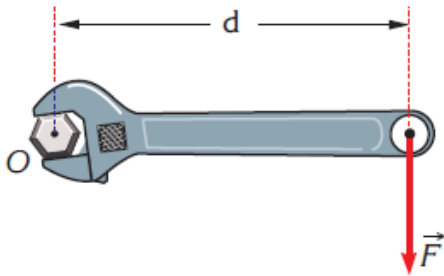# PHYSICS

Instruction: *You are offered the test items with one correct answer from four proposed ones.*

1. How much work is done if a force of 15 N moved an object a distance of 8 m?

A) 100 J
B) 80 J
C) 120 J
D) 150 J

2. What is the torque produced by a 2,5 N force, perpendicular to the 0,2 m spanner, as shown in the figure below? $(\sin90° = 1)$

A) 0,2 Nm
B) 0,5 Nm
C) 2,5 Nm
D) 1,5 Nm

3. A gas sample in a cylinder- piston system is slowly compressed from state (i-initial) to state (f-final) as, in the PV graph shown in the figure. What is the work done by the gas during compression?
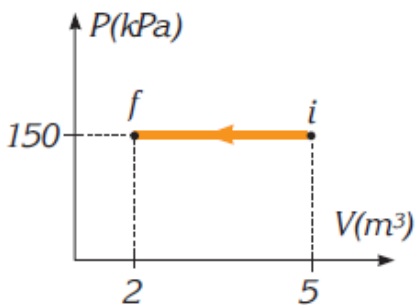
A) -450 kJ
B) 750 kJ
C) 150 kJ
D) -300 kJ

4. The pressure of a gas increases from 100 kPa to 120 kPa isothermally. What is the initial volume of the gas if the volume of gas decreases by 4 lt?
A) 20 lt
B) 2 lt
C) 6 lt
D) 24 lt

5. What mass of aluminum is deposited in an electrolysis experiment in $t = 20$ min, if the current is 2 A. (Take $k = 0.093$ mg/C)
A) 3,72 g
B) 223 mg
C) 55,8 mg
D) 0.93 g

6. In an electric circuit, the battery provides a current of 3,2 A for 2 s. How many electrons flow in this time? (The charge on an electron is $1.6 \cdot 10^{-19}$ C)
A) $2 \cdot 10^{19}$
B) $4 \cdot 10^{19}$
C) $0.5 \cdot 10^{19}$
D) $0.25 \cdot 10^{19}$

7. IMAGE formed by a converging lens is real, inverted, and has the same size as the object
A) if the object is between 2F and infinity
B) if the object is at F
C) if the object is between 2F and F
D) if the object is at 2F

8. A diver stands 20 m above the water surface. Calculate his speed just before he enters the water $(g = 10$ m/s$^2)$
A) 400 m/s
B) 10 m/s
C) 20 m/s
D) 100 m/s

9. The half-life of Zn is 2.4 minutes. If one has 100 g at the beginning, how many grams would be left after 7.2 minutes had elapsed?
A) 6,25 g
B) 12,5 g
C) 50 g
D) 25 g

10. If the electric field at point P is zero, what is the ratio $\frac{r_1}{r_2}$?
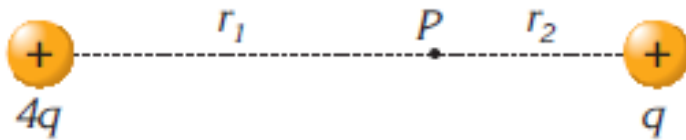
A) 0.25
B) 2
C) 0.5
D) 4

11. What time is it if you look at the clock in the mirror?

A) 12:25 o`clock
B) 12 o`clock
C) 5 o`clock
D) 7 o`clock

12. The period of a 0.5 m long simple pendulum is 2 s. What must the length of the pendulum be, so that its period is 1 s in the same plane?

