Each question has **four** answer options. For each question, choose the **best** answer. Shade your answers on the given answer sheet.

1 Which of the following equation is dimensionally **CORRECT**?

A $s = \frac{1}{2}(u + vt)$ where s is displacement, u and v are velocities, and t is time.

B $W = mgh$ where W is work done, m is mass, g is gravitational acceleration, and h is height.

C $\rho = mv$ where ρ is density, m is mass, and v is velocity.

D $Ft = ma$ where F is force, t is time, m is mass, and a is acceleration.

2 A bus is moving with an initial speed u begins to slow down at a uniform rate of 3 m s^{-2}. Calculate u if it takes 6.67 s to travel at distance of 67.0 m.

A 30 m s^{-1}

B 26 m s^{-1}

C 20 m s^{-1}

D 15 m s^{-1}

3 A ball is thrown horizontally from the top of a building with a speed of 20 m s^{-1}. After 7.0 s, the ball hits the ground. What is the height of the building?

A 380 m

B 240 m

C 100 m

D 60 m

4

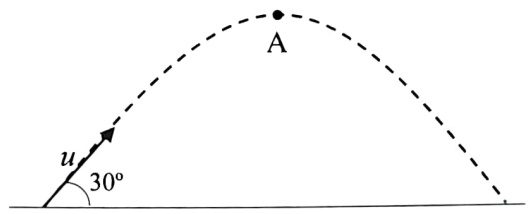

FIGURE 1

FIGURE 1 shows a path taken by an object projected with an initial speed, u at angle 30° to the horizontal. What is the speed of the object at point A?

A $0.57u$

B $0.67u$

C $0.87u$

D $1.07u$

5 A motorcycle accelerates from rest to 5.0 m s^{-1} in 4.5 s and then continues at this speed for another 4.5 s. Calculate the total distance travelled by the motorcycle.

A 11.25 m

B 22.50 m

C 33.75 m

D 45.50 m

6 A 500 g soccer ball is kicked horizontally at the speed of 12 m s^{-1} towards a wall. It rebounds off the wall at the speed of 2 m s^{-1}. Calculate the magnitude of the impulse on the ball.

A 5 kg m s^{-1}

B 7 kg m s^{-1}

C 5000 kg m s^{-1}

D 7000 kg m s^{-1}

7 Two rugby players with mass 75 kg and 100 kg run directly towards each other with velocities of 6 m s^{-1} to the right and 8 m s^{-1} to the left respectively. If they grab each other as they collide, calculate the combined velocity of the two players just after the collision.

A 2 m s^{-1}

B −2 m s^{-1}

C 3 m s^{-1}

D −3 m s^{-1}

8 A man of mass 75.0 kg and woman of mass 55.0 kg stand facing each other on a smooth horizontal surface, both wearing roller blades. The woman pushes the man to the right with a horizontal force of 85.0 N. Determine the acceleration of the woman.

A 1.13 m s^{-2}

B −1.13 m s^{-2}

C 1.55 m s^{-2} 4

D −1.55 m s^{-2}

9 How large a net force required to accelerate a 600 N object at rate 0.70 m s^{-2} on a smooth horizontal surface?

A 430 N 4

B 420 N

C 43 N

D 42 N

10

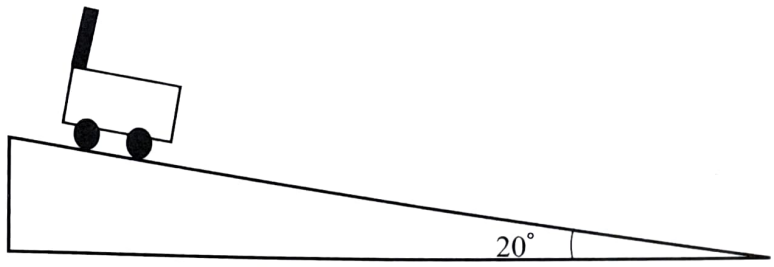

FIGURE 2

A shopping trolley with a total mass of 40 kg is released from rest and rolls down a 2 m long surface which is inclined at 20° as shown in **FIGURE 2**. Calculate the work done to stop the trolley at the bottom of the surface if it experiences a constant frictional force of 16 N.

A 237 J

B 273 J

C 300 J

D 705 J

11 A man is lifting three boxes each weighing 80 N to a 1.2 m high shelf in 2.0 s. Calculate the power required by the man to lift the boxes.

A 0 W

B 48 W

C 144 W

D 1412 W

12 Calculate the falling height of a 2 kg sphere if its kinetic energy is 300 J just before striking the ground. The air resistance can be ignored.

A 7.3 m

B 15.3 m

C 27.5 m

D 30.6 m

5

13 In a bike race, a racer and his bike of mass 230 kg moves round a curve on a level track with a velocity of 80 km h^{-1}. If the radius of the curve is 90 m, what is the frictional force acting on the bike at the curve?

