PHYSICS MODEL EXAMINATION FOR GRADE 12

DIRECTIONS: THIS BOOKLET CONTAINS PHYSICS EXAMINATION FOR GRADE 12. THE EXAMINATION CONTAINS **50 MULTIPLE CHOICE QUESTIONS**. CHOOSE THE BEST ANSWER FROM THE SUGGESTED OPTIONS AND WRITE THE LETTER OF YOUR CHOICE ON THE SEPARAT ANSWER SHEET PROVIDED.

YOU ARE ALLOWED TO WORK ON THE EXAM FOR **2 HOURS**.

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

Constant	Symbol	Value
Acceleration due to gravity	g	10 m/s^2
Electrostatic constant	k	9×10^9 Nm^2/c^2
Charge of an electron	e	1.6×10^{-19} coulomb
Universal gravitational constant	G	6.67×10^{-11} Nm^2/kg^2
Plank's constant	h	6.63×10^{-34}J.s
Speed of light	c	3×10^8 m/s
Permittivity of free space	ε_0	8.85×10^{-12} Nm^2/c^2
Permeability of free space	μ_0	$4\pi\times10^{-7}$ Tm/A
$\sin90^0 = \cos0^0 = 1$		
$\sin60^0 = \cos30^0 = 0.866$		
$\sin53^0 = \cos37^0 = 0.8$		
$\sin45^0 = \cos45^0 = 0.707$		
$\sin30^0 = \cos60^0 = 0.5$		

1. The area under acceleration-time graph represents:

A) displacement B.) change in acceleration C) change in velocity D) speed

2. Vectors $\vec{A}$ and $\vec{B}$ have magnitudes 2 units and 12 units respectively. If $\vec{A}\cdot\vec{B}$ is 12 units,

what is the angle between the vectors?

A) 30^0 B) 37^0 C) 45^0 D) 60^0

3. The value of $\hat{k}\cdot(\hat{i}\times\hat{j})$ is:

A) 0 B) +1 C) -1 D) +2

4. The area of a parallelogram formed by the vectors $\vec{A}=9\hat{i}-2\hat{j}$ and $\vec{B}=5\hat{i}+10\{\hat{j}$ is

A) 100 B) 90 C) 26 D) 10

5. For two non-zero vectors $\vec{A}$ and $\vec{B}$, if $|\vec{A}+\vec{B}|=|\vec{A}|+|\vec{B}|$, then:

A) $\vec{A}$ and $\vec{B}$ are parallel and in opposite directions. C) the angle between $\vec{A}$ and $\vec{B}$ is 45^0.

B) $\vec{A}$ and $\vec{B}$ are parallel and in the same direction. D) the angle between $\vec{A}$ and $\vec{B}$ is 60^0.

6. The position of a particle moving along the x-axis is given by $x = t^2 + 4t$. Where x is in meters and t in seconds. What is speed of the particle at t = 1 sec?

A) 2 m/s B) 4 m/s C) 6 m/s D) 8 m/s

7. A boat is traveling at 14 km/h north with respect to a river that is flowing at 6 km/h south with respect to the ground. A man runs directly across the boat, from west to north, at 6km/h with respect to the boat. The *speed* of the man with respect to the ground is:

A) 10 km/h B) 14 km/h C) 18 km/h D) 26 km/h

8. One object is thrown vertically upward with an initial velocity of 100 m/s and another object with an initial velocity of 10 m/s. The ratio of the maximum height reached by the first object to that of the other is: A) 1:10 B) 10:1 C) 1:100 D) 100:1

9. A car moving with constant acceleration increases its speed from 10 m/s to 50 m/s over a distance of 60 m. How long does this take?