A) 0.25 m
B) 0.125 m
C) 0.1 m
D) 0.5 m

13. A spaceship leaving Earth at a speed of 0,95c flashes a laser beam back at Earth. An observer on Earth will register this laser beam as having what speed?
A) 0.5c
B) 0.95c
C) 0.05c
D) c

14. A steam power plant burns 50 tons of coal every hour. The useful power output of the plant is 130 MW. What is the efficiency of this plant? (Take q_{coal} = 30 MJ/kg)
A) 0,312
B) 0,525
C) 0,625
D) 0,428

15. The Rutherford gold-foil experiment demonstrated
I. the plum-pudding model
II. atoms are mostly empty space
III. electrons occupy specific energy levels
A) I and III
B) I only
C) II only
D) III only

16. Two masses of $m_1 = 2\ kg$ and $m_2 = 3\ kg$ are connected by a massless and stretchless string with the aid of a frictionless pulley as shown in the figure. The masses are released from rest. Determine the acceleration of the system (g = $10\ m/s^2$, the surface is frictionless)
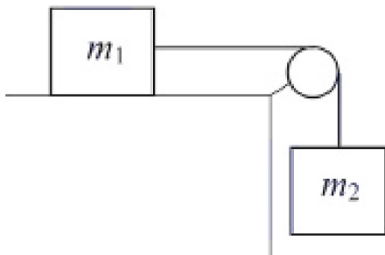
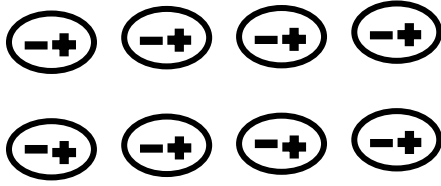A) 18 m/s²
B) 12 m/s²
C) 6 m/s²
D) 16 m/s²

17. A steel wire of diameter 2 mm and the length 5 m is suspended from a fixed point. 90 N weight is suspended from its free end. Young modulus of material of the wire is $2.1 \cdot 10^{11}$ Pa. The extension of wire is equal to
A) $\approx 6.8 \cdot 10^{-5} m$
B) $\approx 6.8 \cdot 10^{-4} m$
C) $\approx 3.74 \cdot 10^{-5} m$
D) $\approx 37.4 \cdot 10^{-5} m$

18. A dielectric in a parallel plate capacitor is polarized as shown in the picture.

External electric field is directed
A) to the right
B) up
C) down
D) to the left

19. A wave has a frequency of 200 Hz and a speed of 800 m/s. What is the wavelength of this wave?
A) 8 m
B) 4 m
C) 16 m
D) 2 m

20. If the voltage of the battery equals 10 V and the ammeter is showing the value of 2 A, the resistance of the connected device is
A) 0.2 Ohms
B) 5 Ohms
C) 8 Ohms
D) 20 Ohms

21. Figure below shows a hypothetical atom with a ground state of -10 eV that is radiated by photons of 12 eV energy. What is the maximum kinetic energy of the ejected electrons?
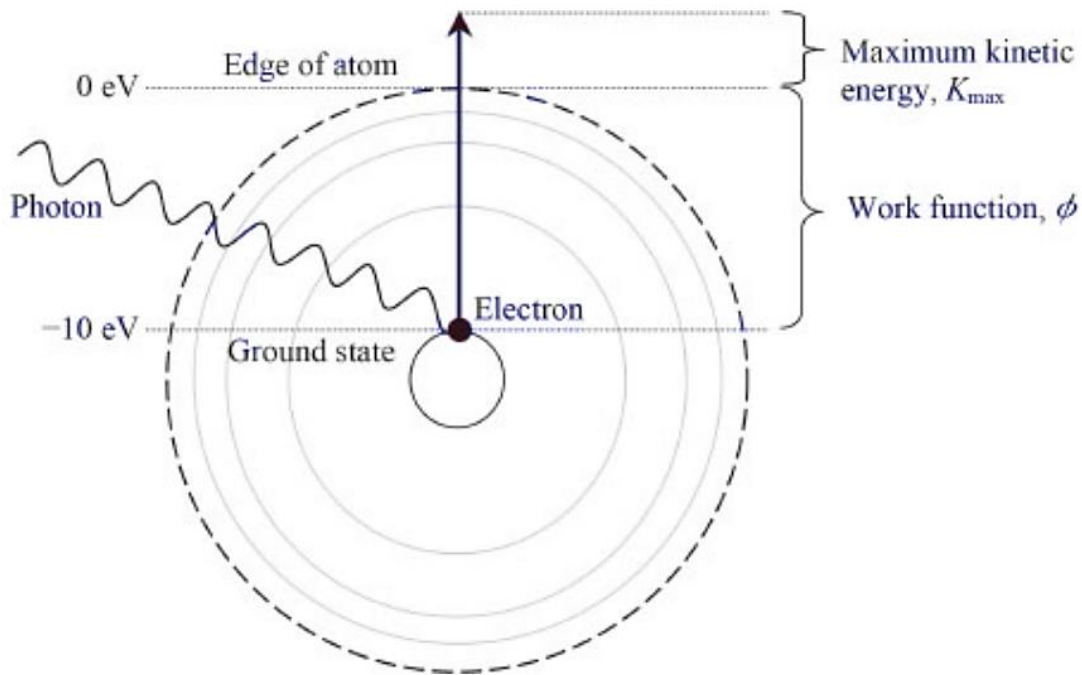
A) 5 eV
B) 2 eV
C) 4 eV
D) 3 eV

