MEASUREMENT & KINEMATICS

1. SIMAK UI KKI 2021

A riffle that shoots bullets at 460 m/s is to be aimed at a target 46 m away. If the center of the target is level with the riffle, how high above the target must the riffle barrel be pointed so that the bullet hits dead center (gravitational acceleration 9.8 m/s^2)?

(A) $\sin 2\theta = 0.49$
(B) $\sin 2\theta = 0.10$
(C) $\sin \theta = 0.49$
(D) $\sin \theta = 0.98$
(E) $\sin 2\theta = 0.98$

2. SIMAK UI KKI 2020

A particle moves circularly with an angular velocity of 4 rad/s for 5 seconds. The magnitude of the angle taken by the particles is … rad.

(A) 40
(B) 50
(C) 30
(D) 60
(E) 20

3. SIMAK UI KKI 2016

The unit of measurement for intensity of sound is …

(1) Watt/m^3
(2) Joule/s.m^2
(3) Watt
(4) Watt/m^2

4. SIMAK UI KKI 2015

A box of food is dropped from a rescue plane flying at a velocity of 252 km/h in the horizontal direction. In a very short time, the box is released and the resque plane starts to accelerate horizontally at 9720 km/h^2. The box attains the ground at 4.0s. By neglecting an air resistance, the box will reach the ground …

(A) directly on the released place
(B) 6.0 m in front of the released place
(C) 274 m in front of the released place
(D) 280 m in front of the released place
(E) 286 m in front of the released place

5. SIMAK UI KKI 2014

A particle moves along a straight line in such a way that its displacement during any given interval of 1 second is 3 meters larger than its displacement during the previous interval of 1 second. Which one of the following options is correct?

(A) The particle moves with constant acceleration of 3 m/s^2.
(B) The particle moves with constant velocity of 3 m/s.
(C) The particle moves with constant acceleration of 6 m/s^2.
(D) The acceleration of the particle is increasing with time.
(E) The particle moves with constant velocity of 6 m/s^2.

6. SIMAK UI KKI 2016

A person stands 40 m away from a flag pole. With a protractor at eye level, he finds the angle between the line from the top of the flag pole to his eyes and the horizontal is 25.0 degrees. The distance from his feet to his eyes is 1.8 m. The high of the flag pole is … ($\tan 25^o = 0.466$)

(A) 15.0 m
(B) 16.8 m
(C) 18.0 m
(D) 18.6 m
(E) 20.4 m

DYNAMICS

7. SIMAK UI KKI 2021

As a 40 N block slides down a plane that is inclined at 30° to the horizontal, its aceleration is 0.80 m/s^2, directed up the plane. What is the coefficient of kinetic friction between the block and the plane (gravitational acceleration is 9.8 m/s^2)?

(A) 0.74

(B) 0.87
(C) 0.67
(D) 0.56
(E) 0.93

8. SIMAK UI KKI 2015

A stone of mass m is tied to a thread. The thread with a stone is rotated in a vertical circle with the length of the thread L. Assuming negligible air resistance, the thread's tension difference at the bottom of the circle and at the top the circle is …

(A) mg
(B) 2mg
(C) 4 mg
(D) 6 mg
(E) 8 mg

9. SIMAK UI KKI 2013

A box sits on a horizontal wooden board. The coefficient of static friction between the box and the board is 0.5. You grab one end of the board and lift it up, keeping the other end of the board on the goard. The angle between bthe board and the horizontal direction when the box begins to slide down the board is …

(A) $\tan^{-1}(0.5)$
(B) $\sin^{-1}(0.5)$
(C) $\cos^{-1}(0.5)$
(D) $\sec^{-1}(0.5)$
(E) $\text{cosec}^{-1}(0.5)$

10. SIMAK UI KKI 2013

A 1.25 kg mass is attached to the end of a 80 cm string. The system is whirled in a horizontal circular path. The maximum tension that the string can withstand is 400 N. The maximum angular velocity of the system is … (9.8 m/s^2)

(A) 20.00 rad/s
(B) 5.00 rad/s
(C) 2.00 rad/s
(D) 0.50 rad/s
(E) 0.05 rad/s

MOMENTUM AND IMPULSE

11. SIMAK UI KKI 2021

Two students hold a bed sheet loosely by its corner to form a "catching net" in front of a wall. The third student, who happens to be the pitcher of the school baseball team, throws a rew egg into the middle of the sheet against the wall. The egg does not break when it hits the sheet.

BECAUSE

The rate at which an egg is stopped by the sheet is much lower than the rate at which an egg is stopped by the wall.

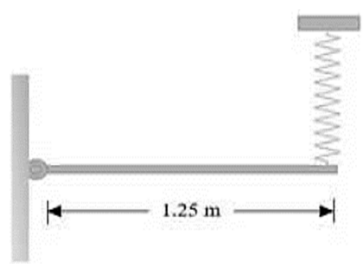
12. SIMAK UI KKI 2020

A ball of mass of 0.1 kg is initially at rest. After being hit with a stick, the speed of the ball becomes 20 m/s. The correct information(s) is (are) …

1. The magnitude of the impulse id 2 Ns
2. The final momentum is 2 kgm/s
3. The initial momentum is 0 kgm/s
4. The instantaneous force is 2 N

VIBRATION AND WAVES

13. SIMAK UI KKI 2021



A uniform meter stick of mass M is pivoted on a hinge at one end and held horizontal by a spring with spring constant k attached at the other end. If the stick oscillates up and down slightly, what is its frequency?

(A) $f = \frac{1}{2\pi}\sqrt{\frac{2k}{M}}$

(B) $f = \frac{1}{2\pi}\sqrt{\frac{k}{2M}}$

(C) $f = \frac{1}{2\pi}\sqrt{\frac{3k}{M}}$

(D) $f = \frac{1}{2\pi}\sqrt{\frac{k}{M}}$

(E) $f = \frac{1}{2\pi}\sqrt{\frac{4k}{M}}$

14. SIMAK UI KKI 2020

An object of 50 grams moves in a simple harmonic oscillation with an amplitude of 10 cm and a period of 0.2 s. When the deviation from equilibrium is half the amplitude, the force that works on the object is about …

(A) 1.5 N
(B) 3.0 N
(C) 2.5 N
(D) 2.0 N
(E) 1.0 N

15. SIMAK UI KKI 2015

A wave is destructive by the equation $y(x,t) = 0{,}030\sin(5\pi x + 4\pi t)$, where x and y are in meters and t is in seconds. The $+x$ direction is to the right. The velocity of the wave is ...