A 1.26 N

B 1.26 kN

C 4.54 N

D 4.54 kN

14

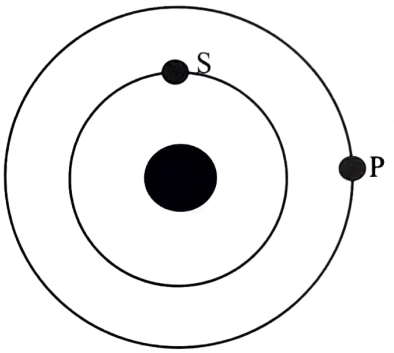

FIGURE 3

Two satellites S and P are orbiting the earth in circular path. The orbital radius of S is half of P as shown in **FIGURE 3**. The ratio of gravitational field strength of S to P is

A 4

B 2

C 1/2

D 1/4

15 The distance between the centre of earth and a satellite of mass 3500 kg is 7.18×10^6 m. Calculate the gravitational force between the satellite and the Earth if the mass of Earth is 6.0×10^{24} kg.

A 1.56×10^4 N

B 2.11×10^4 N

C 2.71×10^4 N

D 3.50×10^4 N

16 A mass of 200 g is attached to a spring. When the mass displaced a certain distance from equilibrium and released, it oscillates at a period of 0.85 s. What is the constant of the spring?

A $0.57\ \text{N m}^{-1}$

B $1.47\ \text{N m}^{-1}$

C $10.93\ \text{N m}^{-1}$

D $10973.94\ \text{N m}^{-1}$

17

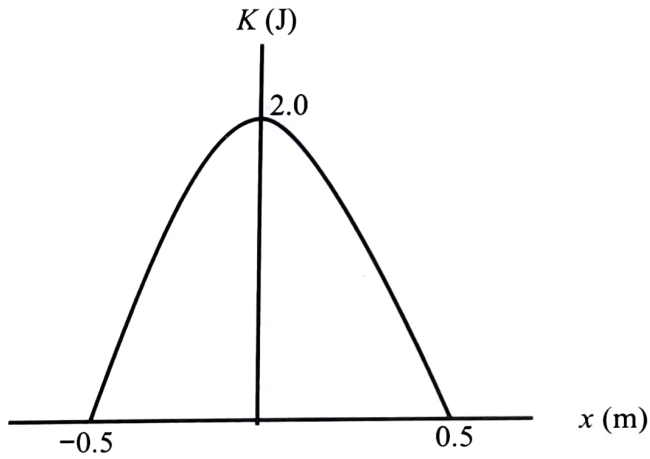

FIGURE 4

FIGURE 4 shows a particle of mass 4.0 kg moves in simple harmonic motion and its kinetic energy, K varies with position, x. Determine the period of the oscillation.

A $\frac{1}{2}\pi$ s

B π s

C $\frac{3}{2}\pi$ s

D 2π s

18 What is the speed of a transverse wave in a rope of length 5.00 m and mass 55.00 g under a tension of 600.00 N?

A $0.01\ \text{m s}^{-1}$

B $233.55\ \text{m s}^{-1}$

C $0.14\ \text{m s}^{-1}$

D $54.55\ \text{m s}^{-1}$

19 A transverse wave is represented by the following equation:

$$y = 7 \sin (5t - 3x)$$

where y and x are measured in centimeters and t in seconds. What is the maximum vibrational velocity of a particles in the wave?

A 0.15 m s^{-1}

B 0.21 m s^{-1}

C 0.35 m s^{-1}

D 21 m s^{-1}

20

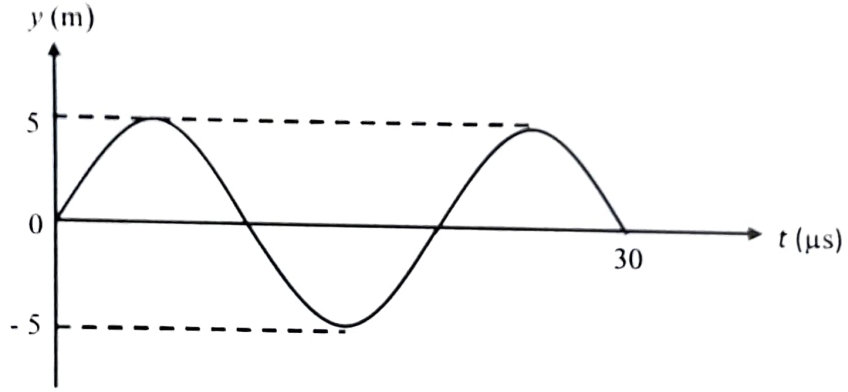

FIGURE 5

FIGURE 5 shows how the displacement, y of a particle varies with time, t when a wave passes through the particle at speed 6.0 km s^{-1}. The wave is reflected and superimposed with an incident wave. What is the equation of the standing wave formed?

A $y = 5 \cos (52.36x) \sin (3.14 \times 10^5 t)$ where y and x are in m, and t in s

B $y = 5 \cos (34.91x) \sin (2.09 \times 10^5 t)$ where y and x are in m, and t in s

C $y = 10 \cos (52.36x) \sin (3.14 \times 10^5 t)$ where y and x are in m, and t in s

D $y = 10 \cos (34.91x) \sin (2.09 \times 10^5 t)$ where y and x are in m, and t in s

21 If a sound of intensity 1.00×10^{-6} W m^{-2} falls on a detector of area 7.00×10^{-5} m^2, how much power is received by the detector?

