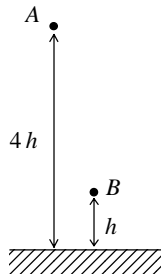


1995 Hong Kong Advanced Level Examination
AL Physics
Multiple Choice Question

1. When given a slight push, a toy car moves freely with constant velocity down a plane inclined at 20° to the horizontal. If the mass of the car is 0.5 kg, find the force parallel to the inclined plane for pulling the car up the plane with constant velocity.

- A. 1.7 N
B. 3.4 N
C. 4.7 N
D. 6.7 N
E. 9.4 N

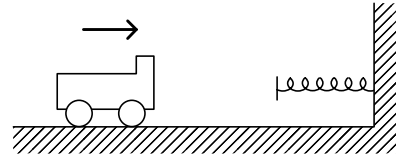
2.



Two small spheres *A* and *B* of masses 1 kg and 2 kg respectively are released from rest at heights $4h$ and h above the ground as shown. Which of the following statements is/are correct? (Assume air resistance is negligible)

- (1) The acceleration of sphere *A* doubles that of sphere *B*.
(2) The time taken for sphere *A* to reach the ground is double that of sphere *B*.
(3) The kinetic energy of sphere *A* when reaching the ground is double that of sphere *B*.
- A. (1) only
B. (3) only
C. (1) and (2) only
D. (2) and (3) only
E. (1), (2) and (3)

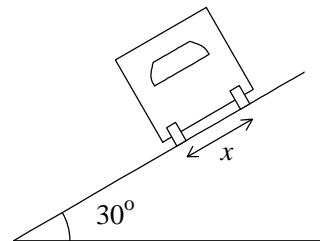
3.



A trolley travels with constant velocity to the right on horizontal ground and collides with a light helical spring attached to a wall fixed to the ground (earth) as shown. At the instant that the trolley comes momentarily to rest during collision, what has happened to the initial momentum of the trolley?

- A. It has been transferred to the earth.
B. It has been stored in the spring.
C. It has been dissipated as sound and heat.
D. It has been destroyed by the friction due to the ground.
E. It has been lost because the collision was not perfectly elastic.

4.



For safety reasons, a vehicle should be so designed that no sideways toppling occurs before reaching an angle of inclination of 30° . If the centre of gravity of that vehicle is 1.8 m above the ground, what is the minimum separation x between its wheels?

- A. 1.0 m
B. 1.5 m
C. 1.8 m
D. 2.1 m
E. 2.4 m

5. A small object of mass 0.05 kg is released from rest at the rim of a heavy, smooth semi-spherical bowl of radius 10 cm. Find

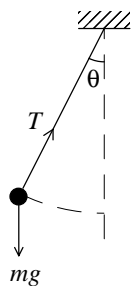
the force acting on the object by the bowl when it passes the bottom of the bowl.

- A. 0.5 N
- B. 1.0 N
- C. 1.5 N
- D. 2.0 N
- E. 2.5 N

6. An aircraft flies along a horizontal circle of radius 10 km with a constant speed of 155 m/s. Calculate the angle between its wings and the horizontal.

- A. 11.5°
- B. 12.0°
- C. 12.5°
- D. 13.0°
- E. 13.5°

7.

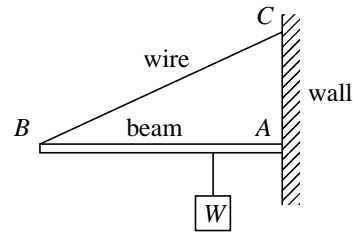


A simple pendulum is displaced an angle θ and is released from rest. If T is the tension in the string and m is the mass of the bob, which of the following statements is/are correct?

- (1) At the moment when the bob is released, $T \cos \theta = mg$.
- (2) The restoring force of the harmonic motion is $T \sin \theta$.
- (3) The period of oscillation is independent of θ when θ is small.

- A. (1) only
- B. (3) only
- C. (1) and (2) only
- D. (2) and (3) only
- E. (1), (2) and (3)

8.

