

Teacher Guide

For the Use of IAS Model Assessments

A Sampling of Items and Annotations

2011



Teacher Guide Sampler

A selection of IAS model assessment items from all content areas, with explanations regarding their development and use.

The Internal Assessment System

The QSSC assessment system incorporates both internal and external assessments. While the external exam comes at the end of the year and accounts for most of a student’s QSSC score, it is the internal assessments that are closer and more responsive to teaching and learning throughout the year. Internal assessments cover the same material as the QSSC external exams, only in shorter segments. They can, also, serve as predictors for later performance on the summative, and higher counting, external test.

Why is a Teacher Guide needed?

Schools develop and administer their own internal assessments following each cluster, based upon the same standards and test blueprints. To support the teaching and testing of the clusters the IAS provides model assessments to all schools.

Another source of direction **will be** the new *IAS Model Assessment Teacher Guide*. This document, hereafter referred to as the Teacher Guide, takes one Foundations and one Advanced model and explains each item in it—how it functions in the test and how the tested skill functions in the learning of the student.

The long range goal is to have Teacher Guides accompany at least one assessment at each level for each cluster. That would mean a total of six guides for subjects having both advanced and foundations levels, and three guides for subjects with only one level.

How can the Teacher Guide be used?

Teachers can use the Teacher Guide to understand how the standards are best measured. While model tests are just that—models—each item within them is also a model. Teachers can also use the Teacher Guide to show them how to improve, not only their building-level cluster assessments, but also their regular classroom tests.

Finally, the greatest benefit of the Teacher Guide is to demonstrate the close connection between teaching and testing. The annotations for each item reinforce that everything in the test is aligned to a standard, and therefore required to be taught. But they go beyond to explore the teaching strategies that support the standard, and enrichment activities that can take the student beyond the limits of the question.

The Sampler

This document contains a few items taken from actual model assessments in each content area. For each item, three types of information appear:

- a meta-data box with the item number, the standard measured, the DOK level, and the correct answer;
- a paragraph discussing the assessment considerations that are part of the items;
- a paragraph discussing links to instruction based on the item.

TABLE OF CONTENTS

Biology	3
Chemistry	6
Physics	8
Mathematics	11
English	15
Glossary of Assessment Terms	19

BIOLOGY

17. Which adaptation is **most often** found in plants that live in the desert?

- A. few shallow roots
- B. thick waxy cuticle
- C. wide, flattened leaves
- D. many large stomata

Item: 17

Standard: 8.2 Explain some of the adaptations that help xerophytic plants conserve water.

DOK: 1

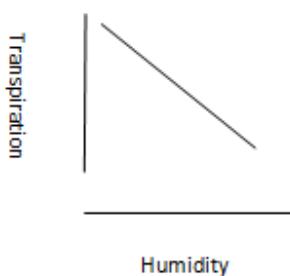
Key: B

Item discussion: This is a good, real-world illustration of xerophytic adaptation.

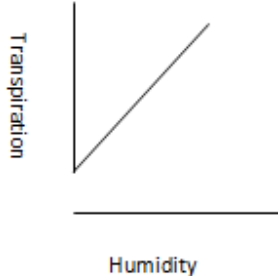
Links to instruction: Students can observe this phenomenon in any desert plant collection. To get more from this standard, give students several pictures of different plants and have them choose which are desert plants.

15. Which of the following graphs represents the relation between humidity and transpiration?

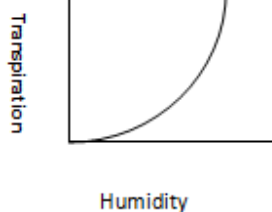
A.



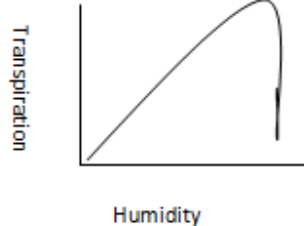
B.



C.



D.