A 6.20×10^{-14} W

B 7.00×10^{-11} W

C 1.00×10^{-6} W

D 3.40×10^{-2} W

22 The security alarm in a parking area produces a siren with frequency of 980 Hz. As a car drives away, the driver observes the frequency changes to 850 Hz. The speed of sound in air is 345 m s^{-1}. What is the speed of the car?

A 48.14 m s^{-1}

B 66.85 m s^{-1}

C 52.76 m s^{-1}

D 45.77 m s^{-1}

23 A 5 m long wire has a cross sectional area of 4×10^{-4} m^2. The wire is extended by 0.5 cm. Calculate the Young's Modulus of the wire when a 200 kg load is suspended at its one end.

A 5.00×10^{8} Pa

B 4.91×10^{9} Pa

C 5.00×10^{9} Pa

D 4.91×10^{10} Pa

24 An aluminium rod of radius 0.5 cm and length 20.0 cm is welded end-to-end with a steel rod of the same dimensions. The free end of the aluminium rod is held at 100 °C while the steel free end is placed in an ice bath. When the system is at steady state, calculate the temperature at the aluminium-steel interface.
[Given the thermal conductivity of aluminium is 240 W m^{-1} °C^{-1} and the thermal conductivity of steel is 14 W m^{-1} °C^{-1}]

A 90 °C

B 94 °C

C 100 °C

D 115 °C

25 An aluminium tube of external diameter 3.00 cm at 25 °C is heated to 80 °C. Calculate the external area of the tube at 80 °C if the coefficient of linear expansion for aluminium is 2.4×10^{-5} K^{-1}.

A 4.71×10^{-2} m^2

B 1.87×10^{-2} m^2

C 2.84×10^{-3} m^2

D 7.09×10^{-4} m^2

26 What is the pressure of one mole ideal gas in the container of volume 4×10^{-4} m^3 at temperature 363.15 K?

A 4.00×10^{6} Pa

B 6.03×10^{6} Pa

C 6.23×10^{6} Pa

D 7.54×10^{6} Pa

27 Given the molar mass of oxygen is 32 g per mol. What is the root mean square speed of the oxygen molecules at a temperature of 333 K.

A 16 m s^{-1}

B 100 m s^{-1}

C 216 m s^{-1}

D 509 m s^{-1}

28 A balloon contains helium gas at 30 °C and 2×10^{-5} Pa. The number of helium gas molecules per unit volume is

A 6.80×10^{15} m^{-3}

B 5.32×10^{15} m^{-3}

C 4.78×10^{15} m^{-3}

D 4.10×10^{15} m^{-3}

29

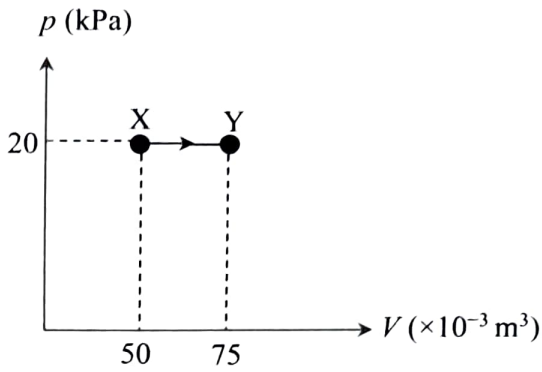

FIGURE 6

FIGURE 6 shows a graph of pressure, p against volume, V of an ideal gas. When the gas changes from state X to state Y, the amount of heat transfer into the gas is 1.0 kJ. The internal energy of the gas is

A decreased by 0.5 kJ.

B decreased by 1.0 kJ.

C increased by 0.5 kJ.

D decreased by 0.5 kJ.

30

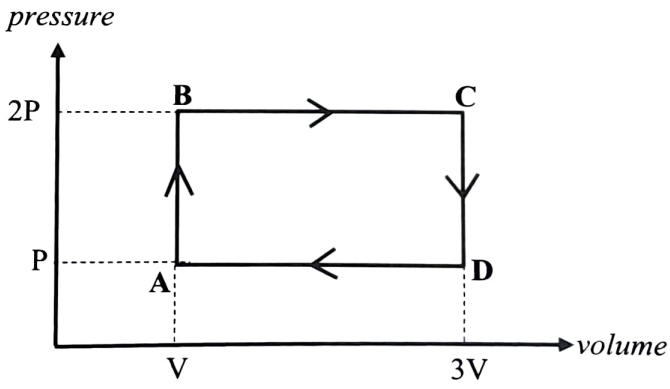

FIGURE 7

FIGURE 7 shows a graph of pressure versus volume of an ideal gas undergoing the cyclic thermodynamic process **ABCDA**. Calculate the total work done by the gas.

A 1PV

B 2PV

C 3PV

D 4PV

END OF QUESTION PAPER