(A) 0.80 m/s to the left
(B) 1.25 m/s to the left
(C) 0.12π m/s to the right
(D) $0.80\ m/s$ to the right
(E) 1.25 m/s to the right

16. SIMAK UI KKI 2013

The quartz crystal used in an electric watch vibrates with frequency of 32.768 Hz. The period of the crystal motion is …

(A) 30.5 s
(B) 30.5 ms
(C) 30.5 μs
(D) 30.5 ns
(E) 30.5 ps

17. SIMAK UI KKI 2012

A sinusoidal wave travelling in the positive x direction has an amplitude of 15.0 cm, a wavelength of 40.0 cm, and a frequency of 8.00 Hz. The wave number k period of the wave is …

(A) 0.157 rad/m
(B) 0.125 rad/s
(C) 0.157 rad/s
(D) 0.125 rad/m
(E) 0.100 rad/s

18. SIMAK UI KKI 2012

A small-amplitude progressive wave in a stretched string has a velocity of 10 m/s and a frequency of 100 Hz. What is the phase difference, in radians, between two points 2.5 cm apart in the string?

(A) $\frac{\pi}{8}$
(B) $\frac{\pi}{4}$
(C) $\frac{3\pi}{8}$
(D) $\frac{\pi}{2}$
(E) $\frac{3\pi}{2}$

FLUIDS

19. SIMAK UI KKI 2020

The surface tension of mercury is 0.465 N/m. The contact angle of mercury with a capillary tube of radius of 2.5 mm on a bowl is 150°. The density of mercury is 13.6 gr/cm^3 and the Earth's gravitation is 10 m/s^2. The mercury height in the tube relative to the mercury surface in the bowl is …

(A) -0.16 m
(B) -0.40 m
(C) -0.24 m
(D) -0.32 m
(E) -0.08 m

20. SIMAK UI KKI 2021

A reciprocating compressor is a device that compresses air by a back-and-forth straight-line motion, like a piston in a cylinder. Consider a reciprocating compressor running at 150 rpm. During a compression stroke, 1.00 mol of air is compressed. The initial

temperature of the air is 117°C, the engine of the compressor is supplying 7.5 kW of power to compress the air, and heat is being removed at the rate of 1.5 kW. Calculate the temperatyure change perb compression stroke (specific heat at constant volume is 20.93 J/mol.K)?
(A) 48°C
(B) 57°C
(C) 54°C
(D) 60°C
(E) 51°C

21. SIMAK UI KKI 2021
A marble 5 mm in diameter is dropped into a liquid glycerin which has a viscosity coefficient of 2.5 Pa.s. Then the marble settles at a speed of 0.4 m/s. Determine the Stokes friction between the marble and the glycerin.
(A) 1.18×10^{-2} Hz
(B) 2.36×10^{-2} Hz
(C) 9.42×10^{-2} Hz
(D) 4.71×10^{-2} Hz
(E) 0.59×10^{-2} Hz

22. SIMAK UI KKI 2016
The concentration of oxygen O_2 at the atmospheric pressure is 20.9 % v/v. The partial pressure of the concentration is 21.2 kPa. At an altitude of 6962 m above sea level (approximately 7000 m), the partial pressure of oxygen at the altitude is …
(A) 0.21 kPa
(B) 0.44 kPa
(C) 9.33 kPa
(D) 21.00 kPa
(E) 44.00 kPa

23. SIMAK UI KKI 2012
A simple pendulum has a period of 2 s and the reading on a barometer is 1 atm on the surface of the mine which has a depth of 1.5 km. At the bottom of the mine, which one of the following statements is CORRECT?
(A) Reading on barometer greater than 1 atm and periode of pendulum greater than 2 s.
(B) Reading on barometer less than 1 atm and period of pendulum less than 2 s.
(C) Reading on barometer less than 1 atm and period of pendulum greater than 2 s.
(D) Reading on barometer greater than 1 atm and period of pendulum less than 2 s.
(E) Reading on barometer greater than 1 atm and period of pendulum is 2 s.

GRAVITY

24. SIMAK UI KKI 2020
As a planet orbiting the Sun, the imaginary line joining the planet and the Sun sweeps some areas during some time interval. According to the second law of Kepler, the rate of the swet area …
(A) Depens on the distance between the planet and the Sun
(B) Depens on the inverse of the distance between the planet and the Sun
(C) Varies with time
(D) Is constant
(E) Depens on the mass of the planet

25. SIMAK UI KKI 2016
The distance between the sun and Jupiter is 7.78×10^{11} m and the distance between Earth and the Sun is 1.496×10^{11} m. The time for Jupiter to make one complete revolution around the sun in the earth years is …
(A) 11.86 earth years
(B) 12.86 earth years
(C) 13.86 earth years
(D) 14.86 earth years
(E) 15.86 earth years

26. SIMAK UI KKI 2014
The Earth is 81 times more massive than the moon and for the purpose of this question they can be assumed to be a stationary frame of reference where Newton's laws of motion

apply. As explained by an observer on Earth, the moon does not fall and crash into the Earth because …

(A) The net force on it is zero
(B) It is being pulled by the Sun and planets as well as the Earth.
(C) It is in the Earth's gravitational field.
(D) The Earth is spinning.
(E) It is possible to accelerate towards something indefinitely without reaching it.

LIGHT & OPTICS

27. SIMAK UI KKI 2021

A cat with its tail in the air stands facing a converging lens. Under what circumstances (if any) will the image of the nose be virtual and the image of the tail be real?

1. The virtual image of the front part of the cat will be spread out from the image of the nose to infinity.
2. The virtual image of the front part of the cat will be spread out from the image of the tail to the infinity.
3. The real image of the back part of the cat will be spread out from the image of the tail to infinity on the opposite side of the lens.
4. None of the above.

28. SIMAK UI KKI 2020

A man with hyperopia has a near point of 50 cm. If he wants to read at a normal distance (25 cm), the lens power that must be used is … diopter.