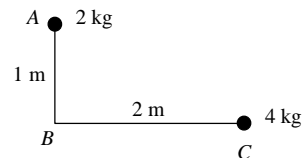


The figure shows a uniform rigid beam AB , pivoted at A , held in horizontal position by a wire attached to a wall at point C , vertically above A . The beam carries a load W . If W is shifted gradually from A towards B , which of the following quantities will increase?

- (1) The tension in the wire.
- (2) The horizontal compression force in the beam.
- (3) The vertical component of the reaction at A .

- A. (1) only
- B. (3) only
- C. (1) and (2) only
- D. (2) and (3) only
- E. (1), (2) and (3)

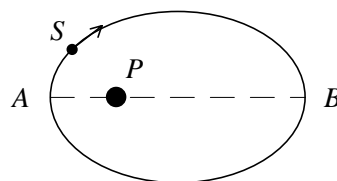
9.



Point masses of 2 kg and 4 kg are attached to the ends of an L-shaped light frame ABC , with AB vertical and BC horizontal. The frame is pivoted at and free to rotate about point B in a vertical plane. What is the initial angular acceleration of the system when released from rest?

- A. 4.4 rad s^{-2}
- B. 5.0 rad s^{-2}
- C. 5.6 rad s^{-2}
- D. 8.0 rad s^{-2}
- E. 10.0 rad s^{-2}

10.



The figure shows a satellite S moving round a planet P in an elliptical orbit. Which of the following statements is/are correct?

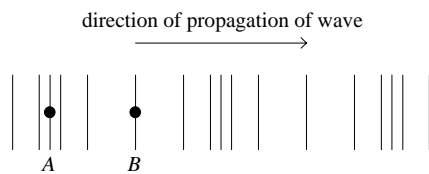
- (1) The speed of the satellite at A is faster than when it is at B .
- (2) The angular momentum of the satellite about P is the same when it is at positions A and B .
- (3) The total mechanical energy of the satellite is the same at positions A and B .

- A. (1) only
- B. (3) only
- C. (1) and (2) only
- D. (2) and (3) only
- E. (1), (2) and (3)

11. On a certain planet, an object is thrown vertically upwards with an initial velocity of v_1 and it returns to the ground after time t . If the velocity of escape from the planet is v_2 , find the radius of the planet.

- A. $\frac{2v_1^2 t}{v_2}$
- B. $\frac{4v_1^2 t}{v_2}$
- C. $\frac{2v_2^2 t}{v_1}$
- D. $\frac{v_2^2 t}{4v_1}$
- E. $\frac{v_2^2 t}{2v_1}$

12.

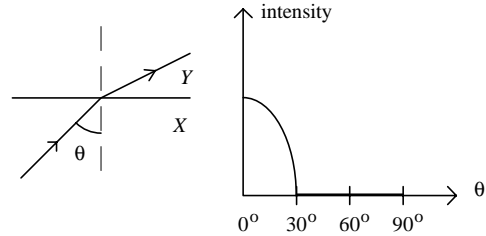


The figure shows a sound wave travelling to the right in air. Air particles A and B are at the centre of a compression and a rarefaction respectively. Which of the following gives correctly the directions of motion of A and B at the moment shown?

- Particle A Particle B

- A. to the right to the left
- B. to the right at rest
- C. to the right to the right
- D. at rest to the right
- E. to the left to the right

13.



When a beam of light travels from a medium X to another medium Y , the variation in intensity of the refracted beam when angle θ varies from 0° to 90° is as shown. What is the ratio $\frac{\text{speed of light in } X}{\text{speed of light in } Y}$?

- A. 1 : 2
- B. 1 : 3
- C. 2 : 1
- D. 2 : 3
- E. 3 : 1

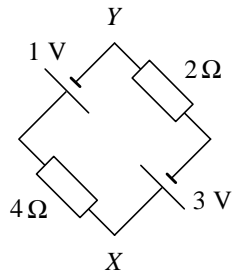
14. In Young's double-slit experiment, which of the following combinations of monochromatic light, the slit-separation and the slit-to-screen distance would produce the widest fringe separation on the screen?