22. A solenoid 0.5 m in length has 200 turns and carries a current of 0.5 A, as shown in the figure. Find the magnetic field strength at the centre of the solenoid

$(\mu_0 = 4\pi \cdot \frac{10^{-7}N}{A^2})$
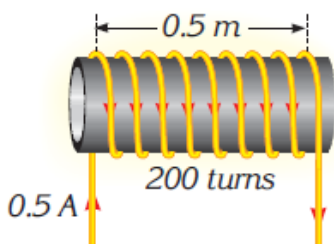
A) $20\pi \cdot 10^{-6}T$
B) $10\pi \cdot 10^{-6}T$
C) $80\pi \cdot 10^{-6}T$
D) $40\pi \cdot 10^{-6}T$

23. An ideal gas sample isothermally expands from 0.3 Lt to 0.5 Lt. What is the change in the internal energy of the gas during the process, if its initial temperature is 300K ?
A) 150 J
B) 300 J
C) 600 J
D) 0

24. An alternating current is induced in a loop of 200 turns and area $500\ cm^2$ which rotates in a magnetic field of magnitude $2 \cdot 10^{-2}T$. Determine the period of the rotation if the amplitude of emf is 10 V.
$$(\pi = 3.14)$$
A) 50 s
B) 1.26 s
C) 0.126 s
D) 5 s

25. An object moves horizontally 4 m under the effect of forces $F_1 = 50$ N, $F_2 = 40$ N, and $F_3 = 30$ N, as shown in the figure. Find the net work done by the net force, if surface is frictionless $(g = 10N/kg)$ $(\cos37° = 0.8, \sin37° = 0.6, \cos90° = 0, \cos180° = -1)$
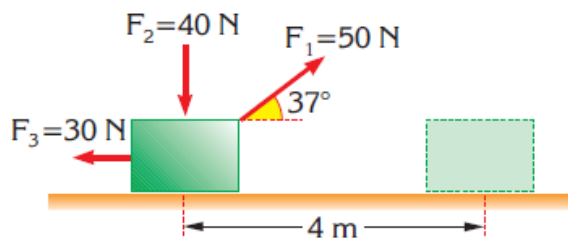
A) 40 J
B) 30 J
C) 50 J
D) 20 J