(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

29. SIMAK UI KKI 2020

A beam of light is directed perpendicular to a diffraction lattice. The maximum interference occurs at an angle of 30°. If the wavelength of the light is 9450 angstrom, the right statement(s) bellow is (are) …

1. The number of slit is 5291
2. The energy of the beam is 9450 J
3. Distance between scratches is 18900×10^{-8} cm
4. The order is 2

30. SIMAK UI KKI 2016

The image of an object as formed by a plane is located behind the mirror surface.

BECAUSE

The location of an image is different to different observers

31. SIMAK UI KKI 2016 [modified]

The image formation of thin optical lense have some properties. The correct property is …

(A) If the lens is divergent, as an object approaches the focal point from the center of the lens, the formed image is virtual, inverted and bigger than the object
(B) If the lens is divergent, as an object approaches the focal point from far away, the formed image is real, upright and bigger than the object
(C) If the lens is divergent, as an object approaches the focal point from far away, the formed image is real, upright and smaller than the object
(D) If the lens is convergent, as an object approaches the focal point from far away, the formed image is real, inverted and bigger than the object
(E) If the lens is divergent, as an object approaches the focal poin from far away, the formed image is real, inverted and more distant

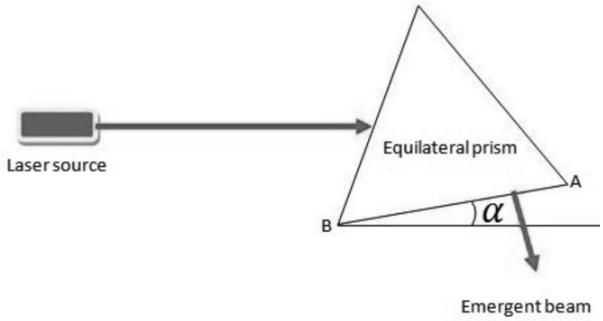
32. SIMAK UI KKI 2015

You are given two lenses, a converging lens with focal length $+10$ cm and a diverging

lens with focal length -20 cm. Which of the following would produce a virtual image that is larger than the object?
(A) Placing the object 5 cm from the converging lens.
(B) Placing the object 15 cm from the converging lens.
(C) Placing the object 25 cm from the converging lens.
(D) Placing the object 15 cm from the diverging lens.
(E) Placing the object 25 cm from the diverging lens.

33. SIMAK UI KKI 2014
Which of the following is the best evidence that light is a wave?
(A) Light beams can interfere
(B) Light energy comes in packets called photons
(C) Light beams can be reflected
(D) Light beams travel in straight lines
(E) Light comes in different colours

34. SIMAK UI KKI 2014



A light beam from a laser source which is parallel to a horizontal surface hits an equilateral prism as shown in the surface hits an equilateral prism as shown in the figure above. What is the angle α (between AB and the horizontal surface) if the emergent beam is perpendicular to the face AB? (refractive index of the prism is 2) …
(A) 15.0°
(B) 24.5°
(C) 30.0°
(D) 42.5°
(E) 46.0°

35. SIMAK UI KKI 2012
Double-slit interference is investigated using light of wavelength 600 nm. The fringe spacing is 1.44 mm. If the screen is 1.2 m away from the slits, how far apart are the slits?
(A) 2.500 mm
(B) 0.500 mm
(C) 0.250 mm
(D) 0.050 mm
(E) 0.005 mm

36. SIMAK UI KKI 2012
A point source of light is placed at the bottom of a tank of water 1.00 m deep such that it emits light rays upward in all directions. A circle of light is formed by the rays that are refracted into the air and the rays outside of this circle are reflected back into the water. Given that the index of refraction of water is 1.33, the radius r of the circle at the surface of the water is approximately …
(A) 1.33 m
(B) 1.00 m
(C) 1.14 m
(D) 0.75 m
(E) 0.50 m

ELECTROMAGNETIC WAVES

37. SIMAK UI KKI 2014
Television signals are carried by radio waves, which travel at the speed of light 3×10^8 m/s. The frequency of a certain television channel is 600 MHz. The corresponding wavelength is therefore:
(A) 5 km
(B) 50 m
(C) 5 m
(D) 50 cm
(E) 5 cm

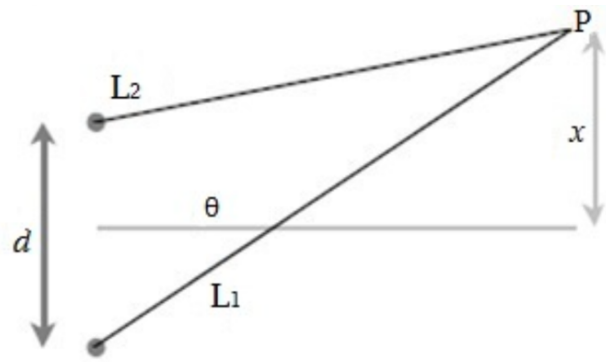
SOUNDS

38. SIMAK UI KKI 2021

A bat is flitting about in a cave, navigating via ultrasonic bleeps. Assume that the sound emission frequency of the bat is 54,000 Hz. Dusing one fast swoop directly toward a flat wall surface, the bat is moving at 0.025 times the speed of sound in air. What frequency does the bat hear reflected off the wall?

(A) 5.46×10^4 Hz
(B) 5.85×10^4 Hz
(C) 4.98×10^4 Hz
(D) 5.14×10^4 Hz
(E) 5.68×10^4 Hz

39. SIMAK UI KKI 2015

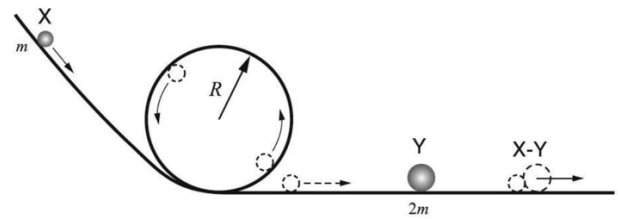


Two origin of sounds are separated by a distance d. Both sounds are in phase. Each sound source emits a wave with wavelength λ. The path difference of the two sources is $\Delta L = L_1 - L_2$. If the interference between the two sounds at point P is always dertructive, the ΔL is equal to…

(A) $d \sin \theta$
(B) $\frac{x}{L_1}$
(C) $\frac{x}{L_2} d$
(D) $\frac{1}{2}\lambda$
(E) 2λ

