IA:

As the total volume remains unchanged, we have $S_A h = S_B h'$, i.e.

$h' = \frac{S_A}{S_B} h = \frac{h}{n}$.

On the other hand, after the force is applied, the partial pressure of water in A is increased by $\frac{F}{S_A}$.

As the total pressure remains unchanged, the partial pressure of water in B is decreased by $\frac{F}{S_A}$.

To counter the change, we have $\frac{F'}{S_B} = \frac{F}{S_A}$, i.e. $F' = \frac{S_B}{S_A} F = nF$.

Therefore, the correct combination is $\boxed{5}$

IB:

Consider the balance of forces, we have $F_A + F_B = mg$.

On the other hand, take moment at the mid-point of AB, we have anti-clockwise moment=clockwise moment:

$$F_B \cos\theta l + mg \sin\theta l = F_A \cos\theta l$$

$$F_A - F_B = mg \tan\theta$$

By solving, we have $F_A = \frac{mg(1+\tan\theta)}{2}$ and $F_B = \frac{mg(1-\tan\theta)}{2}$. Therefore, $\frac{F_A}{F_B} = \boxed{\dfrac{1+\tan\theta}{1-\tan\theta}}$.

IC:

Let v_y be the vertical initial speed. Then, we have $h = v_y t - \frac{1}{2} g t^2$.

As the ball lands at time T, we have $v_y T - \frac{1}{2}gT^2 = 0$, i.e. $v_y = \frac{1}{2}gT$.

Therefore, $h = \frac{1}{2}gtT - \frac{1}{2}gt^2 = \boxed{\frac{1}{2}gt(T-t)}$.

ID:

Consider the balance of force, we have $0.5g = 0.2k + 0.2k$, i.e. $k = \frac{5}{4}g$.

Comparing $F = 2kx$ with $F = 0.5\omega^2 x$, we have $\omega = \sqrt{5g}$, i.e. $T = \frac{2\pi}{\sqrt{5g}}$.

When A reaches its maximum height, half the period is passed. Therefore, the required time$=\frac{T}{2} = \frac{\pi}{\sqrt{5g}} \approx \boxed{0.45}\ s$.

IE:

At P, the kinetic energy of the object is 0 as it is at rest.

For path A, the acceleration of the object is decreasing, hence the graph of its velocity should be convex upwards.

For path B, the acceleration of the object is constant, hence the graph of its velocity should be a straight line.

For path C, the acceleration of the object is increasing, hence the graph of its velocity should be convex downwards.

As $KE \propto v^2$, the graph of KE should has the same shape as the graph of velocity. Therefore, the graph matches the above will be $\boxed{4}$.

IF:

Consider the balance of force in figure 2, we have $k(0.1) = 0.5g$, i.e. $k = 5g$.

Now, set the GPE as 0 at the height when the object is released. When the ball reaches the maximum height, the speed of it drops to 0. Moreover, as the string does not exert restoring force when the ball reaches the maximum height, the EPE becomes 0.

Consider the conservation of energy: KE+GPE+EPE=KE+GPE+EPE

$$0 + 0 + \frac{1}{2}(5g)(0.3)^2 = 0 + 0.5gh + 0$$

$$h = 0.45\ m = \boxed{45}\ cm$$

IG:

As the centripetal force of the satellite is entirely provided by the gravitational attraction, we have:

$$m\omega^2 r^2 = \frac{GMm}{r}$$

$$(\frac{2\pi}{T})^2 = \frac{gR^2}{r^3}$$

$$T = \boxed{2\pi\frac{r}{R}\sqrt{\frac{r}{g}}}$$

IIA:

Consider the heat flow:

$$0.15 \cdot 0.40(80 - T) = (0.1 \cdot 0.40 + 0.2 \cdot 4.2)(T - 20)$$

$$T = \frac{2240}{94} \approx \boxed{24}^{\circ}C$$

IIB:

By $pV = nRT$, we have $p_A(0.1 + x)S = nR(57 + 273)$ and

$p_B(0.1 - x)S = nR(273)$.

As the force is balanced, there is no pressure difference, i.e. $p_A = p_B$.

Therefore, we have $\frac{0.1+x}{0.1-x} = \frac{330}{273}$, i.e. $x = \frac{57}{6030}\ m = \frac{570}{603}\ cm \approx \boxed{1}\ cm$.

IIC:

The energy from gasoline is chemical energy.

When the automobile moves, it carries kinetic energy.

When the brakes are applied, work is done by friction, which cause the kinetic energy lost as heat.

Therefore, the correct combination is $\boxed{7}$.