Two cars

The graph shows the variation of velocity with time of two cars, A and B, which are travelling in the same direction over a period of time of 40 s. Car A, travelling at a constant velocity of 40 m/s, overtakes car B at time t = 0. In order to catch up with car A, car B immediately accelerates uniformly for 20 s to reach a constant velocity of 50 m/s.
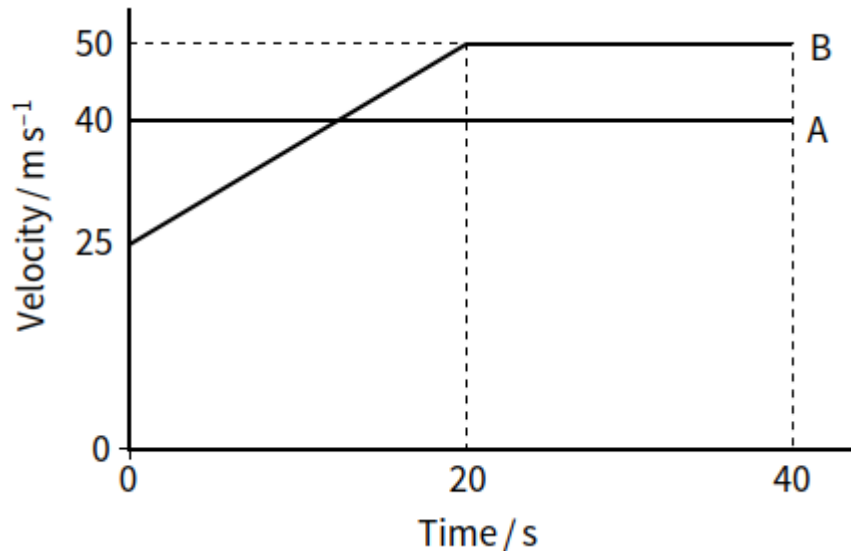
26. Calculate acceleration of B during the first 20 s
A) 2 m/s^2
B) 1.75 m/s^2
C) 1.5 m/s^2
D) 1.25 m/s^2

27. Calculate how far A travels during the first 20 s
A) 400 m
B) 800 m
C) 1000 m
D) 1600 m

28. Calculate distance of travel of B during the first 20 s
A) 1500 m
B) 1250 m
C) 750 m
D) 1000 m

29. Calculate total distance car B have travelled
A) 1750 m
B) 1250 m
C) 1000 m
D) 1500 m

30. Calculate time for B to catch up with A
A) 25 s
B) 40 s
C) 20 s
D) 35 s

31. Match the following properties with appropriate electromagnetic waves

A)	the wave with smallest frequency in electromagnetic spectrum	ultraviolet rays
		infrared waves
		radio waves
		gamma rays
B)	the wave with highest frequency in electromagnetic spectrum	ultraviolet rays
		infrared waves
		radio waves
		gamma rays

32. Match the root-mean square speed of gas with pressure exerted. Concentration is $4 \cdot 10^{25} \ m^{-3}$, mass of single gas molecule is $5 \cdot 10^{-26} \ kg$

A)	400 m/s	≈ 107 kPa
		≈ 167 kPa
		≈ 207 kPa
		≈ 247 kPa
B)	500 m/s	≈ 107 kPa
		≈ 167 kPa
		≈ 207 kPa
		≈ 247 kPa

33. An emf is induced in a 0.5 H coil by a current that rises uniformly from zero to I in 0.1 s. Match the magnitude of I with emf induced

		10 V
		50 V
A)	10 A	25 V
		75 V
		10 V
		50 V
B)	5 A	25 V
		75 V

34. Two 2 kg balls moving with velocities of 4 m/s and 2 m/s on a smooth horizontal surface undergo a head–on inelastic collision, as shown in the figure. Match the kinetic energy with its magnitude


		10 J
		18 J
A)	total kinetic energy after colision	20 J
		16 J
		10 J
		18 J
B)	total kinetic energy before colision	20 J
		16 J

35. Two objects which are moving in opposite directions on a smooth horizontal plane undergo an **inelastic collision**. Match the kinetic energy with its magnitude

$v_2 = 4$ m/s $v_1 = 2$ m/s

$m_2 = 2$ kg $m_1 = 6$ kg
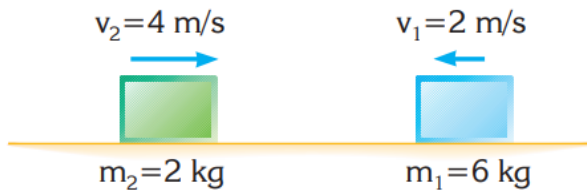
A)	total kinetic energy before colision	12 J	
		28 J	
		1 J	
		21 J	
B)	total kinetic energy after colision	12 J	
		28 J	
		1 J	
		21 J	

36. A force F is applied to an object of mass m placed on a rough horizontal plane, as shown in the figure. If there is friction between the horizontal plane and the object, which of the following statements may be correct?