MOMENTUM AND IMPULS

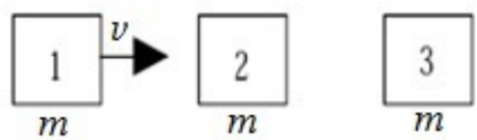
40. SIMAK UI KKI 2016



There is a frictionless track with a combination of line and circular track with radius R as shown in the figure. A small ball X with a mass m slides down and then enters a circular track. After rotating in the circular track, the small ball X collides with another ball Y with a mass of $2m$. The ball Y is at rest. After colliding, X and Y embed together and move. The ratio of kinetic energy of X and Y just before and after the collision is …

(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

41. SIMAK UI KKI 2015



Three cars with the same mass m are shown in the accompanying figure. Car 1 moves to the right direction with the speed v and collides with car 2. After the collision, car 1 sticks together with car 2 and both move to the right direction. They collide with car 3 in an elastic collision. The final speed of car 3 is approximately …

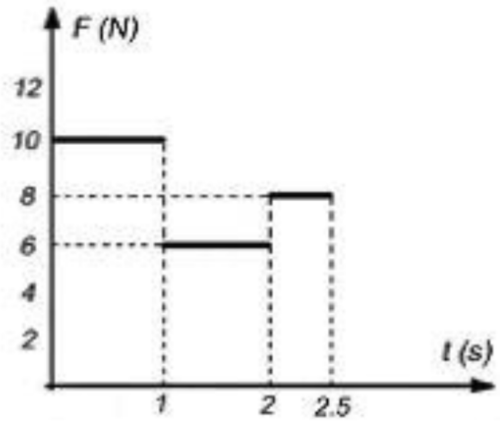
(A) $0.17\ v$
(B) $0.50\ v$
(C) $0.67\ v$
(D) $0.80\ v$
(E) v

42. SIMAK UI KKI 2014

A truck weighing 6000 kg runs into a car weighing 800 kg. The truck was moving at 15 m/s and the car was at rest. Assuming that the truck and car continue moving together, the final speed of the combined car/truck system is …

(A) 1.8 m/s
(B) 7.5 m/s
(C) 13.0 m/s
(D) 17.0 m/s
(E) 113.0 m/s

43. SIMAK UI KKI 2014

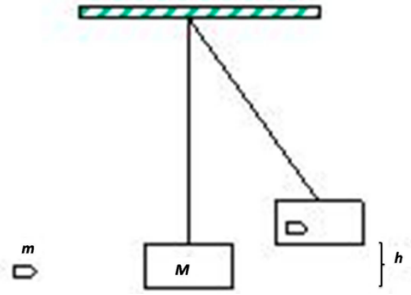


The diagram above shows changing force which is applied to a body with the mass of 5 kg in the same direction. The body is initially at rest. What is the final speed in m/s after 2.5 s?

(A) 4
(B) 6
(C) 8
(D) 10
(E) 12

44. SIMAK UI KKI 2014

A bullet of mass $m = 0.01$ kg is fired into a ballistic pendulum of mass $M = 2.0$ kg as shown in above. The bullet remains in the block after the collision and the whole system rises to a maximum height of $h = 8$ cm. The bullet's initial speed is approximately … ($g = 10$ m/s^2)



(A) 18 m/s
(B) 80 m/s
(C) 150 m/s
(D) 254 m/s
(E) 275 m/s

KINETIC THEORY OF GASES

45. SIMAK UI KKI 2021

Two samples of the same ideal gas have the same pressure and density. Sample B has twice the volume of sample A.

BECAUSE

The gases are the same so they have the same molecular mass, M. If the two samples have the same density, then their ratios of number of moles to volume, n/V, are the same because their densities, $(nM)/V$, are the same.

46. SIMAK UI KKI 2020

Gas in aclosed vessel has a temperature of T. The average kinetic energy of the gas molecule is $E_k = 1200$ J. If the gas temperature is raised to $2T$, the average of the kinetic energy is …

(A) 2400 J
(B) 2000 J
(C) 3200 J
(D) 1200 J
(E) 1600 J

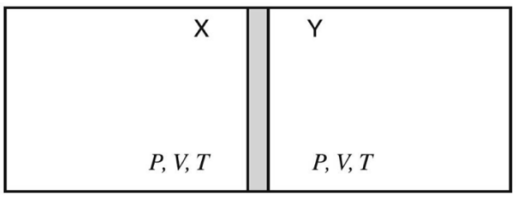
47. SIMAK UI KKI 2020

The efficiency of an ideal heat engine that works between 500°C and 300°C is about 26%.

BECAUSE

A common machine working between 500°C and 300°C may have the maximum efficiency of about 18.2%.

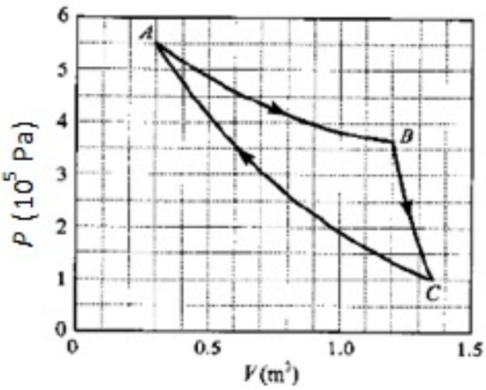
48. SIMAK UI KKI 2016



A vessel (see the figure) comprises of into two chambers X and Y with an adiabatic wall. The adiabatic wall can move freely. The chambers X and Y contain an ideal gas under the condition that pressure P, volume V, and temperature T are all same, respectively. The system gains an equilibrium tate after heating when the temperature of chamber X becomes 3T, while the temperature of chamber Y is always constant at T. The gas pressure of chamber Y at the equilibrium after the heating is …

(A) P
(B) 1.5 P
(C) 2P
(D) 3P
(E) 4P

49. SIMAK UI KKI 2015



The network output per cycle for the thermodynamic cycle in the figure is …

(A) 5.0 kJ
(B) 10.0 kJ
(C) 25.0 kJ
(D) 50.0 kJ
(E) 110.0 kJ

WORK & ENERGY

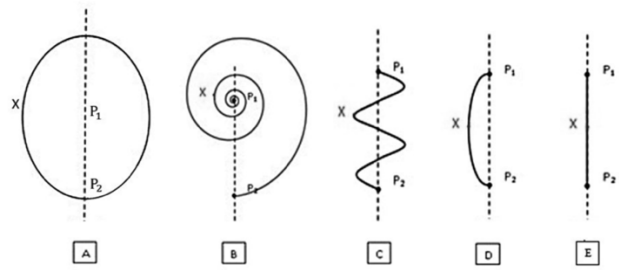
50. SIMAK UI KKI 2020

An object is said to move if it undergoes a displacement.