Item: 17

Standard: 8.1 Explain how temperature, wind speed, and humidity affect the rate of transpiration and how plants control their water loss by regulating stomatal opening.

DOK: 2

Key: A

Item discussion: This item aligns well with the standard discussing the relationship between environmental conditions and the rate of transpiration in plants. In this case there is an inverse relationship between transpiration and humidity, as shown in Option A.

Links to instruction: Have students work with parallel scenarios involving other environmental factors in relation to transpiration.

3. During aerobic respiration, electrons move in which sequence?

- A. food → citric acid cycle → ATP → NAD⁺
- B. food → NADH → electron transport chain → oxygen
- C. food → pyruvate → ATP → oxygen
- D. food → glycolysis → citric acid cycle → NADH → ATP

Item: 3

Standard: 5.2 Explain the structure and function of ADP and ATP and the synthesis of ATP in the electron transport chain on the membranes of the mitochondria

DOK: 2

Key: B

Item discussion: The question depends on construction of electron transport during aerobic respiration and the molecules through which it moves.

Links to instruction: Students need to recognize when it is time to read a question carefully, paying attention to every detail. This question contains a number of stages in each option, meaning a number of places for error or correctness. We can add a question about the conversion of ATP to ADP to AMP and vice versa

22. Draw a diagram of the glycolysis process that shows:

- A. a glucose molecule and the end products, and
- B. the *net* energy (ATP) that is used and produced.

Item: 22

Standard: 5.3 Outline glycolysis as the phosphorylation of glucose and the subsequent splitting of hexose phosphate (6C) into two triose phosphate molecules which are further oxidised with a small yield of ATP and reduced NAD.

DOK: 2

Key: 0 – 3 points

Item discussion: This question relies largely on memorisation of a number of basic facts and details. And though artistic ability is not required for the drawing, scientific accuracy is. The locations of used and produced ATP are essential to the diagram.

Links to instruction: Constructed response items are reserved for items that require extended analysis and explanation. This item illustrates that constructed response items do not have to be answered with writing.

CHEMISTRY

4. Which type of intermolecular forces exists between N_2 molecules?

- A. dipole – dipole force
- B. London force
- C. dipole – induced dipole
- D. hydrogen bond

Item: 4

Standard: 14.1 Know that permanent and induced molecular dipoles can give rise to intermolecular forces (van der Waals' forces), and explain their consequences in terms of physical properties of elements and compounds.

DOK: 1

Key: B

Item discussion: This item is a good example of matching the standard. Students need to know what is meant by intermolecular forces, as well as types and examples of each.

Links to instruction: To support this standard through instruction, the teacher can have students compare several types of intermolecular forces and arrange them according to their strength by using diagrams, tables, graphs and power points.

8. Which of the following best describes the types of bonding in hydroxonium ion H_3O^+ ?

- A. Two covalent bonds – one dative (coordinate covalent) bond
- B. Two covalent bonds – two dative (coordinate covalent) bonds
- C. One covalent bond – two dative (coordinate covalent) bonds
- D. Three covalent bonds

Item: 8

Standard: 14.5 Describe coordinate (dative covalent) bonding, as exemplified by the formation of the ammonium and hydroxonium ions and in the structure of carbon monoxide

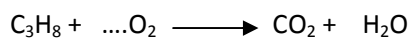
DOK: 1

Key: A

Item discussion: This item matches the standard in a very straightforward manner. Students need to differentiate between covalent bonds and dative bonds and draw the structural formulae of ions or molecules consisting of dative bonds. DOK is level one because the item requires simple identification rather than analysis of factors.

Links to instruction: Teaching this standard requires the use of Lewis dot and cross diagrams to show coordinate bonding.

12. What is the coefficient of oxygen when the following equation is balanced?



- A. 2
- B. 3
- C. 5
- D. 6

Item: 12

Standard: 15.1 Write balanced equations and use them to provide information on reacting masses

DOK: 1

Key: C

Item discussion: To answer this question, students need to know that in balancing equations, the number of atoms of an element in one side of the equation should be the same on the other side of the equation for the same element. DOK for this item is level one because the algorithm is essentially just counting.