	Monochromatic light	Slit-separation	Slit-to-screen distance
A.	red light	1 mm	1 m
B.	red light	1 mm	2 m
C.	red light	2 mm	1 m
D.	green light	1 mm	2 m
E.	green light	2 mm	1 m

15. A coating material of refractive index 1.25 is used for the blooming of a lens having a larger refractive index. For normal incidence, if green light is to be transmitted in its greatest amount through the lens, which of the following thicknesses of the coating would do? (Given : wavelength of green light in air is 550 nm)

- (1) 137.5 nm
 (2) 220 nm
 (3) 330 nm
- A. (1) only
 B. (3) only
 C. (1) and (2) only
 D. (2) and (3) only
 E. (1), (2) and (3)
16. An astronomical refracting telescope consists of two converging lenses of focal lengths 100 cm and 5 cm. Under normal adjustment, it is used to observe a distant object which subtends an angle of 0.2° when viewed directly. Which of the following statements is/are correct?
- (1) The lens with focal length 5 cm should be the objective.
 (2) The height of the first image formed by the telescope is 3.5 mm.
 (3) The angle subtended by the final image seen by the observer is 4° .
- A. (1) only
 B. (3) only
 C. (1) and (2) only
 D. (2) and (3) only
 E. (1), (2) and (3)
17. When an object placed far away from a convex lens is gradually moved towards the lens, the separation between the object and its real image will
- A. decrease.
 B. decrease and then increase.
 C. increase.
 D. increase and then decrease.
 E. remain unchanged.
18. An aircraft flies near the earth's surface over a stationary observer on a windless day. The frequency of the notes from the engine received by the observer is 300 Hz when approaching, and becomes 150 Hz when leaving. Assume the speed of sound in air to be 336 m/s. The speed of the aircraft is
- A. 56 m/s
 B. 84 m/s
 C. 112 m/s
 D. 168 m/s
 E. 224 m/s
19. Two loudspeakers are connected to the same signal source of negligible impedance. At a point equidistant from the two loudspeakers, a maximum intensity of intensity level 60 dB is detected. If one loudspeaker is disconnected, the intensity level at that point will be
- A. 57 dB
 B. 54 dB
 C. 46 dB
 D. 30 dB
 E. 15 dB
20. The pressure of an ideal gas in a container is P . If the number of gas molecules is halved, the volume of the container is doubled and the temperature is kept constant, the pressure will be
- A. $P/4$
 B. $P/2$
 C. P
 D. $2P$
 E. $4P$
21. The r.m.s. speed of the molecules of a certain gas X is 341 m/s at 298 K. Find the molar mass of the gas X . (Given: Universal gas constant $R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$)
- A. 5.4 g
 B. 21.8 g
 C. 33.8 g
 D. 42.6 g
 E. 63.9 g
22. A uniform wire is clamped at both ends which are 0.4 m apart. The tension in the wire is 65 N and the area of its cross-section is $4.5 \times 10^{-7} \text{ m}^2$. When the wire is plucked to produce transverse vibrations, the frequency of the fundamental note obtained is 160 Hz. The density of the wire is
- A. 5 600 kg/m^3
 B. 8 800 kg/m^3
 C. 12 600 kg/m^3
 D. 14 000 kg/m^3
 E. 22 000 kg/m^3

23.

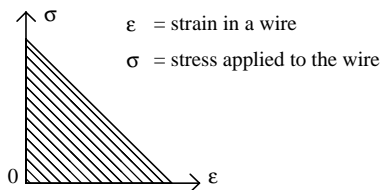


Two cells of negligible internal resistance are connected with two resistors as shown. What is the potential difference between *X* and *Y*?