BECAUSE

The work done by an object equals the change of the object's kinetic energy.

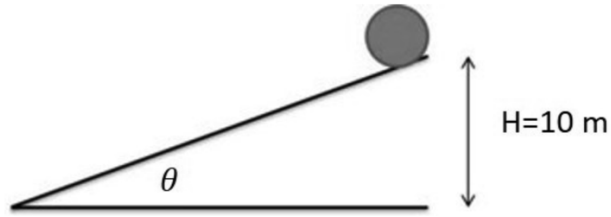
51. SIMAK UI KKI 2016



On the tables, we located two points, P_1 and P_2, respectively. A particle moves from P_1 to P_2 without acceleration along five different paths. The duration is the same for all paths. If we put a point X, the suitable path with the lowest kinetic energy is …

(A) A
(B) B
(C) C
(D) D
(E) E

52. SIMAK UI KKI 2016



A sphere starting from rest is rolling down a 10 m height (see figure), 37° inclined plane.

If $I_{sphere} = 2/5\ MR^2$ and $g = 10$ m/s^2, the speed of the sphere at the bottom is …
(A) 9.25 m/s
(B) 10.25 m/s
(C) 11.25 m/s
(D) 12.25 m/s
(E) 13.25 m/s

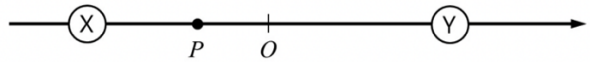
53. SIMAK UI KKI 2014
If generator at a hydro power station with 2000 kg/s of water flowing through its turbine at a speed of 10 m/s converts 80% of the water's kinetic energy to electricity, the electrical power output from the turbine is …
(A) 80 kJ
(B) 80 kW
(C) 800 kW
(D) 800 kJ
(E) 8000 MW

54. SIMAK UI KKI 2013
A 10 kg box moves at 5 m/s on a horizontal, frictionless surface runs into a light spring of force constant 10,000 N/m. By using the work energy theorem, the maximum compression of the spring is … ($g = 9.8$ m/s^2)
(A) 16 nm
(B) 16 μm
(C) 16 mm
(D) 16 cm
(E) 16 dm

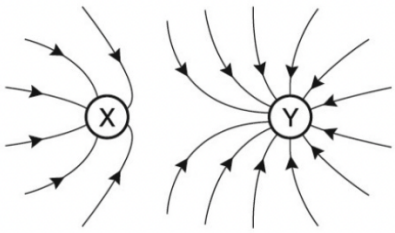
55. SIMAK UI KKI 2013
A hockey puck on a frozen pond is given an initial speed of 20.0 m/s. If the puck always remains on the ice and slides 115 m before coming to rest, the coefficient of kinetic friction between the puck and ice is … ($g = 10$ m/s^2)
(A) 0.134
(B) 0.144
(C) 0.154
(D) 0.164
(E) 0.174

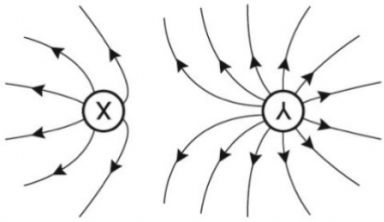
ELECTROSTATICS

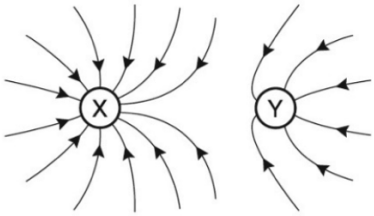
56. SIMAK UI KKI 2016

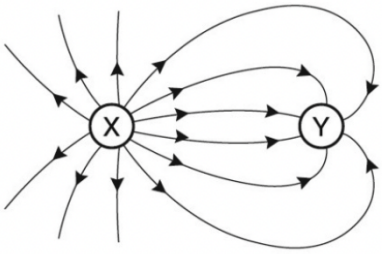


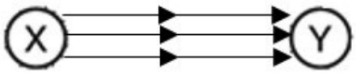
X is a positive point charge. Y is a point charge that is placed at a point that has the same length from origin O with X, but on opposite sides. A negative charge is located at point P. Since the negative charge is still at resty, the suitable electric field lines sketched before locating the negative charge at P is …

A


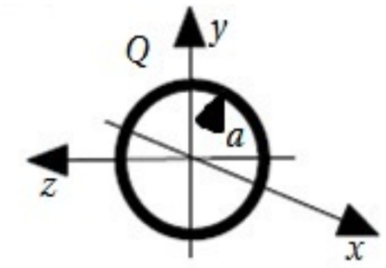
B


C


D


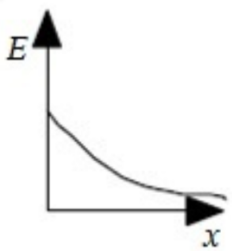
E


57. SIMAK UI KKI 2015

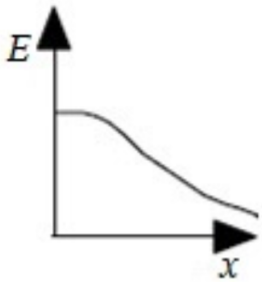


A ring of radius a lies in a y-z plane. The ring contains positive charge Q that is uniformly distributed. The center of the ring is at the origin. The suitable graph that represents relation between electric field E and distance x is … (see the figure)

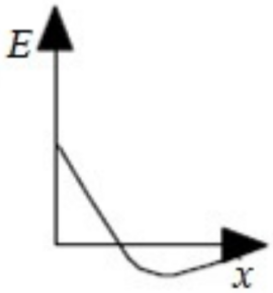
(A)



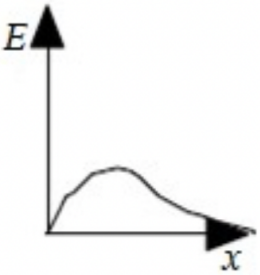
(B)