Links to instruction: After a few guided demonstrations of balancing equations, students need to practice it over and over until the logic becomes automatic for them. This item illustrates a developmental point: note that the options are arranged in ascending order. Options should always appear in some kind of intentional order—ascending, descending, alphabetical, or by length—to avoid confusion on the part of the student.

25. Potassium hydroxide reacts with sulphuric acid according to the following equation:



A. What volume of 0.15M potassium hydroxide is needed to neutralize 25 ml of cm^3 of 0.15M sulphuric acid? Show your work.

B. What is an appropriate indicator for this titration?

Item: 25

Standard: 15.4 Determine concentrations of reactants in solutions through acid–base titrations with appropriate indicators..

DOK: 2

Key: 0 – 3 points

Item discussion: This constructed response item functions well in the test because it has two related steps. Where multiple choice items focus on a single piece of information, CRs can use more than one and combine them in a number of illustrative ways. This is responsible for the higher DOK.

Links to instruction: The best support for this item is experience with actual titration done in the lab. The practical nature of laboratory work takes this standard out of the abstract and makes it real.

PHYSICS

5. Which of the following compounds is the **most** soluble in water?

- A. MgCO_3
- B. SrCO_3
- C. BaCO_3
- D. CaCO_3

Item: 5

Standard: 19.3 Know the general chemistry of the s-block elements, including:

- trends in the physical properties of the elements;
- trends in the chemical properties of the elements;
- general common properties of the compounds of the elements, including the solubility, colour and thermal stability of the nitrates, carbonates and hydroxides;
- the occurrence and extraction of the elements

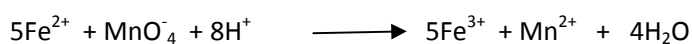
DOK: 1

Key: A

Item discussion: This question relates to the standard in terms of a trend in a common property of the compound (solubility)-clear. It is a clear, direct question. The answer is chosen according to the presence of the element in the periodic table and in the group.

Links to instruction: The same question can be asked about thermal stability or solubility of nitrates , or hydroxides , as well as carbonates. Students must know the trends in the common properties of compounds of s-block elements thoroughly. The teacher must give students practical work –different salts and hydroxides--to test solubility and thermal stability in the lab. Familiarity with the periodic table is a must.

8. From the following equation, which statement is **correct**?



- A. Fe^{2+} is the oxidizing agent.
- B. H^+ ions are reduced.
- C. Fe^{2+} ions are oxidized.
- D. MnO_4^- is the reducing agent.

Item: 8

Standard: 19.10- Explain how the variable oxidation states can result in transition metal ions acting as oxidising and reducing agents. Give examples of transition metal redox systems

DOK: 2

Key: C

Item discussion: This is a fairly advanced question. It measures the relation between oxidation number and oxidizing and reducing agents. Students must know redox equations and able to identify oxidizing and reducing agents after calculating the oxidation number of each atom or ion. If the oxidation number of a species increases, it is a reducing agent; and if the oxidation number decreases, it is a reducing agent.

Links to instruction: Students need to practice different types of equations to identify oxidizing and reducing agents. This is a good opportunity to point out the real world application of the standard embedded in this question, e.g.--in corrosion of metals like iron oxygen is the oxidizing agent and iron is the reducing agent.

16. Which of the following reactions will **not** take place?

- A. $\text{Cl}_2 + 2\text{NaF} \longrightarrow 2\text{NaCl} + \text{F}_2$
- B. $\text{Cl}_2 + 2\text{NaI} \longrightarrow 2\text{NaCl} + \text{I}_2$
- C. $\text{Br}_2 + 2\text{NaI} \longrightarrow 2\text{NaBr} + \text{I}_2$
- D. $\text{Cl}_2 + 2\text{NaBr} \longrightarrow 2\text{NaCl} + \text{Br}_2$

Item: 16

Standard: 19.5- Outline and explain trends in a number of properties down group VII:

- physical properties;
- the reactivity of the elements as oxidising agents;
- the thermal stability of the hydride;
- the reaction of the halide ions with silver nitrate followed by aqueous ammonia.