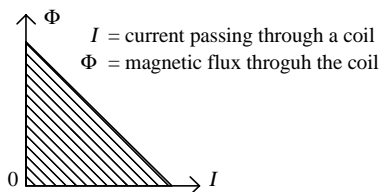
- A. 1.33 V
- B. 1.67 V
- C. 2.00 V
- D. 2.33 V
- E. 2.67 V

24. In which of the following graphs does the area of the shaded part represent energy?

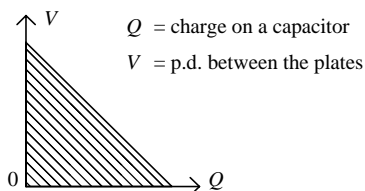
(1)



(2)



(3)



- A. (1) only
- B. (3) only
- C. (1) and (2) only
- D. (2) and (3) only
- E. (1) and (3) only

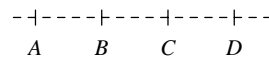
25. A $1 \mu\text{F}$ capacitor, which is initially charged, is discharged through a 50Ω resistor. The maximum current during discharge is 100 A. What is the initial charge on the capacitor?

- A. $5 \times 10^{-3} \text{ C}$
- B. $1 \times 10^{-4} \text{ C}$
- C. $5 \times 10^{-4} \text{ C}$
- D. $1 \times 10^{-3} \text{ C}$
- E. $2 \times 10^{-6} \text{ C}$

26. Two uncharged metal spheres, *A* and *B*, supported by insulating stands are placed side by side but not touching each other. A student places a positively-charged rod near sphere *A* and he touches sphere *B* with his finger momentarily. When the rod is removed afterwards, what are the signs of the charges induced on the spheres?

	<u>Sphere A</u>	<u>Sphere B</u>
A.	positive	neutral
B.	negative	negative
C.	negative	neutral
D.	neutral	positive
E.	neutral	negative

27.



A, *B*, *C*, *D* are four points on a straight line as shown. A point charge $+Q$ is fixed at *A*. When another point charge $-Q$ is moved from *B* to *C*, which of the following quantities will increase?

- (1) The electric potential energy of the system of charges.
- (2) The magnitude of the electric field strength at the point *D*.
- (3) The electric potential at the point *D*.

- A. (1) only
- B. (3) only
- C. (1) and (2) only
- D. (2) and (3) only
- E. (1), (2) and (3)

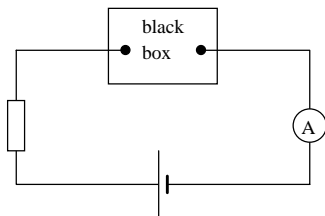
28. The mechanical power output of a d.c. motor is always less than the electrical

power input. Which of the following can be an explanation of this?

- (1) heat loss in the coil of the motor
- (2) work done against friction
- (3) work done against the back e.m.f. generated by the rotating coil

- A. (1) only
- B. (3) only
- C. (1) and (2) only
- D. (2) and (3) only
- E. (1), (2) and (3)

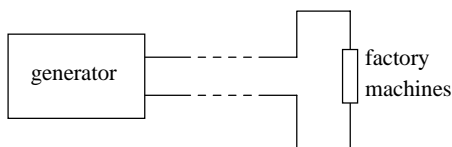
29. A 'black box' containing two unknown components is connected to a cell, a resistor and an ammeter as shown.



A current flows steadily no matter which way the box's terminals are connected to the cell and the same ammeter reading is obtained. The two components in the 'black box' could be

- A. two diodes in series.
- B. two diodes in parallel.
- C. two capacitors in parallel.
- D. a diode and a resistor in parallel.
- E. a diode and a capacitor in parallel.

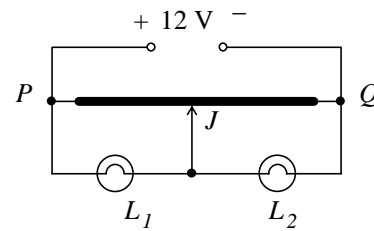
- 30.



The machines in a factory consume 10 kW of electrical power at a voltage of 500 V. If the generator is connected to the factory through cables of total resistance 0.2 Ω , the e.m.f. produced by the generator should be

- A. 500 V
- B. 501 V
- C. 502 V
- D. 504 V
- E. 508 V

- 31.



