※ 考生請注意：本試題不可使用計算機

以下試卷共 15 題，請選 10 題作答，每題十分.

資源處理工程：

1. Domestic dimension stone production in eastern Taiwan mostly are white marbles, please explain the steps from mine site to slabs?

2. Reservoir sediments in Taiwan not only damage the water supply system also shorten the life of reservoir, please describe the properties of sediments and how to excavate and reuse those materials.

3. Recently, rare earth elements find its roles in magnetical, electrical and optical applications. Monazite, a major source of REE, was found in heavy sand deposited in southern Taiwan coast. Explain how to separate Monazite from Magnetite, Chromite, Garnet, Zircon, Rutile and Quartz?

4. What is the principle of shaking table, draw a figure to describe the behavior of minerals with different particle size and density on the table?

5. Disassembly a refrigerator can recycle and reuse all the materials, please describe the components of a refrigerator and how to separate them after crushing a refrigerator?

礦物材料導論：

6. Within a cubic unit cell, Sketch the following directions: [111], [101], [312]

7. Name and describe 8 different ionic point defects that are found in ceramic compounds.

8. What are solid state sintering and liquid state sintering? What are their purposes, procedures, advantage, disadvantage and application?

9. Define the following properties: plane stress and strain, stress intensity factor, fracture toughness, plane strain fracture toughness.

10. What is spinodal decomposition? Draw ΔG^{mix} vs. Composition figure to explain.

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普通物理：

11.本大題包含五題獨立選擇題(單選題每題二分)　提示的答案數量級差距明顯　並不需要計算機

Two plane mirrors are separated by 120°. If a ray strikes mirror M_1 at 65° angle of incidence, at what angle does it leave mirror M_2? (A) 65° (B) 55° (C) 35° (D) 25° .

Which of the following statements about the image of a real object formed by a plane mirror is NOT correct? The image is (E) erect (F) laterally inverted (G) smaller than the object (H) virtual.

Two diverging light rays, originating from the same point, have an angle of 10° between them. After the rays reflect from a plane mirror, what is the angle between them? (I) 0° (J) 10° (K) 20° (L) 90°.

An object is placed 20.0 cm to the left of a diverging lens (f=-8.0cm). A concave mirror (f=12.0cm) is placed 30.0 cm to the right of the lens. Find the final image distance, measured relative to the mirror (M) 18.1cm (N) 18.2 cm (P) 18.3 cm (Q) 18.4 cm.

Which one of the following types of wave is intrinsically different from the others? (R) Radio waves (S) sound waves　(T) gamma rays　(U) ultraviolet radiation

12. 本大題包含五題獨立選擇題((單選題每題二分) 提示的答案數量級差距明顯　並不需要計算機

What is the work needed to lift 15 kg of water from a well 12 m deep? Assume the water has a constant upward acceleration of 0.7 m/sec². (A) 1.89 kJ　(B) 21.34 kJ　(C) 134 kJ　(D) 980 kJ.

A pump has to raise water from a depth of 50 m and eject it at 10m/s. If the flow rate is 2 kg/s, what horsepower is needed? (E) 1.45 Hp　(F) 9.8 Hp　(G) 21.4 Hp　(H) 98 Hp.

Consider the following forces. (1) frictional (2) gravitational (3) tension (4) strong nuclear (5) normal (6) electroweak, Which of the forces listed are considered fundamental forces?　(I) 1, 2 and 4 (J) 1, 3 and 5 (K) 2, 3, 4 and 5　(L) 2, 4 and 6

Each atom in the periodic table has a unique set of spectral lines. Which one of the following statements is the best explanation for this observation?　(M) Each atom has a dense central nucleus.　(N) The electrons in atoms orbit the nucleus.　(P) Each atom has a unique set of energy levels.　(Q) The electrons in atoms are in constant motion.

Two 110 V light bulbs, one "25W" and the other "100W", are connected in series to a 110 V source. Then (R) the current in the 100W bulb is greater than that in the 25W bulb. (S) the current in the 100W bulb is less than that in the 25W bulb. (T) both bulbs will light with equal brightness. (U) None of the above

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普通物理：

13. 本大題包含五題獨立選擇題((單選題每題二分) 提示的答案數量級差距明顯 並不需要計算機

In a purely capacitive AC circuit, the current (A) leads the voltage by one-fourth of a cycle (B) leads the voltage by one-half of a cycle (C) lags the voltage by one-fourth of a cycle (D) lags the voltage by one-half of a cycle.