A) 4 s B) 3 s C) 2 s D) 1 s

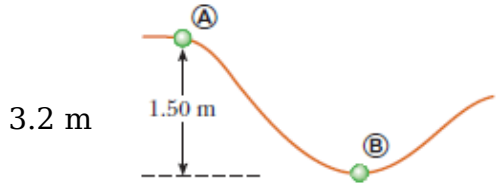
10. An object starts from rest at the origin and moves along the x-axis with a constant

acceleration of 4 m/s^2. Its average velocity as it goes from x = 2 m to x = 8 m is:

A) 2 m/s B) 3 m/s C) 5 m/s D) 6 m/s

11. A 0.40-kg bead slides on a curved frictionless wire, starting from rest at point **(A)** in figure

below. At point (**B**), the bead collides elastically with a 0.60-kg ball at rest.



What is the maximum height the ball rises as it moves up the wire.

A) 3.240m B) 2.048 m C) 1.654m D) 1.024m

12. A box rests on a rough board 10 m long. When one end of the board is slowly raised to a

height of 6 m above the other end, the box begins to slide at constant speed. The coefficient of

kinetic friction between the box and the board is:

A) 0.25 B) 0.60 C) 0.75 D) 0.80

13. A solid sphere and a hollow sphere have equal mass and radius. If they are rotating at

ω_s= 5 rad/s and ω_h = 3 rad/s , respectively. What is the ratio of the angular momentum of

the solid sphere to that of the hollow sphere?

A) 3:5 B) 5:3 C) 2:1 D) 1:1

14. Water flows through a horizontal pipe between two points having cross-sectional areas

A_1= 10 cm^2 and A_2= 2cm^2. If the speed of the water at the first point is 2 m/s, what is the

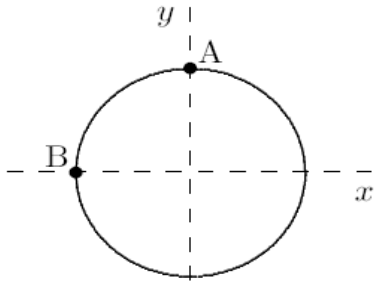
pressure difference between the two points?

A) 4.8×10^4 N/m^2 B) 4.2×10^5 N/m^2 C) 9.6×10^3 N/m^2 D) 1.6×10^5 N/m^2

15. A toy car moves with a constant speed around a horizontal circle shown below. When it is at

point B its coordinates are $x = -3$m and $y = 0$ and its velocity is 6m/s$\hat{j}$.When it is at point A

its velocity and acceleration are respectively:



A) 6 m/s$(-\hat{j})$ and 12 m/s$^2\hat{i}$

B) 6 m/s $\hat{i}$ and 12 m/s^2 $(-\hat{j})$

C) 6 m/s $\hat{i}$ and $12\ m/s^2\ \hat{j}$

D) $6\ m/s\ \hat{j}$ and $12 m/s^2\ \hat{i}$

16. A cylinder has a radius of 0.10 m. Its moment of inertia, about the cylinder's axis on which it

is mounted, is 0.020 kg m^2. A string is wound around the cylinder and pulled with a force of

1 N. What is the angular acceleration of the cylinder?

A) 2.5 rad/s^2 B) 5.0 rad/s^2 C) 10 rad/s^2 D) 20 rad/s^2

17. The angular speed of a ball rotating around a circular path changes by a factor of 2 and its

angular acceleration by a factor of 4. The magnitude of the total acceleration changes by a

factor of

A) 2 B) ½ C) 4 D) ¼

18. Two satellites are revolving around the earth. Satellite B is two times as far from the earth's

center as satellite A. If the period of revolution of A is T, what is the period of revolution of B?

A) 2T B) $2\sqrt{2}$T C) 4T D) $\sqrt[3]{4}$T

19. The bulk modulus is a proportionality constant that relates the pressure acting on an object to

A) the fractional change in volume C) the fractional change in length

B) Young's modulus D) the spring constant

20. A 3 kg ball is suspended from a ceiling by a 5 m long string. What horizontal force is

required to keep the ball at a horizontal distance of 4 m from the initial equilibrium position?