In the above circuit, PQ is a uniform resistance wire connected to a 12 V constant voltage source. L_1 and L_2 are two identical light bulbs, each of rating 12 V, 8 W. What is the power dissipated by L_1 when the sliding contact J is at the midpoint of PQ ?

- A. 1 W
- B. 2 W
- C. 4 W
- D. 6 W
- E. 8 W

32. In a Hall probe, the slice of semiconductor inside has 10^{25} charge-carriers per cubic metre. When a steady current of 0.4 A passes through the slice and a uniform magnetic field of 0.1 T applies perpendicularly to it, a Hall voltage of 20 μV is set up. Find the thickness of the slice.

(Given: electronic charge = 1.6×10^{-19} C)

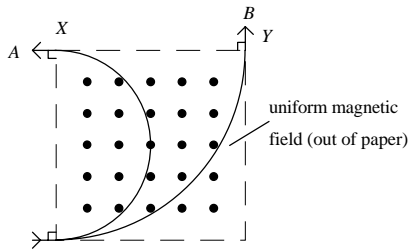
- A. 0.9×10^{-3} m
- B. 1.1×10^{-3} m
- C. 1.3×10^{-3} m
- D. 1.5×10^{-3} m
- E. 1.7×10^{-3} m

33. A uniform wire is stretched under tension. The strain in the wire depends on

- (1) the Young modulus of the wire.
- (2) the cross-sectional area of the wire.
- (3) the unstretched length of the wire.

- A. (1) only
- B. (3) only
- C. (1) and (2) only
- D. (2) and (3) only
- E. (1), (2) and (3)

- 34.



Particles A and B moving at the same speed enter a square region of uniform magnetic field as shown. Particle A leaves at X while particle B leaves at Y . If the charge to mass ratio of particle A is k , what is that of particle B ?

- A. $k/2$
 B. $k/4$
 C. k
 D. $2k$
 E. $4k$
35. A magnet is moved along a perpendicular direction towards a sheet of copper. Which of the following statements is/are correct?
- (1) Eddy current flows in the sheet.
 (2) Temperature of the sheet increases.
 (3) Repulsive force is experienced by the magnet.
- A. (1) only
 B. (3) only
 C. (1) and (2) only
 D. (2) and (3) only
 E. (1), (2) and (3)
36. When light of frequency f_1 is shone on to a metal surface, the maximum energy of the electrons emitted is E_1 . If the same surface is illuminated with light of frequency f_2 , the maximum energy of the electrons emitted is E_2 . The Planck constant is given by

- A. $\frac{f_2 E_1 + f_1 E_2}{f_1 f_2}$
 B. $\frac{f_2 E_1 - f_1 E_2}{f_1 f_2}$
 C. $\frac{E_1 + E_2}{f_1 + f_2}$
 D. $\frac{E_1 - E_2}{f_1 + f_2}$

E. $\frac{E_1 - E_2}{f_1 - f_2}$

37. In an LCR series circuit, the total impedance across the three components is the same at both frequencies 25 Hz and 225 Hz. What is the resonant frequency of the circuit?

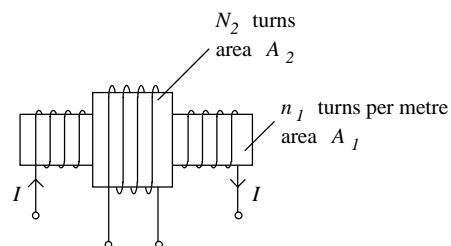
- A. 50 Hz
 B. 75 Hz
 C. 100 Hz
 D. 125 Hz
 E. 150 Hz

38. When an electron in an atom undergoes a transition from a higher energy level to a lower one, the time taken is about 10^{-9} s. Which of the following statements about the transition is/are correct?

- (1) Electromagnetic radiation is emitted during the transition.
 (2) The length of the wave train from such a transition is about 0.3 m.
 (3) The energy of the photon emitted depends on the energy difference between the two levels.

- A. (1) only
 B. (3) only
 C. (1) and (2) only
 D. (2) and (3) only
 E. (1), (2) and (3)

39.