In a purely inductive circuit, the current (E) lags the voltage by one-fourth of a cycle (F) lags the voltage by one-half of a cycle (G) lags the voltage by three-fourths of a cycle (H) lags the voltage by one cycle.

For an ohmic resistor, resistance is the proportionality constant for (I) potential difference and electric field (J) current and electric field (K) potential difference and current (L) current and cross-sectional area.

The electric field between parallel plates connected to a 100 V power supply is 5.00 kV/m. How far apart are the plates? (M) 2.0cm (N) 2.5cm (P) 5.0cm (Q) 10.0cm.

The capacitance of a parallel-plate capacitor is 2.0 pF. If the area of each plate is 2.4×10^{-4} m^2, what is the plate separation? The permittivity constant ε_0 is 8.854×10^{-12} C^2/N $\cdot$ m^2 (R)1.1×10^{-2}m (S) 1.1×10^{-3}m (T) 1.1×10^{-4}m (U) 1.1×10^{-5}m.

14. 本大題包含五題獨立選擇題(單選題每題二分) 提示的答案數量級差距明顯 並不需要計算機

A rod of length 10 cm moves through a 1.5-T magnetic field at a constant velocity of 10 m/s. What is the potential difference between the ends of the rod? (A) 0.5V (B) 1.0 V (C) 1.5 V (D) 2.0 V

A 50-N $\cdot$ m torque is applied to a rigid body that is free to rotate around a fixed axis, The body starts from rest and rotates through 40 rad in 20s. What is its moment of inertia? (E) 250 kg $\cdot$ m^2 (F) 400 kg $\cdot$ m^2 (G) 500 kg $\cdot$ m^2 (H) 800 kg $\cdot$ m^2

A flywheel with a moment of inertia of 100 kg $\cdot$ m^2 is rotating at an angular speed of 600 rev/min about a fixed axis. What is its rotational kinetic energy? (I) 1.97×10^3 J (J) 1.97×10^4 J (K) 1.97×10^5 J (L) 1.97×10^6 J.

In the fission of a nuclear fuel, 0.1% of the rest energy is released as heat, which is used to drive and electric generator. When 1Kg of the fuel is fissioned, the electric generator delivers 3×10^{13}J of electrical energy. What is the efficiency of the generator? (M) 10% (N) 0.1% (P) 25% (Q) 33%.

There is an electric potential of +130 V at a spot that is 0.25 m away from a charge. Find the magnitude and sign of the charge. (R) $+3.6 \times 10^{-8}$C (S) -3.6×10^{-8}C (T) $+3.6 \times 10^{-9}$C (U) -3.6×10^{-9}C.

系所組別：資源工程學系乙組

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普通物理：

15. 本大題包含五題獨立選擇題(單選題每題二分) 提示的答案數量級差距明顯 並不需要計算機

The head of a golf club strikes a 46-g golf ball at rest. If the collision lasts 0.5 ms and ball is given a speed of 220 km/h, estimate the average force on the ball. (A) 2450 N　(B) 5620 N　(C) 9800 N　(D) 50600 N.

A rod of length 2.5 m and cross-sectional area 0.3 cm^2 stretches by 0.1 cm when a tension of 800 N is applied. What is its Young's modulus? (E) 6.67×10^4 MPa (F) 6.67×10^6 MPa (G) 6.67×10^8 MPa (H) 6.67×10^{10} MPa.

An object of mass 1 kg makes a completely inelastic collision with and object of unknown mass at rest. If 60% of the kinetic energy is lost, what is the unknown mass? (I) 150 kg (J) 50 kg (K) 5.0 kg (L) 1.5 kg.

A ball of radius 5.0 cm and mass 3.0 kg is attached to one end of a spring of mass 2.0 kg and force constant 1000 N/m. A ball of radius 6.0cm and mass 5.0 kg is attached to the other end of the spring, and the combination is thrown into the air. What is the acceleration of this system's center of mass (M) 0.5 g (N) 1.0 g (P) 2.5 g (Q) 3.0 g

With one exception, each of the following units can be used to express mass. What is the exception?
(R) Newton　(S) gram　(T) kilogram　(U) N · s^2/m