A) 10 N B) 12 N C) 15 N D) 40 N

21. An older model car of mass *m* accelerates from 0 to a speed *v* in 10 seconds. A newer, more

Powerful, car of equal mass *m* accelerates from 0 to 2*v* in the same time. What is the ratio of

the powers expended by the new car to the older one?

A) 2:1 B) 1:2 C) 1:4 D) 4:1

22. A 0.20 kg ball moving at 2 m/s$(\hat{i})$ collides elastically with a 0.40 kg ball, initially at rest on a

frictionless horizontal surface. After the collision, the 0.20 kg ball has a speed of 1.0 m/s at an

angle of 53° above positive *x*-axis. What is velocity of the 0.40 kg ball after the collision?

A) $\sqrt{0.46}\,m/s$ at $\phi = \tan^{-1}(5/6)$ C) $\sqrt{0.55}\,m/s$ at $\phi = \tan^{-1}(4/5)$

B) $\sqrt{0.65}\,m/s$ at $\phi = \tan^{-1}(4/7)$ D) $\sqrt{0.86}\,m/s$ at $\phi = \tan^{-1}(5/4)$

23. A 200 g block of an unknown substance at a temperature of 90°C is placed in a 0.4 kg water

at 20°C. The system reaches an equilibrium temperature of 30°C. What is the specific heat

capacity, c_x, of the unknown substance? (Take specific heat capacity of water = 4200J/kg.^{0}C)

A) 1000 J/kg.^{0}C B) 1200 J/kg.^{0}C C) 1400 J/kg.^{0}C D) 1600 J/kg.^{0}C

24. The rate of heat flow by conduction through a slab is H_{cond}. If the slab thickness is doubled,

its cross-sectional area is halved, and the temperature difference across it is doubled, then

the rate of heat flow becomes:

A) ½ H_{cond} B) 2H_{cond} C) 8H_{cond} D) 1/8 H_{cond}

25. The molar mass of an oxygen molecule is 16 times that of a hydrogen molecule. At room

temperature, the rms speed of an oxygen molecule is ____ times that of a hydrogen molecule.

A) 1/4 B) 4 C) 16 D) 1/16

26. A heat engine in each cycle absorbs energy from a hot reservoir and does an equivalent

amount of work, with no other changes. This engine violates:

A) zeroth law of thermodynamics. C) second law of thermodynamics

B) first law of thermodynamics. D) third law of thermodynamics.

27. An engine extracts 2×10^3J of energy from a hot reservoir and transfers 1.5×10^3J to a cold

reservoir. What is thermal efficiency of the engine?

A) 75% B) 50% C) 25% D) 20%

28. A system undergoes an adiabatic process in which its internal energy increases by 40 J.

Which of the following statements is true?

A) 40 J of work was done on the system. C) the system received 40 J of energy as heat.

B) 40 J of work was done by the system. D) the system lost 40 J of energy as heat.

29. In simple harmonic motion, the magnitude of the acceleration is:

A) constant. C) inversely proportional to the displacement.

B) greatest when the velocity is greatest. D) directly proportional to the displacement.

30. A 4 kg block, attached to a spring, executes simple harmonic motion according to $x = 2\sin(10t)$ where x is in meters and t is in seconds. The spring constant of the spring is:

A) 400 N/m B) 300 N/m C) 200 N/m D) 100 N/m

31. Three physical pendulums, with masses m_1, $m_2 = 2m_1$, and $m_3 = 3m_1$, have the same shape and size and are suspended at the same point. Rank them according to their periods, from shortest to longest.

A) 1, 2, 3 B) 3, 2, 1 C) 2, 3, 1 D) All have the same periods.

32. The length of organ pipe open at both ends ($\mathbf{L_{0p}}$) is twice as long as the length of organ pipe closed at one end ($\mathbf{L_{cl}}$) .If the fundamental frequencies of the pipes are $\boldsymbol{f_{op}}$ for open at both ends end and $\boldsymbol{f_{cl}}$ for closed at one end, which of the following is TRUE?

