PHYSICS

SUGGESTED MARK SCHEME
Maximum Mark: 190

9749

October/November 2019

Paper 1
Multiple Choice

Question	*Key*	*Question*	*Key*	*Question*	*Key*
1	**D**	6	**B**	11	**D**
2	**D**	7	**A**	12	**A**
3	**D**	8	**D**	13	**C**
4	**C**	9	**D**	14	**C**
5	**A**	10	**B**	15	**B**
16	**B**	21	**B**	26	**C**
17	**B**	22	**B**	27	**B**
18	**C**	23	**C**	28	**C**
19	**D**	24	**D**	29	**B**
20	**C**	25	**B**	30	**A**

1 **D**

2 **D**

$0.01 \times 4.072 = 0.04072 \text{ V}$
$= 40.72 \text{ mV}$
$40.72 + 10 = 50.72 \text{ mV}$
$\approx 0.05 \text{ V (1sf)}$

3 **D**

let $(t_1 + 1.00)$ s be total time of fall

at t_1, $s = \frac{1}{2}(9.81)(t_1)^2$

at t_1+1.00, $4s = \frac{1}{2}(9.81)(t_1 + 1)^2$

solving the eqns will give

$t_1 = 1.00$ or $-\frac{1}{3}$

time of fall $= 1 + 1 = 2.00$ s

4 **C** Between t_1 and t_2 the gradient of graph is increasing. Eventually the graph becomes linear and thus acceleration tend towards zero.

5 **A** No net force acting on the system (X, Y and container) and thus by principle of conservation of linear momentum, no change in the combined centre of gravity of the system.

6 **B** By conservation of linear momentum,

$mu + 0 = mv + 2mv$

$u = 3v$

$KE_i = \frac{1}{2}m(u)^2 = \frac{1}{2}m(3v)^2 = \frac{1}{2}m(9v^2)$

$KE_f = \frac{1}{2}m(v)^2 + \frac{1}{2}m(2v)^2 = \frac{1}{2}m(5v^2)$

7 **A** using coordinates (10,14)

$F = kx$

$k = \frac{14}{(\frac{10}{1000})} = 1400$

at (20,28) the elastic limit of spring is reached

work done $= \frac{1}{2}kx^2 = \frac{1}{2}(1400)(\frac{20}{1000})^2 = 0.28$ J

8 **D** As the object moves towards Y, the net force on the object tends to zero and thus the rate of increase in kinetic energy tends to zero. (ie the gradient of KE-distance graph tends to zero)

9 **D** $P = \frac{\Delta GPE}{\Delta t} = \frac{1.3 \times 10^9 \times 9.81 \times 2}{60 \times 60 \times 24} = 295000$ J

10 **B** $v = R\omega$

$\omega = \frac{v}{R}$

Since v is constant, graph B is correct

11 **D** $a_c = \omega^2 r$

$\omega = \sqrt{\frac{a_c}{r}} = \sqrt{\frac{20g}{7.0}} = 5.3$

12 **A** By CoE

$E_i = E_f$

$\frac{1}{2}mv^2 + \left(-\frac{GMm}{R}\right) = 0$

$v = \sqrt{\frac{2GM}{R}}$

13 **C** $\frac{1}{2}m\langle c\rangle^2 = \frac{3}{2}kT$

$\langle c\rangle = \sqrt{\frac{3kT}{m}} = \sqrt{\frac{1.25 \times 10^{-20}}{\left(\frac{4 \times 10^{-3}}{6.02 \times 10^{23}}\right)}} = 1374$

14 **C** By definition, total internal energy of a gas is the sum of the random distribution of KE and PE associated with the molecules of a system of gas

15 **B** By 1st Law of thermodynamics

16 **B** When the displacement (from the equilibrium position) is zero, the spring is not extended, hence the EPE is zero. The KE is thus at its maximum. The spring is not extended, hence the restoring force is zero.

17 **B**

$$T_A = \frac{1}{480} = 2.0833 \times 10^{-3}$$

$$T_B = \frac{1}{482} = 2.0747 \times 10^{-3}$$

$$\frac{0.25}{T_A} = 120$$

$$\frac{0.25}{T_B} = 120.5$$

at $t = 0.25$ s, the 2 waves will meet and interfere destructively

$$\frac{0.75}{T_A} = 360$$

$$\frac{0.75}{T_B} = 361.5$$

at $t = 0.75$ s, the 2 waves will meet and interfere destructively

18 **C** Between consecutive constructive intereferences, the metal sheet is moved by 60 mm.
When the metal sheet is moved by 60 mm, the path difference between the 2 waves detected by the receiver is increased by 120 mm. thus wavelength is 120 mm.

19 **D**

$$n\lambda = d \sin\theta$$

$$\lambda = \frac{3 \times 10^8}{6 \times 10^{14}} = 5 \times 10^{-7}$$

$$\theta_3 = \sin^{-1}\left(\frac{5 \times 10^{-7}}{\frac{10^{-2}}{4 \times 10^3}}\right) = 36.869$$

$$36.869 \times 2 = 74°$$

20 **C**

$$\theta = \frac{\lambda}{b}$$

21 **B** In uniform electric field, the electric force acting on electron is constant and thus acceleration is constant. By Newton's 2nd Law, rate of increase of velocity is constant.

22 **B**

$$\Delta V = \left(\frac{4}{10}\right) \times 1000 = 400 \text{ V}$$

23 **C** Without the diode, the current against p.d. curve would be a straight line through the origin, because the resistor is ohmic (constant resistance). With the diode connected, the curve is the same straight line for p.d. < 2 V, since there is yet no current in the diode. For p.d. > 2 V, there is a constant current in the diode. So the original straight line is shifted upwards by a constant amount for p.d. > 2 V.

24 **D** When R = 0 parallel arrangement is short circuited
minimum V reading when $R = 1.0$

$$V_1 = \frac{1}{1.5} \times 12 = 8.0$$

25 **B** By Faraday's Law of EMI,

$$\varepsilon = -\frac{d\Phi}{dt} = \frac{10 \times 10^{-3} \times 2 \times 10^{-2}}{4} = 5 \times 10^{-5}$$

26 **C** Refer to the EM tutorial solution.

27 **B** $\frac{N_p}{N_s} = \frac{V_p}{V_s} = \frac{I_s}{I_p}$

28 **C**

29 **B**

30 **A** A is comparatively the best answer, although the actual constant in the equation relating the rate of decay to the number of nuclei is $-\lambda$.