DOK: 2

Key: A

Item discussion: The question is about group – 7 elements and how they differ in reactivity as oxidizing agents. To answer, the student must know the trend in the oxidation power of halogens, and how to deduce the suitable replacement equation and predict if the reaction will take place.

Links to instruction: The students need to know group -7 elements, their physical and chemical properties, and how the ion halide can be oxidized by stronger halogens. Students need practical work to show, for example, how chlorine gas can replace bromide or iodide in their salts and write the equations of the reactions. This item also illustrates a developmental point. Generally IAS assessments do not use stems with negatives, but this one works because the task requires four applications of a proof to see which one does not work.

29. Define the term ionization energy.

Write an equation, with state symbols, for the **first** ionization energy of sodium (Na).

Item: 29

Standard: 19.1- Understand and use the term *ionisation energy*. Explain the factors influencing the ionisation energies of elements and the trends in ionisation energies across a period and down a group of the periodic table

DOK 2

Key: 0 – 2 points

Item discussion: This is a clear and direct closed question measuring knowledge level information; however, asking for an application moves it to DOK 2. To answer the first part of the question, the students must know the definition of ionization energy. For the second part, students must know how to apply and write an equation representing ionization energy of an element at the gaseous state, and must know that it is an endothermic reaction.

Links to instruction: The constructed response format requires student to consider far more variables than would be possible in multiple choice format, and apply their reasoning. For more practice with this standard have students practice writing equations for first, second, and third ionization energy. To increase the level of the question even more, give students a graph of ionization energy across a period and have them analyze the graph and predict reasons for exceptions like N₂ having higher IE than O₂.

MATHEMATICS

Which of the following is the simplest form of $\frac{1}{x} + \frac{5}{x^2}$?

A. $\frac{1}{x}$

B. $\frac{x+5}{x^2}$

C. $\frac{5}{x^2}$

D. $\frac{x+5}{x^2}$

Item 2:

Standard: 2.2 Combine and simplify rational algebraic fractions.

DOK: 1

Key: B

ITEM DISCUSSION: To add two fractions with different denominators we need first to find the LCD, and then collect the like terms, and finally write the answer in simplest form which is B. Choice A is incorrect since it represents the common factor only for the two terms, Choice C incorrect since it is represents the multiplication of the two terms, and D is incorrect since the numerator is the sum of the numerators, while the denominator is the product of the denominators. The item is too straightforward to be used in the constructed response format, since it is requires only two steps to get the answer.

Links to instruction: To go a little deeper with this standard and this item the teacher can ask:

- One- third of a number and its reciprocal are the same, what is the number?
- Write the equation, find the LCD, simplify, and then solve the equation to find the number.

Which of the following is the inverse of the function $f(x) = \ln x$?

A. $f(x) = e^x$

B. $f(x) = \log x$

C. $f(x) = \frac{1}{\ln x}$

D. $f(x) = \frac{1}{e^x}$

Item:14

Standard: 5. 2 Plot and describe the features of the natural logarithm function $y = \ln x$; understand that the natural logarithm function is inverse to the exponential function

DOK: 1

Key: A

Item discussion: This is a relatively easy question, and therefore suitable to for the multiple choice format.

- B is incorrect because $f(x) = \log x$ is the inverse function of $g(x) = 10^x$
- C is incorrect because it is the reciprocal of the function, not its inverse.
- D is incorrect since it is the reciprocal of the inverse of the function.