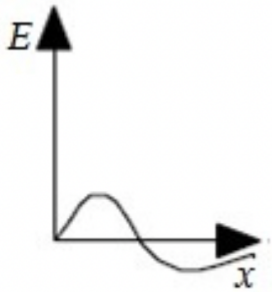
(C)



(D)



(E)



58. SIMAK UI KKI 2014

A solid steel ball with a small positive electrical charge on it is brought into contact with an identical uncharged ball and then they are separated. After the contact, the electrical charges on the balls are …

(A) Swapped : the charge is transferred to the second ball
(B) Unchanged : static electricity cannot flow
(C) Unchanged: the charge is in the interior of the ball and cannot affect the second ball
(D) Cancelled: there is no net charge after the contact
(E) Equal: the original charge is shared equally between the two balls

59. SIMAK UI KKI 2013

Initially, a sphere A has a charge of $-50e$ and a sphere B has a charge of $+20e$. The spheres are made of conducting materials and are identical in size. If the spheres then touch each other, the resulting charge on sphere A is …

(A) $-50e$
(B) $-20e$
(C) $-15e$
(D) $+15e$
(E) $+20e$

60. SIMAK UI KKI 2013

A particle of mass 5 g is placed in a downward-directed electric field of magnitude 800 N/C. ($g = 9.8$ m/s^2). To keep the particle stationary, the sign and magnitude of the charge should be …

(A) Negative and 0.0000613 C
(B) Positive and 0.0000613 C
(C) Neutral and 0.0000613 C
(D) Negative and 0.0000613 μC
(E) Positive and 0.0000613 μC

61. SIMAK UI KKI 2013

In a Milikan oil drop experiment a student sprayed oil droplets with a density of 780 kg/m^3 between two horizontal parallel plates that were 6.0 cm apart. The student adjusted the potential difference between the plates to 5000 V so that one of the drops became stationary. The diameter of this drop was measured to be 3×10^{-6} m. The magnitude of the charge on the drop is …

(A) 1.10×10^{-18} C
(B) 1.06×10^{-17} C
(C) 1.10×10^{-15} C
(D) 1.06×10^{-13} C
(E) 1.10×10^{-12} C

62. SIMAK UI KKI 2016

Using certain radioactive elements, the age of rocks and other geological features (even some man-made objects) can be determined; this is called Radiometric dating.

BECAUSE

Other forms of radiation such as radio waves, microwaves, and light waves are called non-ionizing.

63. SIMAK UI KKI 2016

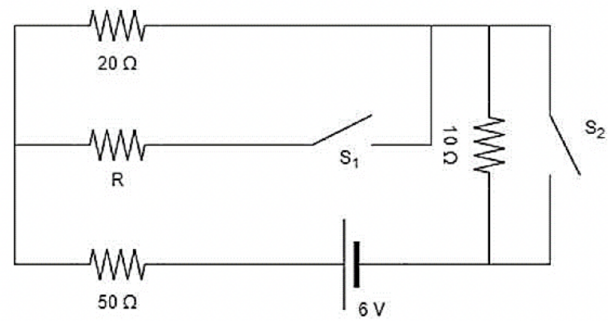
An x-ray beam with a wavelength 0.16 nm is incident on a set of planes of certain crystal. The first Bragg reflection is observed for an incidence angle of 30°. The reflection satisfies the relation $2d \sin q = nl$. The possible planes separation d for the reflection is …

(1) 0.136 nm and 0.272 nm
(2) 0.136 nm and 1.36 nm
(3) 0.136 nm and 13.6 nm
(4) 0.136 nm only

DIRECT CURRENT CIRCUITS

64. SIMAK UI KKI 2021

The current through the 20Ω resistor does not change whether the two switches S_1 and S_2 are both open or both closed. Use this clue to determine the value of the unknown resistance R.



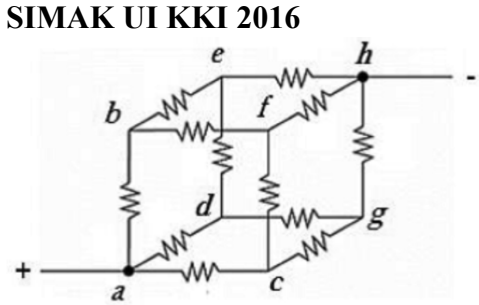
(A) 130 A
(B) 110 A
(C) 120 A
(D) 100 A
(E) 90 A

65. SIMAK UI KKI 2020

Two resistor of 4 ohm and 3 ohm are connected in serial. Then the two resistors are connected to a battery of 21 V. The magnitude of the total electric current flowing through the circuit is …

(A) 5 A
(B) 4 A
(C) 3 A
(D) 2 A
(E) 1 A

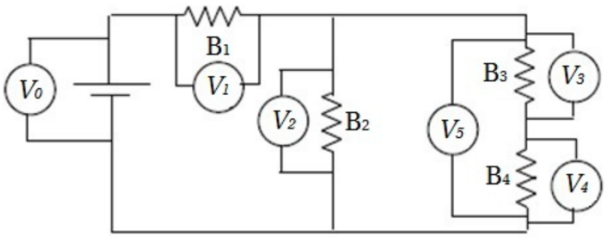
66. SIMAK UI KKI 2016



The 12 identic resistors network with resistance of R is shown in the figure. The resistance between points a and b is …

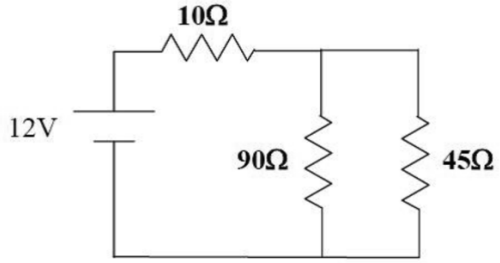
(A) 12 R
(B) 5 R
(C) (5/6) R
(D) (3/2) R
(E) R

