masses be each having a mass of 'm' and situated at the corner of the square of side 'b', when axis of rotation passes through the center of the square perpendicular to the plane of the square?

A) mb^2 B) $4mb^2$ C) $8mb^2$
D) $2mb^2$

Answer-D

48. The figure-8, below shows, two concentric conducting loops, the outer connected to a battery and a switch. The switch is initially open. It is then closed, and then what is the direction of current in the inner loop during the entire procedure.

A) Clock wise direction C) In the same direction as the outer loop.
B) Counter clock wise direction. D) It is difficult to determine.



Answer-B

Figure -8

49. When sand and water are exposed to the same amount of heat energy from the sun, it is observed that sand gets much hotter than water. This is because

A) sand has higher specific heat than water. C) sand has higher latent heat than water.
B) water has higher specific heat than sand. D) water liquid whereas sand is solid.

Answer-B

50. Which of the following is true when a transistor is operating in the active region?

A) The collector-emitter junction is forward biased
B) The base-emitter junction is reverse biased
C) The base-emitter junction is forward biased
D) Both junctions are reverse biased

Answer-C

51. What are the respective values of the output Y in the given circuit shown in figure-9 below when all three inputs (A, B, C) are first 1 and then 0?

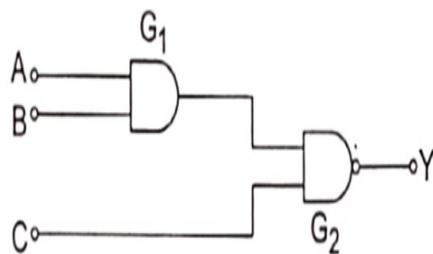


Figure -9

- A) 0 and 1 B) 0 and 0 C) 1 and 0
D) 1 and 1

Answer-A

52. If the radius of a rotating disk is doubled while keeping the angular velocity constant, the rotational kinetic energy will be:

- A) doubled B) quadrupled C) stayed the same
D) Became half

Answer-B

53. What would happen to the gravitational force between two objects if both their masses were doubled and the distance between them was halved?

- A) The force would remain the same C) The force would be 16 times greater
B) The force would be quadrupled D) The force would be 8 times greater

Answer-C

54. A boy walks from his home to school at constant speed of 4m/s along straight line and then back along the same line (road) from school to his home at constant speed of 6m/s. What is the average speed of the boy for the entire trip? A)

- 2.4m/s B) 4.8m/s C) 1.5m/s D) 0.67m/s

Answer-B

55. Which of the following pair of vectors is **collinear**?

- A) $3\hat{i}+4\hat{j}$ and $6\hat{i}+8\hat{j}$ B) $\hat{i}+\hat{j}$ and $\hat{j}-\hat{i}$ C) $2\hat{i}+\hat{j}$ and $3\hat{i}+3\hat{j}$
D) $4\hat{i}+\hat{j}$ and $\hat{i}+3\hat{j}$

Answer-A

56. A transformer steps up the voltage from 120 V to 480 V. The primary current is 3 A. If the transformer is 90% efficient, then how much power is delivered to the load?

- A) 324W B) 360W C) 120W
D) 270W

Answer-A

57. Metal **A** has a coefficient of linear expansion that is three times the coefficient of linear expansion of metal **B**. How does the coefficient of area expansion of metal **A** to metal **B** compare?

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

Answer-C

58. Rainbow is produced when sunlight falls on drops of rain. Which of the following physical phenomena are responsible for this?

I. Diffusion II. Refraction III. Internal reflection

- A) I, II and III B) I and II C) II and III D) I and III

Answer-C

59. Which part of the electromagnetic spectrum is most commonly used by night vision devices?

- A) Ultraviolet B) Infrared C) Radio
D) Microwave

Answer-B

60. The position vector of a particle of mass 2kg is given as a function of time by $\vec{r} = (6\hat{i} + 5t\hat{j})$ m. What is the magnitude of the angular momentum of the particle about the origin at $t=1$ s?

A) 10m/s
D) 60m/s
Answer-D

B) 22m/s

C) $2\sqrt{61}$ m/s

The End