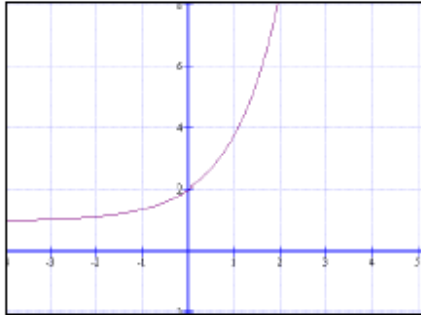
Links to instruction:

Support students by giving them more practice using graphics calculators, and relate this standard to standard 5.5 to make the concept even clearer. Help students distinguish between the inverse function and the reflection of the function about the x or y axis and be sure they know that the inverse function is the reflection of the original function about the line $y = x$.

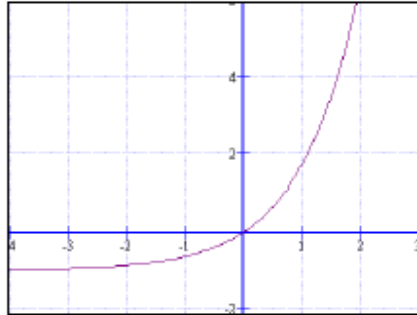
Zoom out (Ctrl+Minus)

Which of the following is the graph of $y = e^x + 1$?

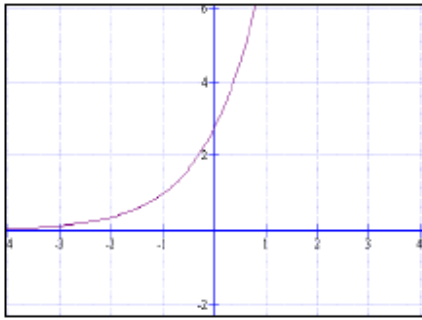
A.



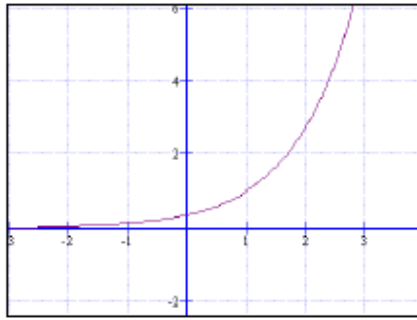
B.



C.



D.



Item 11:

Standard: 5.1 Use a graphics calculator to plot exponential functions of the form $y = ekx$ describe these functions, distinguishing between cases when k is positive or negative, and the special case when k is zero.

DOK: 2

Key: A

Item discussion: Because this is a multiple choice item, $K=1$ was used to get directly to the standard itself. There is a vertical transformation for the function one step up, and students need to know the graph of $f(x) = e^x$, and how to make a transformation for a given function. B is incorrect since it is translated one unit down, C is incorrect since it is translated one unit to the left side, and D is incorrect since it is translated one unit to the right.

Links to instruction: To cover the standard completely we can ask, "Which of the following is the graph of $y = e^{2x} + 1$?" Support the students by giving them more practice using the graphics calculator, and discuss the cases when K is positive, negative or zero.

A. Show that $x - 2$ is a factor of $P(x) = x^3 - 2x^2 - 9x + 18$.

B. Find the other factors of $P(x) = x^3 - 2x^2 - 9x + 18$ and write the polynomial in its completely factorized form. Show your work.

Item 25:

Standard: 2.5 Understand and use the factor theorem

DOK: 2

Key:

Item discussion: This constructed response item has two parts. The first part covers the factor theorem. Part two covers long division and factorization. In this way the question covers the standard and other related and important skills.

Links to instruction: To cover the standard more thoroughly with this item and make it deeper we can ask. "Factor completely: $x^3 + 6x^2 + 11x + 6$." Another method is to check which substitution (2, -2, 3, -3, 1, -1, 6, or -6) gives zero to find the first factor. Then students can use the same method as in the original question to complete the solution. Encourage the students to use a calculator to make the correct substitution.

ENGLISH

English differs from the other content domains in a number of ways, but most important for this document is the way items generally appear as groups. That is, a single reading passage is the source for seven or eight items. With that distinction in mind, this section of the sampler will present a sample reading prompt and four items associated with it.