67. SIMAK UI KKI 2015



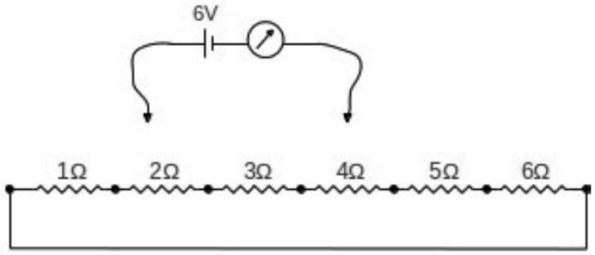
Four identical light bulbs (B_1, B_2, B_3, and B_4) and six voltmeters are connected as shown as in the figure. Assuming that V is as its original reading when all bulbs are working and V' is as its reading when B_2 is caught on fire. If B_2 were to be caught on fire, the reading of V_1 is …
(A) $V' \gg 2V$
(B) $2V > V' > V$
(C) $V' = V$
(D) $V > V' > \frac{1}{2}V$
(E) $\frac{1}{2}V \gg V'$

68. SIMAK UI KKI 2014



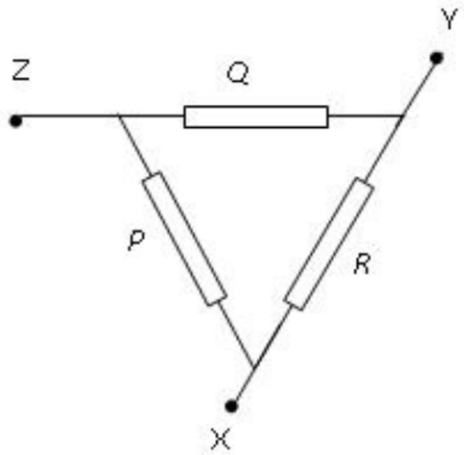
In the circuit above there is a current of 0.3 amps flowing through the 10 ohm resistor. How much current flows throught the 90 ohm resistor?
(A) 0.05 A
(B) 0.10 A
(C) 0.15 A
(D) 0.20 A
(E) 0.30 A

69. SIMAK UI KKI 2014



Consider six resistances connected as shown in the figure above. Note that the extreme ends are shorted. A circuit element consisting of a 6 V battery and an ideal ammeter can be connected across any two different points marked by dots in the resistance network. The *minimum* possible value of the current passing through tthe ammeter would be …
(A) 0.29 A
(B) 1.15 A
(C) 1.17 A
(D) 1.41 A
(E) 1.71 A

70. SIMAK UI KKI 2016



The diagram shows a circuit consisting of three identical resistors, P, Q, and R, each of resistance 4.0 Ω and connected as shown. If 3.0 A of current flows into point X in the circuit and 3.0 A flows out at point Y, then the power generated by resistor R is approximately …
(A) 36 W
(B) 16 W
(C) 9 W

(D) 4 W
(E) 2 W

MAGNETISM

71. SIMAK UI KKI 2020

An electrically charged particle moves in an area of magnetic field in such a way that the path is in the form of a circle with a radius of 10 cm. If another particle of the same electrical charge moves at a speed of 1.2 times that of the first particle, then the radius of the circle is 20 cm. This means that the ratio between the mass of the first particle to that of the second particle is …

(A) 3 : 5
(B) 4 : 5
(C) 5 : 4
(D) 1 : 2
(E) 5 : 3

72. SIMAK UI KKI 2020

Surrounding an electrically charged object is magnetic field.

BECAUSE

When a posotive charge is placed in electric field, the direction of the electric field is equal to the direction of force experienced by the positive charge.

73. SIMAK UI KKI 2015

One particle has mass m. It travels along a way and makes an upright angle with a magnetic field. Because the particle has a positive charge q, it is influenced by Lorentz force and makes a circle of radius R with frequency f. The magnitude of the magnetic field is …

(A) $\frac{mf}{q}$
(B) $\frac{2\pi fm}{q}$
(C) $\frac{m}{2\pi fq}$
(D) $\frac{mf}{qR}$
(E) $\frac{mqf}{2\pi R}$

74. SIMAK UI KKI 2013

Two long straight wires are carrying the same current I and separated by a distance r exert a force F on each other. The ratio of force between two wires before and after changes is 96. If the current is increased to $4I$, the separation between the two wire is reduced to …

(A) $\frac{r}{6}$
(B) $\frac{r}{16}$
(C) $\frac{r}{24}$
(D) $\frac{r}{96}$
(E) $\frac{r}{144}$

75. SIMAK UI KKI 2012

A long solenoid with closely spaced turns carries a direct electric current. Each turn of wire exerts …

(A) An attractive force on the next adjacent turn.
(B) A repulsive force on the next adjacent turn.
(C) Zero force on the next adjacent turn.
(D) Either an attractive or a repulsive force on the next adjacent turn, depending on the direction of current in the solenoid.
(E) Either an attractive or a repulsive force on the next adjacent turnm, but is not depending on the direction of current in the solenoid.

ELECTROMAGNETIC INDUCTION

76. SIMAK UI KKI 2021

A piece of aluminium is dropped vertically downward between the poles of the electromagnet. Which of these statements regarding magnetic fields is correct?

1. The eddy currents induced on the aluminium surface will accelerate the decline of the aluminium.
2. The eddy currents induced on the aluminium surface will slow down the aluminium's landing.
3. In rugged terrain, aluminium scraps can fall down very quickly.
4. In rugged terrain, aluminium scraps can fall very slowly.

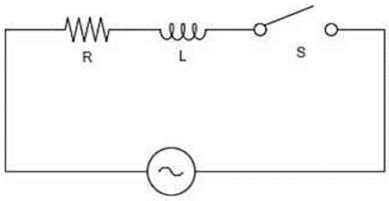
5. SIMAK UI KKI 2021

Quantities regarding to an electromotor force which can vary with time is (are) …

1. Magnitude of B
2. Area A enclosed by the loop
3. Angle θ between B and loop normal
4. Numbers of turns

DIRECT CURRENT CIRCUITS

77. SIMAK UI KKI 2021



An inductor and a resistor are connected in series across an AC source. Immediately after the switch is closed, the currend in the circuit is zero.

BECAUSE

When a power source, AC or DC, is first connected to a RL combination, the presence of the inductor impedes the buildup of a current in the circuit.

HEAT & TEMPERATURE

78. SIMAK UI KKI 2021

Approximately how long should it take 9.5 kg of ice at 0°C to melt when it is placed in a carefully sealed styrofoam ice chest of dimensions 25 cm × 35 cm × 55 cm whose walls are 1.5 cm thick? Assume that the conductivity of styrofoam is double that of air and that the outside temperature is 34°C, specific latent heat of water fusion is 3.33×10^5 J/kg, and thermal conductivity of styrofoam is 0.023 J/s.m°C.