$2 \leftarrow\bullet\rightarrow 1$

F

m

$\mu \neq 0$
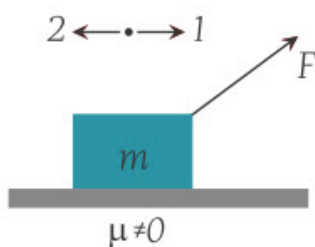
I. The object doesn't move.
II. The object moves in direction 1.
III. The object moves in direction 2.
A) I and II
B) II
C) I and III
D) III
E) II and III
F) I

37. The periods of the mass-spring systems in figure of spring constants k_1 and k_2 are 2 s and 5 s, respectively. If the spring constant $k_1 = 30 \ N/m$, find the spring constant k_2, if the masses of objects are same.
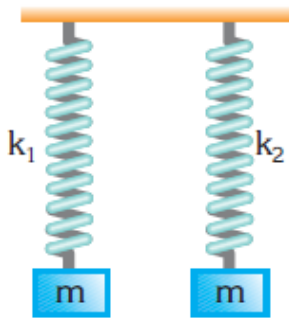
A) $4.8 \cdot 10^3$ mN/m
B) 0.2 N/m
C) 5 N/m
D) $5 \cdot 10^{-3}$ kN/m
E) 4.8 N/m
F) $0.2 \cdot 10^{-3}$ kN/m
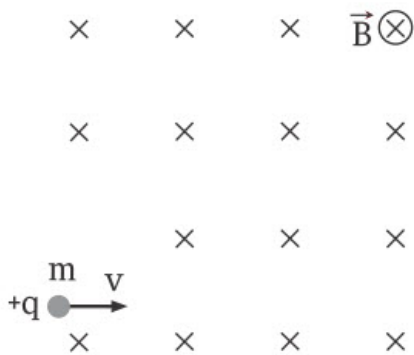
38.
A particle of charge +q projected with a speed of v in a uniform magnetic field moves in a circular path. Which of the following parameter(s) must be increased in order to increase the radius of the circular orbit?
I. The velocity of the particle
II. The mass of the particle
III. The magnitude of the magnetic field
IV. The charge of the particle
A) I and II
B) I
C) II
D) IV
E) III and IV
F) III

39. The volume of an air bubble becomes three times greater as it rises from the bottom to the top of a lake. What is the depth of the lake if its temperature is constant? Atmospheric pressure is measured to be 100 kPa and the density of water is 1000 kg/m^3.
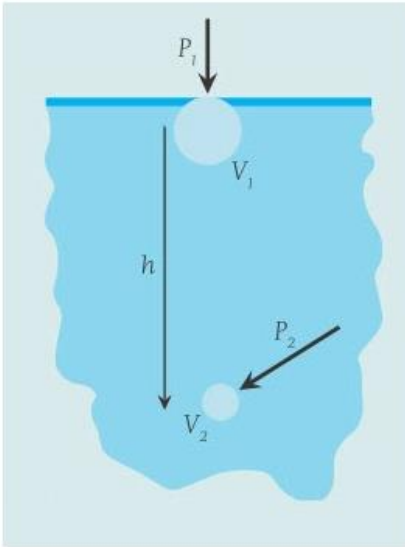
A) 20 m
B) 30 m
C) 200 dm
D) 40 m
E) 40000 mm
F) 0,03 km

40. The image of an object in front of a diverging lens
A) inverted
B) smaller than the object
C) real
D) larger than the object
E) virtual
F) upright

PHYSICS TEST IS COMPLETED