Here are two stories about Nasreddin, a famous judge, whose reasoning pleased some, and disappointed others. Read the stories to see his unusual thinking.

Nasreddin and the Smell of Soup

- 1) One day, a poor man, who had only one piece of bread to eat, was walking past a restaurant. There was a large pot of soup on the table. The poor man held his bread over the soup, so the steam from the soup went into the bread, and gave it a good smell. Then he ate the bread.
- 2) The restaurant owner was very angry at this, and he asked the man for money, in exchange for the steam from the soup. The poor man had no money, so the restaurant owner took him to Nasreddin, who was a judge at that time. Nasreddin thought about the case for a little while.
- 3) Then he took some money from his pocket. He held the coins next to the restaurant owner's ear, and shook them, so that they made a jingling noise.
- 4) "What was that?" asked the restaurant owner.
- 5) "That was payment for you," answered Nasreddin.
- 6) "What do you mean? That was just the sound of coins!" protested the restaurant owner.
- 7) "The sound of the coins is payment for the smell of the soup," answered Nasreddin. "Now go back to your restaurant."

Nasreddin's Visitors

- 1) One day a visitor came to Nasreddin's house. "I am your cousin from Konya," he said, "and I have brought you a duck to celebrate the visit." Nasreddin was delighted. He asked his wife to cook the duck, and served the visitor a fine dinner.
- 2) The next day another visitor arrived. "I am the friend of the man who brought you the duck," he said. Nasreddin invited him in and gave him a good meal. The next day another visitor arrived, and said he was the friend of the friend of the man who had brought the duck. Again Nasreddin invited him in for a meal. However, he was getting annoyed. Visitors seemed to be using his house as a restaurant.
- 3) Then another visitor came, and said he was the friend of the friend of the friend of the man who had brought the duck. Nasreddin invited him to eat dinner with him. His wife brought some soup to the table and the visitor tasted it. "What kind of soup is this?" asked the visitor. "It tastes just like warm water." "Ah!" said Nasreddin, "That is the soup of the soup of the soup of the duck."

Reading passages are introduced with a purpose setting statement. It appears boxed and written in italic font, to attract the student’s attention. Its purpose is to activate prior knowledge or establish schema for the reader in order for the reader to know the general nature of the passage and have the details and events contextualized a bit. This is the sort of thing that good teachers of reading routinely do to prepare their students for a reading task.

This reading prompt is actually two related stories about the judge Nasreddin. Paired passages offer an opportunity for students to carry information from one passage into another. When pairing passages, the developer needs to choose passages that have important similarities or differences, preferably both, and then balance the questions accordingly.

2. In “Nasreddin and the Smell of Soup,” what did the poor man get from the restaurant owner?
- A. soup
 - B. coins
 - C. bread
 - D. smell

Item: 2

Standard: 7.3 Understand how narratives are structured, noting how paragraphs and chapters are used to separate, sequence and link the text to create emphasis and capture the reader’s interest.

DOK: 1

Key: D

Item discussion: The year 12 reading standards do not explicitly mention recognizing key details of a text, but this standard values the ways in which details provide the connections from one event to another. Attention to detail is an essential skill for the reader of narrative text as well informational text.

Links to instruction: Good practice for attending to detail is for the student to construct simple time lines of the plots, and then explain relationships among elements, such as causes, effects, examples, etc. Discuss which events are most important, and which might have been omitted.

6. Based on “Nasreddin’s Visitors,” if the last visitor had expected a poem, which would Nasreddin **most likely** have given him?
- A. a short poem
 - B. a short story
 - C. a blank page
 - D. a soup bowl

Item: 6

Standard: 6.8 Extend use active comprehension strategies to derive meaning while reading by predicting outcomes, stating reasonable generalisations, and drawing conclusions based on prior knowledge and information gained while reading.