A) $f_{op} = 2 f_{cl}$ B) $f_{op} = ¼ f_{cl}$ C) $f_{op} = 4 f_{cl}$ D) $f_{op} = f_{cl}$

33. Two coherent waves from two slits travel to a distant screen to produce the third maximum interference pattern. The difference in the distance traveled by the waves is:

A) three halves of a wavelength. C) two wavelengths.

B) three wavelengths. D) half a wavelength.

34. In a Young's double-slit experiment, the slit separation is doubled. This results in:

A) halving of the fringe spacing. C) doubling of the fringe spacing.

B) doubling of the wavelength. D) halving of the wavelength.

35. A monochromatic light is normally incident on a diffraction grating that has10 000 lines/cm.

The first order line is deviated at an angle of 30^0. What is the wavelength of the incident light?

A) 300 *n*m B) 400 *n*m C) 500 *n*m D) 600 *n*m

36. A small object has charge Q. Charge q is removed from it and placed on a second small

object. The two objects are placed 1m apart. For the force that each object exerts on the other

to be a maximum q should be:

A) ½ Q B) 1/3 Q C) ¼ Q D) 1/5 Q

37. What is the electric flux through an area of 2 m^2 which is in the yz plane due to an electric

field $\vec{E}=(24\{\hat{i}+30\{\hat{j}+16\{\hat{k})N/C$?

A) 32 $N.m^2/C$ B) 34 $N.m^2/C$ C) 42 $N.m^2/C$ D) 48 $N.m^2/C$

38. Two identical capacitors, each with capacitance C, are connected in parallel and the

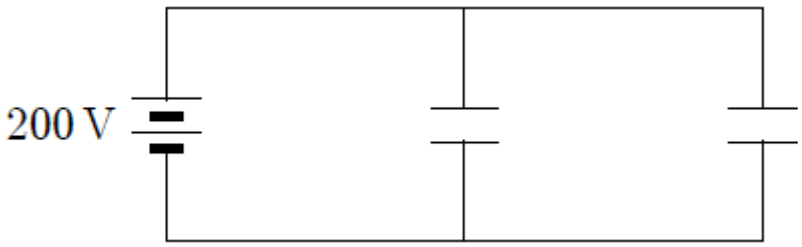
combination is connected in series to a third identical capacitor. The equivalent capacitance

of this arrangement is:

A) C B) 2/3 C C) 3/2 C D) 3C

39. To store a total of 0.040 J of energy in the two identical capacitors shown, each should have a

capacitance of:



A) 0.1 μF B) 0.5 μF C) 1 μF D) 2 μF

40. A certain wire has resistance R. Another wire, of the same material, has half the length and

half the diameter of the first wire. The resistance of the second wire is:

A) ¼ R B) 2R C) ½ R D) 4R

41. Four 20Ω resistors are connected in series and the combination is connected to a 20 V source.

The potential difference across any one of the resistors is:

A) 4V B) 5V C) 20V D) 80V

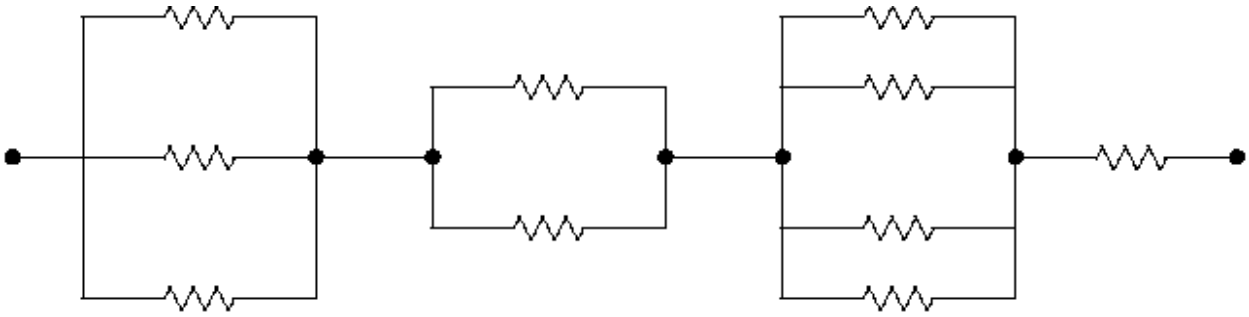
42. Nine identical wires, each with a diameter *d* and length *L*, are connected in parallel. The