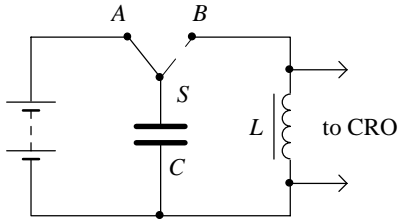


A solenoid of n_1 turns per metre and cross-sectional area A_1 carries a current I . It is inserted into the core of another larger solenoid of N_2 turns and cross-sectional area A_2 . If the current in the smaller solenoid drops uniformly to zero in time t , what is the e.m.f. induced in the larger solenoid?

- A. $2\mu_0 n_1 I A_1 N_2 / t$

- B. $2\mu_0 n_1 I A_2 N_2 / t$
- C. $\mu_0 n_1 I A_1 A_2 / t$
- D. $\mu_0 n_1 I A_2 N_2 / t$
- E. $\mu_0 n_1 I A_1 N_2 / t$

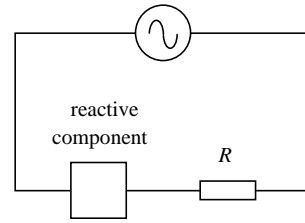
40.



A capacitor C and an inductor L with some resistance are connected to a battery as shown in figure. When switch S is moved from A to B , what is the trace observed on the screen of the CRO with the time base on?

- A.
- B.
- C.
- D.
- E.

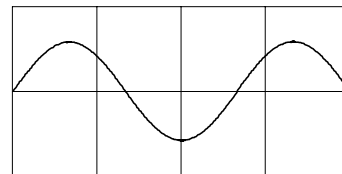
41.



An a.c. power source of negligible impedance is connected in series with a reactive component and a resistor of resistance R . At the source frequency, the source voltage has r.m.s. value V , the component's reactance is X and the circuit's total impedance is Z . The power consumption in the circuit is

- A. $\frac{V^2}{R}$
- B. $\frac{V^2}{Z}$
- C. $\frac{V^2 R}{Z^2}$
- D. $\frac{V^2 R}{X^2}$
- E. $\frac{V^2 X}{Z^2}$

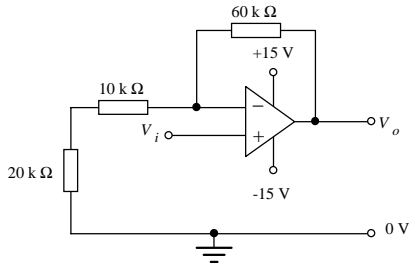
42. The diagram below shows the trace on the screen of a CRO when a sinusoidal signal of frequency 75 Hz was applied to the Y-plates.



What time base, in ms per division, was the CRO set at?

- A. 1
- B. 2
- C. 5
- D. 10
- E. 20

43. An operational amplifier is connected as shown below with input voltage $V_i = +2V$.



What is the output voltage V_o ?

- A. -6 V
 B. -4 V
 C. +4 V
 D. +6 V
 E. +12 V
44. $^{226}_{88}\text{Ra}$ decays to $^{222}_{86}\text{Rn}$ with a half-life of 1 600 years. Which of the following statements is/are correct?
- (1) α particle is produced in the decay.
 (2) All $^{226}_{88}\text{Ra}$ has decayed after 3 200 years.

(3) The half-life of $^{226}_{88}\text{Ra}$ can be shortened by heating.

- A. (1) only
 B. (3) only
 C. (1) and (2) only
 D. (2) and (3) only
 E. (1), (2) and (3)

45. In an experiment to measure the density of steel, a steel sphere was used. The following measurements were obtained:

Mass of the sphere = $530 \text{ mg} \pm 1 \text{ mg}$

Diameter of the sphere
 = $0.51 \text{ cm} \pm 0.01 \text{ cm}$

Estimate the percentage error in the calculated value of the density of steel.

- A. 1%
 B. 2%
 C. 4%
 D. 6%
 E. 8%

- End of Paper -