DOK: 2

Key: C

Item discussion: This is a good example of a DOK 2 item in multiple choice format. The demands on the reader’s thinking are many—first to understand and generalise about the trend in the visits, and then apply analogical thinking to it to answer the question. This is admittedly a very hard question, and it appears in a foundations model. However, regardless of level, we are testing everyone, including high performers, and we need challenges for them. Further, in a number of cases, advanced students frequently take foundations English because they have chosen other advanced level courses.

Links to instruction: Analogical thinking does not come in any set package or download from the Internet. It occurs, more or less, by chance, but the teacher should recognise and seize the opportunity when it comes along. A more concrete form of comparison is the metaphor, in which a word rather than a system of thought makes the connection.

7. Based on both stories, what **most** guides Nasreddin’s thinking?
- A. seeing the way things are related to one another
 - B. making sure that the poor are treated fairly
 - C. placing a high value on food and eating
 - D. having the ability to make people laugh

Item: 7

Standard: 6.8 Extend use active comprehension strategies to derive meaning while reading by stating reasonable generalisations, and drawing conclusions based on prior knowledge and information gained while reading; inferring attitudes, relationships and drawing generalisations from the text; comparing and contrasting different parts of the text; referring to the text for evidence of conclusions or opinions.

DOK: 2

Key: A

Item discussion: The plots of the two stories are quite different, with Nasreddin deciding who is being fooled in one, and with Nasreddin being the one fooled in the other. However, the main character is the same, and, most importantly, his thinking is the same. In the first he sees that food produces smell, and money produces sound. In the second he sees that friends produce friends of friends, and reasons that soup can produce soup of soup. All this before Facebook!

Links to instruction: This item has a couple of lessons for developers. In the original item set for these passages, the first three items addressed the first story, and the next three, the second. The final item covered both. Also note the emphasis word **most**. It appears in italic, bold. Each option contains a bit of correctness, but the reader is instructed to find the one with the most correctness. Option B applies to the first story only. Option C deals with food, which is part of both stories, but is not integral to the judge’s thinking. Option D is attractive because, to most, the stories are humorous, but humour is not Nasreddin’s motivation.

8. How do the two stories differ from one another? Use facts and details from the stories to support your answer.

Item: 8

Standard: 7.4 From selected narratives, make notes, draw diagrams etc. to capture the main points and sequence of each chapter or paragraph. Present, orally or in writing, a brief evaluation.

DOK: 2

Key: 0 – 3 points

Item discussion: Constructed response items are reserved for items that require extended analysis and explanation. They are also suited to items that might allow for different interpretations. For example, one answer might see the critical difference being the injured party—first a poor man, and second, Nasreddin himself. Another student might consider the important difference to be the use of irony in the first story, and the irony of the second. Still a third could note that Nasreddin’s judgment comes after a single incident in the first story, while the second judgment requires a pattern of similar incidents.

Links to instruction: A good follow up activity would be to have students name stories from previous reading that compare with either of these stories. Or students could try their hand at writing a story that mirrors one of these two.

Glossary:

TERMS FOR ASSESSMENT ITEMS

item—a question or task on an assessment.

multiple choice—an item format using a question [stem] and a number [4] of options.

Sometimes referred to as SR-selected response.

stem—the part of the item that asks the question.

prompt—other information required to answer the question. Prompts may be charts, graphs, reading passages. Also called the stimulus.

options—the choices for the question. They are labeled A., B., C., D.

key—the option that answers the question. Also called the CA [correct answer].

distractors—the incorrect answer options. They must be plausible and contain no outliers. They are sometimes called foils.

outlier—a distractor that is so different than the rest as to draw attention to itself

constructed response—constructed response [CR]. An answer which the student has to construct, or generate, rather than choose one. May be called open-ended, open-response, extended response, short answer. [*nota bene*: a one word completion answer is not a constructed response that is used on an IAS assessment.]

scoring guide—all the materials required to score an constructed response item. Includes the rubric, training notes, and exemplars. For a formal scoring session there would be benchmark and anchor papers, as well.

rubric—a simple chart containing descriptions of the answers that would receive each of the points. Rubrics are specific to the item.