combination has the same resistance as a single similar wire of length L but whose diameter is:

A) 3 *d* B) 9 *d* C) 1/3 *d* D) 1/9 *d*

43. Each of the resistors in the diagram has a resistance of 12Ω. The resistance of the entire

circuit is:



A) 120 Ω B) 48 Ω C) 25 Ω D) 5 Ω

44. The magnetic field a distance 2 cm from a long straight current-carrying wire is 2×10^{-5} T.

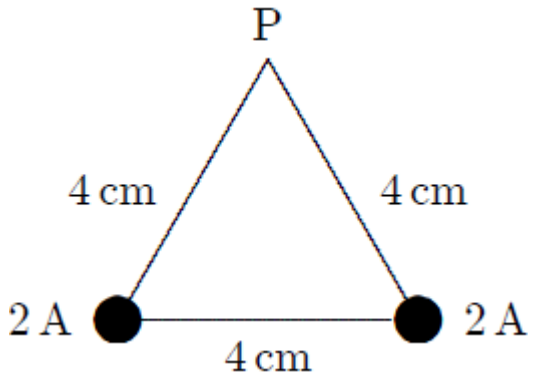
The current in the wire is:

A) 0.16A B) 1.0A C) 2.0A D) 4.0A

45. Two long straight wires pierce the plane of the paper at vertices of an equilateral triangle as

shown below. They each carry 2A, out of the paper. The magnitude of the magnetic field at

the third vertex (P) is:



A) 10^{-5}T B) $\sqrt{3}\times10^{-5}$T C) 2×10^{-5}T D) $\sqrt{5}\times10^{-5}$T

46. A 0.6 m long wire carrying a current of 5 A along positive y-axis is placed in a uniform

magnetic field of $\vec{B}=(0.2\hat{i}+0.4\hat{j}+0.5\hat{k})$ T. What is the magnetic force on the wire?

A) $(0.6\hat{i}-1.5\hat{k})$ N B) $(0.6\hat{i}+1.5\hat{k})$ N C) $(1.5\hat{i}+0.6\hat{k})$ N D) $(1.5\hat{i}-0.6\hat{k})$ N

47. A current of 10A in a certain inductor results in a stored energy of 40 J. What is the stored

energy when the current is 5A?

A) 30 J B) 20 J C) 15 J D) 10 J

48. The plane of a rectangular coil, 5.0 cm by 8.0 cm, is perpendicular to the direction of a

magnetic field $\vec{B}$. If the coil has 80 turns and a total resistance of 8 Ω, at what rate must the

magnitude of $\vec{B}$ change to induce a current of 0.10 A in the coil?

A) 2.5 T/sec B) 5 T/sec C) 0.4 T/sec D) 4 T/sec

49. A 5 m long steel rod, which is lying in east-west direction, is dropped from a height of 5 m

above the ground. The horizontal component of the Earth's magnetic field over the region is

18.0 μT. What is the induced emf in the beam just before it strikes the Earth?

A) 1.2 *m*V B) 1.4 *m*V C) 1.6 *m*V D) 1.8 *m*V

50. The wavelength of light beam A is twice the wavelength of light beam B. The energy of a

photon in beam A is:

A) half the energy of a photon in beam B.

B) one-fourth the energy of a photon in beam B.

C) twice the energy of a photon in beam B.

D) four times the energy of a photon in beam B.