IIIA:

The frequency of wave is constant with any medium.

However, refer to figure 2, the wave length (the separation between wave fronts) decreased after the wave travel to the less depth region. Therefore, we can conclude that wave speed decreases as water depth decreases $\boxed{2}$.

IIIB:

By our experiences, winter nights are generally colder than daytime. Therefore, the provided information suggests that the speed of sound increases with decreased temperature.

As the air temperature in the upper sky is lower than that near the ground (i.e. $t_h < t_g$), we have $v_h > v_g$.

Therefore, the correct combination is $\boxed{2}$.

IIIC:

The wave length of red light is larger than that of violet light.

As the refractive index is inversly proportional to the wave length in medium, violet light has a larger refractive index.

The light with larger refractive index bends more. Therefore, a is violet and b is red.

As the wave with larger wave length has a larger degree of deflection in diffraction, we have c is red and d is violet.

Therefore, the correct combination is $\boxed{4}$.

IVA:

Note that points A and B are lying on the line of symmetry. Therefore, the electric potentials cancelled out and equal to 0 at the two points.

Moreover, $V_C = kQ(\frac{1}{\sqrt{2}a} + \frac{1}{3\sqrt{2}a} - \frac{1}{\sqrt{10}a} - \frac{1}{\sqrt{10}a}) > 0$.

Therefore, we have $\boxed{V_A = V_B < V_C}$.

IVB:

Let C be the capacitance in figure 1.

In figure 2, the conductor allows charges transfer to the other end immediately, the working distance between the parallel plates is shorten to $2d - d = d$. As $C \propto \frac{1}{d}$, the capacitance $C' = \frac{2d}{1d}C = 2C$.

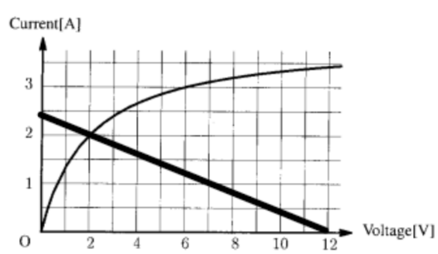
By $U = \frac{1}{2}QV = \frac{Q^2}{2C}$, we have $U \propto \frac{1}{C}$. Therefore, the ratio$=\frac{C}{2C} = \boxed{\frac{1}{2}}$.

IVC:

Let V be the voltage across the light bulb, then the voltage across the resistor will be $12 - V$.

By Ohm's law, we have $12 - V = 5I$.

Plot the line on the graph provided:



The light bulb operates when the two lines intersect. By that time $I = 2\ A$ and

$V = 2\ V$.

By $P = IV$, we have $P = \boxed{4}\ W$.

IVD:

The kinetic energy of the particle after acceleration=The electric potential energy before acceleration=qV. Therefore, its velocity=$\sqrt{\frac{2qV}{m}}$.

As the particle moves in a straight line, the electric force balanced the magnetic force, i.e.

$$qE = Bqv$$
$$\frac{E}{B} = v = \boxed{\sqrt{\frac{2qV}{m}}}$$

IVE:

The magnetic field produced by a straight wire is given by $B = \frac{\mu_0 I}{2\pi r}$.

After a small time duration Δt, the circuit is travelled by $v\Delta t$. Therefore, the magnetic flux density is decreased by $\frac{\mu_0 I}{2\pi(r-b)} \cdot (2av\Delta t) = \frac{\mu_0 avI\Delta t}{\pi(r-b)}$ on the left and increased by $\frac{\mu_0 avI\Delta t}{\pi(r+b)}$ on the right similarly.

By Fleming's right hand rule (or Lenz' law and right hand grip rule), the induced current flows on the left is in the direction $A \to B$ and that flows on the left is in the direction $D \to C$.

Therefore, by Faradays' law, the total induced EMF=$\frac{\mu_0 avI}{\pi(r-b)} - \frac{\mu_0 avI}{\pi(r+b)} = \frac{2\mu_0 abvI}{\pi(r^2-b^2)}$.

By Ohm's law, $I = \frac{V}{R} = \boxed{\dfrac{2\mu_0 abvI}{\pi R(r^2 - b^2)}}$.

IVF:

By Fleming's right rule, when a wire is rotated from right to left, a current in the upwards direction will be induced.

Therefore, when $t = \frac{T}{4}$, a current in the positive direction is induced and when $t = \frac{3T}{4}$, a current in the negative direction is induced.

As there is no induced EMF when the wire is perpendicular to the magnetic field (i.e. when $t = 0, \frac{T}{2}, \frac{3T}{2}, ...$), the correct graph is $\boxed{3}$.