(A) 5 hours
(B) 29 hours
(C) 15 hours
(D) 10 hours
(E) 25 hours

79. SIMAK UI KKI 2015

A 20 g piece of aluminium ($c =$ 0.21 cal/g°C) at 90°C is dropped into a cavity in a large block of ice at 0°C. How much does the ice melt? (latent heat of melting of ice is 80 cal/g)

(A) 4.4 g
(B) 4.7 g
(C) 4.9 g
(D) 5.1 g
(E) 5.3 g

80. SIMAK UI KKI 2014

A block of 0°C ice with the mass of 50 kg mass slides on a horizontal surface. The initial velocity of the ice is 6.0 m/s and it stops after a distance of 28.3 m. How much ice melts due to the friction? (specific latent heat of fusion of ice, $L_f = 80$ cal/g and 1 cal = 4.18 J and ignore the heat transfers to the environment) …

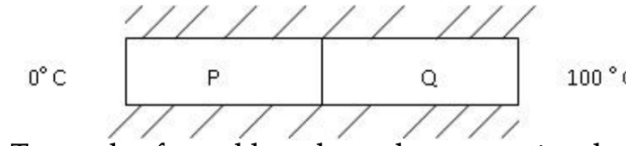
(A) 2.7 g
(B) 4.7 g
(C) 11.2 g
(D) 47.0 g
(E) 57.2 g

81. SIMAK UI KKI 2013

An ice cube having a mass of 50 grams and an initial temperature of −10 degrees Celcius is placed in 400 grams of 40 degrees Celcius water. The specific heat of ice is 2060 J/kg°C. The specific latent heat of fusion is 334,000

J/kg. The total heat needed by the ice to melt to become water with the temperature 0°C is …
(A) 1,030 J
(B) 5,670 J
(C) 16,700 J
(D) 17,730 J
(E) 18,760 J

82. SIMAK UI KKI 2012



Two rods of equal lengths and cross-sectional areas but different materials are placed in thermal contact as shown in figure above. The thermal conductivity of Q is half that of P. The outer end of P is at 0°C and that of Q is at 100°C. What is the temperature of the interface at steady state?
(A) 273.00 K
(B) 296.88 K
(C) 306.33 K
(D) 339.66 K
(E) 353.39 K

83. SIMAK UI KKI 2012
A 40 g ice cube at 0°C is added to 200 g of water at 20°C. The specific heat of ice is 2310 $\text{Jkg}^{-1}\text{°C}^{-1}$ and that of water is 4200 $\text{Jkg}^{-1}\text{°C}^{-1}$ and the specific latent heat of melting of ice is 3.36×10^5 Jkg^{-1}. Calculate the final equilibrium temperature, assuming no other agents for heat exchange are present.
(A) 275.1 K
(B) 276.6 K
(C) 277.6 K
(D) 280.0 K
(E) 298.0 K

84. SIMAK UI KKI 2016
The zeroth law of thermodynamics states that …
(1) The entropy of an isolated system can only increase
(2) Total internal energy is a state function
(3) The efficiency of heat engine can never be 100%
(4) If system A and system B are in thermodynamic equilibrium and if system B is in thermodynamic equilibrium with system C, then system A and C are also in thermodynamic equilibrium

RELATIVITY

85. SIMAK UI KKI 2021
A spaceship in distress sends out two escape pods in opposite directions. One travels at a speed $v_1 = -0.6c$ in one direction, and the other travels at a speed $v_2 = +0.5c$ in the other direction, as observed from the spaceship. What speed does the first escape pod measure for the second escape pod?
(A) 0.65c
(B) 0.45c
(C) 0.75c
(D) 0.55c
(E) 0.85c

86. SIMAK UI KKI 2015
A beam with a length of L is measured by an observer when the beam moves with a speed of 1.8×10^8 m/s relative to him/her. The true statement is …
(A) $L = 0.60$ m
(B) $L = 0.80$ m
(C) $L = 0.90$ m
(D) $L = 1.00$ m
(E) $L \gg 1.00$ m

QUANTUM PHYSICS

87. SIMAK UI KKI 2020
The maximum wavelenght of radiation from an object at a temperature of T is 6000 angstrom. If the temperature of the object

rises to 3/2 T, the maximum wavelenth of the radiation is … angstrom.
(A) 3000
(B) 2000
(C) 6000
(D) 5000
(E) 4000

88. SIMAK UI KKI 2013
A light source of wavelength λ illuminates a metal and ejects photoelectrons with a maximum kinetic energy of 1.00 eV. A second light source of wavelength $\frac{\lambda}{2}$ illuminates a metal and ejects photoelectrons with a maximum kinetic energy of 4.00 eV. The work function of the metal is …
(A) 1.0 eV
(B) 1.5 eV
(C) 2.0 eV
(D) 2.5 eV
(E) 3.0 eV

89. SIMAK UI KKI 2013
Photons of wavelength 450 nm are incident on a metal. The most energetic electrons ejected from the metals are bent into a circular arc of radius 20.0 cm by a magnetic field with a magnitude of 2.00×10^{-5} T. ($1\ \text{eV} = 1.6 \times 10^{-19}$ J). The work function of the metal is …
(A) 5.345 eV
(B) 4.500 eV
(C) 3.345 eV
(D) 2.500 eV
(E) 1.345 eV

NUCLEAR PHYSICS

90. SIMAK UI KKI 2021
In the decay ${}^{234}_{90}Th \rightarrow {}^{A}_{Z}Ra + {}^{4}_{2}He$, which of the following is true?
1. $Z = 88$
2. $A = 230$
3. Ra is Radium
4. When radium decays, ionizing radiation is a product

91. SIMAK UI KKI 2013
Half lives of two uranium isotopes U^{238} and U^{235} are known to be 4.5×10^9 yr and 7.1×10^8 yr, respectively. If the earth was formed with equal amounts of the two isotopes, estimation the current age of the earth given that uranium ores are 99.29% of U^{238} and 0.71% of U^{235} is …
(A) 2×10^9 yr
(B) 4×10^9 yr
(C) 6×10^9 yr
(D) 8×10^9 yr
(E) 9×10^9 yr